

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 02 March 2023 at 13:02:35

Project Information:

Assessed By: Matt Fitzpatrick (STRO003572)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 92.99m²

Site Reference : Swansea Road

Plot Reference: 1 As Built

Address : 30A Swansea Road, READING, RG1 8HA

Client Details:

Name: Helix

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.23 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.77 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 42.8 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.53	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 512, product index 018738): Boiler systems with radiators or underfloor heating - mains gas Brand name: Baxi Model: ASSURE Model qualifier: 36 COMBI (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: North West 3.16m²
 Windows facing: North 0.66m²
 Windows facing: West 0.66m²
 Windows facing: North East 2.36m²
 Windows facing: South East 8.39m²
 Roof windows facing: North West 0.92m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

SAP Input

Property Details: 1 As Built

Address: 30A Swansea Road, READING, RG1 8HA
 Located in: England
 Region: Thames valley
 UPRN: UPRN-558131256487
 Date of assessment: 02 March 2023
 Date of certificate: 02 March 2023
 Assessment type: New dwelling as built
 Transaction type: New dwelling
 Tenure type: Unknown
 Related party disclosure: No related party
 Thermal Mass Parameter: Calculated 180.97
 Water use <= 125 litres/person/day: True
 PCDF Version: 512

Property description:

Dwelling type: House
 Detachment: End-terrace
 Year Completed: 2023
 Floor Location: Floor area: Storey height:
 Floor 0 40.3 m² 2.5 m
 Floor 1 35.42 m² 2.7 m
 Floor 2 17.27 m² 2.323 m
 Living area: 15.13 m² (fraction 0.163)
 Front of dwelling faces: North West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front	Manufacturer	Solid			Wood
1	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
3	BFRC	Windows	low-E, En = 0.1, soft coat	No	
4	BFRC	Windows	low-E, En = 0.1, soft coat	No	
1	Manufacturer	Roof Windows	low-E, En = 0.1, soft coat	No	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front	mm	0.7	0.63	1.5	2.12	1
1	12mm	0	0.39	1.3	3.16	1
2	12mm	0	0.39	1.3	0.66	1
2	12mm	0	0.39	1.3	0.66	1
3	12mm	0	0.39	1.3	2.36	1
4	12mm	0	0.39	1.3	8.39	1
1	12mm	0.7	0.63	1.2	0.92	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front		Brick	North West	0	0
1		Brick	North West	0	0
2		Brick	North	0	0
2		Brick	West	0	0
3		Brick	North East	0	0
4		Brick	South East	0	0
1		Sloping roof	North West	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type: Gross area: Openings: Net area: U-value: Ru value: Curtain wall: Kappa:

SAP Input

External Elements

Brick	55.26	17.35	37.91	0.25	0	False	60
Timber stud	16.45	0	16.45	0.25	0	False	9
Cold roof	2.81	0	2.81	0.11	0		9
Bay roof	0.6	0	0.6	0.11	0		9
Kitchen roof	4.3	0	4.3	0.11	0		9
Loft roof	18.16	0	18.16	0.11	0		9
Sloping roof	20.46	0.92	19.54	0.15	0		9
Suspended floor	40.3			0.11			75

Internal Elements

Metal stud	178.58						9
Int ceiling	52.69						9
Int Floor	52.69						18

Party Elements

Party wall	113.49						70
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Thermal bridges:

Thermal bridges:

User-defined (individual PSI-values) Y-Value = 0.0815

Length	Psi-value		
10.19	0.05	E2	Other lintels (including other steel lintels)
6.79	0.034	E3	Sill
26.7	0.04	E4	Jamb
10.81	0.06	E5	Ground floor (normal)
0	0.32	E20	Exposed floor (normal)
0	0.32	E21	Exposed floor (inverted)
6.58	0	E6	Intermediate floor within a dwelling
16.99	0.123	E10	Eaves (insulation at ceiling level)
15.32	0.24	E24	Eaves (insulation at ceiling level - inverted)
0	0.033	E11	Eaves (insulation at rafter level)
0.74	0.063	E12	Gable (insulation at ceiling level)
0.45	0.08	E13	Gable (insulation at rafter level)
27.39	0.05	E16	Corner (normal)
12.35	-0.069	E17	Corner (inverted internal area greater than external area)
15.05	0.072	E18	Party wall between dwellings
0	0.12	E25	Staggered party wall between dwellings
18.05	0.043	P1	Ground floor
26.5	0	P2	Intermediate floor within a dwelling
0	0.16	P7	Exposed floor (normal)
8.46	0.049	P4	Roof (insulation at ceiling level)
9.88	0.069	P5	Roof (insulation at rafter level)
0.98	0.08	R1	Head
0.98	0.06	R2	Sill
1.92	0.08	R3	Jamb
7.64	0.06	R6	Flat ceiling
6.33	0.06	R8	Roof wall (rafter)

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Decentralised whole house extract
	Number of fans in Wetroom: Kitchen 1 Other 3
	Ductwork: ,
	Approved Installation Scheme: True
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.53 (Assessed dwelling is tested)

SAP Input

Main heating system:

Main heating system: Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 512, product index 018738) Efficiency: Winter 86.7 % Summer: 89.9
Brand name: Baxi
Model: ASSURE
Model qualifier: 36 COMBI
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes

Main heating Control:

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

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Low rise urban / suburban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 1 As Built

Address : 30A Swansea Road, READING, RG1 8HA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.3	(1a) x	2.5	(2a) =	100.75 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.99	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	236.5 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<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			4.53000020980835 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.23 (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) =		0.19 (21)

Infiltration rate modified for monthly wind speed

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

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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DER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

	0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)
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d) If natural ventilation or whole house positive input ventilation from loft

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

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(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
Doors			2.12	x 1.5	= 3.18		(26)
Windows Type 1			3.16	x 1/[1/(1.3)+ 0.04]	= 3.9		(27)
Windows Type 2			0.66	x 1/[1/(1.3)+ 0.04]	= 0.82		(27)
Windows Type 3			0.66	x 1/[1/(1.3)+ 0.04]	= 0.82		(27)
Windows Type 4			2.36	x 1/[1/(1.3)+ 0.04]	= 2.92		(27)
Windows Type 5			8.39	x 1/[1/(1.3)+ 0.04]	= 10.37		(27)
Rooflights			0.92	x 1/[1/(1.2) + 0.04]	= 1.104		(27b)
Floor			40.3	x 0.11	= 4.433	75	3022.5 (28)
Walls Type1	55.26	17.35	37.91	x 0.25	= 9.48	60	2274.6 (29)
Walls Type2	16.45	0	16.45	x 0.25	= 4.11	9	148.05 (29)
Roof Type1	2.81	0	2.81	x 0.11	= 0.31	9	25.29 (30)
Roof Type2	0.6	0	0.6	x 0.11	= 0.07	9	5.4 (30)
Roof Type3	4.3	0	4.3	x 0.11	= 0.47	9	38.7 (30)
Roof Type4	18.16	0	18.16	x 0.11	= 2	9	163.44 (30)
Roof Type5	20.46	0.92	19.54	x 0.15	= 2.93	9	175.86 (30)
Total area of elements, m²			158.34				(31)
Party wall			113.49	x 0	= 0	70	7944.3 (32)

DER WorkSheet: New dwelling as built

Internal wall **	178.58	9	1607.22 (32c)
Internal floor	52.69	18	948.42 (32d)
Internal ceiling	52.69	9	474.21 (32e)

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

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

Fabric heat loss, W/K = $S(A \times U)$	(26)...(30) + (32) =	46.85 (33)
Heat capacity $C_m = S(A \times k)$	((28)...(30) + (32) + (32a)...(32e) =	16827.99 (34)
Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K	= (34) $\div$ (4) =	180.97 (35)

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

Thermal bridges : $S(L \times Y)$ calculated using Appendix K		12.91 (36)
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if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss	(33) + (36) =	59.76 (37)
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Ventilation heat loss calculated monthly	(38)m = $0.33 \times (25)m \times (5)$	
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	(38)

Heat transfer coefficient, W/K	(39)m = (37) + (38)m	
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(39)m=	98.78	98.78	98.78	98.78	98.78	98.78	98.78	98.78	98.78	98.78	98.78	98.78	
	Average = Sum(39) _{1...12} /12=											98.78	(39)

Heat loss parameter (HLP), W/m²K	(40)m = (39)m $\div$ (4)	
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(40)m=	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	
	Average = Sum(40) _{1...12} /12=											1.06	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N	2.66 (42)
if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$	
if TFA $\leq$ 13.9, $N = 1$	

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$	97.48 (43)
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Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	107.23	103.33	99.43	95.53	91.63	87.73	87.73	91.63	95.53	99.43	103.33	107.23	
	Total = Sum(44) _{1...12} =											1169.78	(44)

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

(45)m=	159.02	139.08	143.52	125.12	120.06	103.6	96	110.16	111.48	129.92	141.81	154	
	Total = Sum(45) _{1...12} =											1533.76	(45)

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

(46)m=	23.85	20.86	21.53	18.77	18.01	15.54	14.4	16.52	16.72	19.49	21.27	23.1	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0 (47)
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If community heating and no tank in dwelling, enter 110 litres in (47)

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

DER WorkSheet: New dwelling as built

Water storage loss:

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

0	(48)
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Temperature factor from Table 2b

0	(49)
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Energy lost from water storage, kWh/year

(48) x (49) =

0	(50)
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b) If manufacturer's declared cylinder loss factor is not known:

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

0	(51)
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If community heating see section 4.3

Volume factor from Table 2a

0	(52)
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Temperature factor from Table 2b

0	(53)
---	------

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

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

0	(55)
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Water storage loss calculated for each month

((56)m = (55) x (41)m

(56)m=

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

0	0	0	0	0	0	0	0	0	0	0	0	(57)
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Primary circuit loss (annual) from Table 3

0	(58)
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Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

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

(59)m=

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

(61)m=

11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82	(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=

170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82	(64)
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Output from water heater (annual)_{1...12}

1672.39

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=

55.83	48.91	50.67	44.45	42.86	37.28	34.85	39.56	39.91	46.14	50.01	54.16	(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	
133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	(66)

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

(67)m=

22.35	19.85	16.14	12.22	9.14	7.71	8.33	10.83	14.54	18.46	21.55	22.97	(67)
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=

244.47	247.01	240.62	227.01	209.83	193.68	182.89	180.36	186.75	200.36	217.54	233.69	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=

36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3	(70)
---	---	---	---	---	---	---	---	---	---	---	---	------

DER WorkSheet: New dwelling as built

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

(71)m=

-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

75.04	72.79	68.1	61.74	57.6	51.78	46.84	53.18	55.43	62.02	69.46	72.79
-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

407.83	405.61	390.83	366.93	342.53	319.14	304.03	310.33	322.69	346.81	374.51	395.42
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor	Area			Flux			g_			FF			Gains	
	Table 6d		m²		Table 6a		Table 6b		Table 6c				(W)		
North	0.9x	0.77	x	0.66	x	10.63	x	0.39	x	1.11	=	2.11	(74)		
North	0.9x	0.77	x	0.66	x	20.32	x	0.39	x	1.11	=	4.03	(74)		
North	0.9x	0.77	x	0.66	x	34.53	x	0.39	x	1.11	=	6.84	(74)		
North	0.9x	0.77	x	0.66	x	55.46	x	0.39	x	1.11	=	10.99	(74)		
North	0.9x	0.77	x	0.66	x	74.72	x	0.39	x	1.11	=	14.81	(74)		
North	0.9x	0.77	x	0.66	x	79.99	x	0.39	x	1.11	=	15.85	(74)		
North	0.9x	0.77	x	0.66	x	74.68	x	0.39	x	1.11	=	14.8	(74)		
North	0.9x	0.77	x	0.66	x	59.25	x	0.39	x	1.11	=	11.74	(74)		
North	0.9x	0.77	x	0.66	x	41.52	x	0.39	x	1.11	=	8.23	(74)		
North	0.9x	0.77	x	0.66	x	24.19	x	0.39	x	1.11	=	4.79	(74)		
North	0.9x	0.77	x	0.66	x	13.12	x	0.39	x	1.11	=	2.6	(74)		
North	0.9x	0.77	x	0.66	x	8.86	x	0.39	x	1.11	=	1.76	(74)		
Northeast	0.9x	0.77	x	2.36	x	11.28	x	0.39	x	1.11	=	8	(75)		
Northeast	0.9x	0.77	x	2.36	x	22.97	x	0.39	x	1.11	=	16.28	(75)		
Northeast	0.9x	0.77	x	2.36	x	41.38	x	0.39	x	1.11	=	29.33	(75)		
Northeast	0.9x	0.77	x	2.36	x	67.96	x	0.39	x	1.11	=	48.16	(75)		
Northeast	0.9x	0.77	x	2.36	x	91.35	x	0.39	x	1.11	=	64.74	(75)		
Northeast	0.9x	0.77	x	2.36	x	97.38	x	0.39	x	1.11	=	69.02	(75)		
Northeast	0.9x	0.77	x	2.36	x	91.1	x	0.39	x	1.11	=	64.56	(75)		
Northeast	0.9x	0.77	x	2.36	x	72.63	x	0.39	x	1.11	=	51.47	(75)		
Northeast	0.9x	0.77	x	2.36	x	50.42	x	0.39	x	1.11	=	35.73	(75)		
Northeast	0.9x	0.77	x	2.36	x	28.07	x	0.39	x	1.11	=	19.89	(75)		
Northeast	0.9x	0.77	x	2.36	x	14.2	x	0.39	x	1.11	=	10.06	(75)		
Northeast	0.9x	0.77	x	2.36	x	9.21	x	0.39	x	1.11	=	6.53	(75)		
Southeast	0.9x	0.77	x	8.39	x	36.79	x	0.39	x	1.11	=	92.7	(77)		
Southeast	0.9x	0.77	x	8.39	x	62.67	x	0.39	x	1.11	=	157.91	(77)		
Southeast	0.9x	0.77	x	8.39	x	85.75	x	0.39	x	1.11	=	216.06	(77)		
Southeast	0.9x	0.77	x	8.39	x	106.25	x	0.39	x	1.11	=	267.7	(77)		
Southeast	0.9x	0.77	x	8.39	x	119.01	x	0.39	x	1.11	=	299.85	(77)		
Southeast	0.9x	0.77	x	8.39	x	118.15	x	0.39	x	1.11	=	297.68	(77)		

DER WorkSheet: New dwelling as built

Southeast	0.9x	0.77	x	8.39	x	113.91	x	0.39	x	1.11	=	287	(77)
Southeast	0.9x	0.77	x	8.39	x	104.39	x	0.39	x	1.11	=	263.01	(77)
Southeast	0.9x	0.77	x	8.39	x	92.85	x	0.39	x	1.11	=	233.94	(77)
Southeast	0.9x	0.77	x	8.39	x	69.27	x	0.39	x	1.11	=	174.52	(77)
Southeast	0.9x	0.77	x	8.39	x	44.07	x	0.39	x	1.11	=	111.04	(77)
Southeast	0.9x	0.77	x	8.39	x	31.49	x	0.39	x	1.11	=	79.33	(77)
West	0.9x	0.77	x	0.66	x	19.64	x	0.39	x	1.11	=	3.89	(80)
West	0.9x	0.77	x	0.66	x	38.42	x	0.39	x	1.11	=	7.61	(80)
West	0.9x	0.77	x	0.66	x	63.27	x	0.39	x	1.11	=	12.54	(80)
West	0.9x	0.77	x	0.66	x	92.28	x	0.39	x	1.11	=	18.29	(80)
West	0.9x	0.77	x	0.66	x	113.09	x	0.39	x	1.11	=	22.41	(80)
West	0.9x	0.77	x	0.66	x	115.77	x	0.39	x	1.11	=	22.95	(80)
West	0.9x	0.77	x	0.66	x	110.22	x	0.39	x	1.11	=	21.85	(80)
West	0.9x	0.77	x	0.66	x	94.68	x	0.39	x	1.11	=	18.76	(80)
West	0.9x	0.77	x	0.66	x	73.59	x	0.39	x	1.11	=	14.59	(80)
West	0.9x	0.77	x	0.66	x	45.59	x	0.39	x	1.11	=	9.04	(80)
West	0.9x	0.77	x	0.66	x	24.49	x	0.39	x	1.11	=	4.85	(80)
West	0.9x	0.77	x	0.66	x	16.15	x	0.39	x	1.11	=	3.2	(80)
Northwest	0.9x	0.77	x	3.16	x	11.28	x	0.39	x	1.11	=	10.71	(81)
Northwest	0.9x	0.77	x	3.16	x	22.97	x	0.39	x	1.11	=	21.79	(81)
Northwest	0.9x	0.77	x	3.16	x	41.38	x	0.39	x	1.11	=	39.27	(81)
Northwest	0.9x	0.77	x	3.16	x	67.96	x	0.39	x	1.11	=	64.49	(81)
Northwest	0.9x	0.77	x	3.16	x	91.35	x	0.39	x	1.11	=	86.68	(81)
Northwest	0.9x	0.77	x	3.16	x	97.38	x	0.39	x	1.11	=	92.41	(81)
Northwest	0.9x	0.77	x	3.16	x	91.1	x	0.39	x	1.11	=	86.45	(81)
Northwest	0.9x	0.77	x	3.16	x	72.63	x	0.39	x	1.11	=	68.92	(81)
Northwest	0.9x	0.77	x	3.16	x	50.42	x	0.39	x	1.11	=	47.85	(81)
Northwest	0.9x	0.77	x	3.16	x	28.07	x	0.39	x	1.11	=	26.63	(81)
Northwest	0.9x	0.77	x	3.16	x	14.2	x	0.39	x	1.11	=	13.47	(81)
Northwest	0.9x	0.77	x	3.16	x	9.21	x	0.39	x	1.11	=	8.74	(81)
Rooflights	0.9x	1	x	0.92	x	16.37	x	0.63	x	0.7	=	5.98	(82)
Rooflights	0.9x	1	x	0.92	x	33.68	x	0.63	x	0.7	=	12.3	(82)
Rooflights	0.9x	1	x	0.92	x	62.13	x	0.63	x	0.7	=	22.69	(82)
Rooflights	0.9x	1	x	0.92	x	104.87	x	0.63	x	0.7	=	38.29	(82)
Rooflights	0.9x	1	x	0.92	x	143.66	x	0.63	x	0.7	=	52.46	(82)
Rooflights	0.9x	1	x	0.92	x	154.33	x	0.63	x	0.7	=	56.35	(82)
Rooflights	0.9x	1	x	0.92	x	143.9	x	0.63	x	0.7	=	52.55	(82)
Rooflights	0.9x	1	x	0.92	x	113.05	x	0.63	x	0.7	=	41.28	(82)
Rooflights	0.9x	1	x	0.92	x	76.56	x	0.63	x	0.7	=	27.96	(82)
Rooflights	0.9x	1	x	0.92	x	41.49	x	0.63	x	0.7	=	15.15	(82)
Rooflights	0.9x	1	x	0.92	x	20.65	x	0.63	x	0.7	=	7.54	(82)

DER WorkSheet: New dwelling as built

Rooflights 0.9x

 x

 x

 x

 x

 =

 (82)

Solar gains in watts, calculated for each month

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

(83)m=

123.38	219.92	326.72	447.93	540.95	554.26	527.2	455.19	368.29	250.03	149.56	104.44
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (83)

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

(84)m=

531.21	625.53	717.55	814.86	883.48	873.41	831.24	765.52	690.98	596.84	524.07	499.86
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

 (85)

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.99	0.97	0.92	0.82	0.66	0.51	0.56	0.8	0.95	0.99	1

 (86)

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

(87)m=

19.52	19.72	20.03	20.42	20.75	20.93	20.98	20.97	20.83	20.4	19.87	19.47
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

 (87)

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

(88)m=

20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

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

(89)m=

0.99	0.98	0.96	0.91	0.78	0.58	0.4	0.46	0.73	0.94	0.99	0.99
------	------	------	------	------	------	-----	------	------	------	------	------

 (89)

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

(90)m=

18.05	18.33	18.79	19.33	19.77	19.97	20.02	20.02	19.88	19.31	18.56	17.97
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

 (91)

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

(92)m=

18.29	18.56	18.99	19.51	19.93	20.13	20.18	20.17	20.03	19.49	18.77	18.21
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

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

(93)m=

18.29	18.56	18.99	19.51	19.93	20.13	20.18	20.17	20.03	19.49	18.77	18.21
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=

0.99	0.98	0.95	0.89	0.77	0.59	0.42	0.47	0.73	0.93	0.98	0.99
------	------	------	------	------	------	------	------	------	------	------	------

 (94)

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

(95)m=

525	611.5	683.89	727.16	681.09	514.24	347.58	362.68	507.71	552.31	513.09	495.19
-----	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

1381.76	1349.26	1233.59	1048	812.62	546.19	353.48	372.51	586.27	878.06	1153.29	1384.36
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 (97)

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

(98)m=

637.42	495.77	408.98	231.01	97.86	0	0	0	0	242.36	460.94	661.54
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

 (98)

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

 (98)

Space heating requirement in kWh/m²/year

(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

 (201)

DER WorkSheet: New dwelling as built

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		89.9	(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)												
637.42	495.77	408.98	231.01	97.86	0	0	0	0	242.36	460.94	661.54	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												
709.04	551.47	454.93	256.96	108.85	0	0	0	0	269.59	512.73	735.87	
Total (kWh/year) = Sum(211) _{1..5,10...12} =												3599.42

Space heating fuel (secondary), kWh/month												
= {[(98)m × (201)] } × 100 ÷ (208)												
(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =												0

Water heating

Output from water heater (calculated above)												
	170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82
Efficiency of water heater												86.7
(217)m =	89.2	89.14	89	88.68	88.04	86.7	86.7	86.7	86.7	88.69	89.08	89.24
Fuel for water heating, kWh/month												
(219)m = (64)m × 100 ÷ (217)m												
(219)m =	191.52	168	174.52	153.93	149.72	132.58	124.24	140.6	141.69	159.76	172.02	185.81
Total = Sum(219a) _{1..12} =												1894.4

Annual totals

Space heating fuel used, main system 1												3599.42
Water heating fuel used												1894.4
Electricity for pumps, fans and electric keep-hot												
mechanical ventilation - balanced, extract or positive input from outside												68.83
central heating pump:												30
boiler with a fan-assisted flue												45
Total electricity for the above, kWh/year	sum of (230a)...(230g) =											143.83
Electricity for lighting												394.69
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =												6032.35

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) ×	0.216	777.48
Space heating (secondary)	(215) ×	0.519	0
Water heating	(219) ×	0.216	409.19
Space and water heating	(261) + (262) + (263) + (264) =		1186.67

DER WorkSheet: New dwelling as built

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	74.65	(267)
Electricity for lighting	(232) x	0.519	=	204.84	(268)
Total CO2, kg/year		sum of (265)...(271) =		1466.16	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		15.77	(273)
EI rating (section 14)				86	(274)

TER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 1 As Built

Address : 30A Swansea Road, READING, RG1 8HA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.3	(1a) x	2.5	(2a) =	100.75 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.99	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	236.5 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0
Number of open flues	0	+	0	=	0
Number of intermittent fans				3	30
Number of passive vents				0	0
Number of flueless gas fires				0	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (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) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

TER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1	= 2.12		(26)
Windows Type 1			3.16	x 1/[1/(1.4)+ 0.04] =	4.19		(27)
Windows Type 2			0.66	x 1/[1/(1.4)+ 0.04] =	0.88		(27)
Windows Type 3			0.66	x 1/[1/(1.4)+ 0.04] =	0.88		(27)
Windows Type 4			2.36	x 1/[1/(1.4)+ 0.04] =	3.13		(27)
Windows Type 5			8.39	x 1/[1/(1.4)+ 0.04] =	11.12		(27)
Rooflights			0.92	x 1/[1/(1.7) + 0.04] =	1.564		(27b)
Floor			40.3	x 0.13	= 5.239		(28)
Walls Type1	55.26	17.35	37.91	x 0.18	= 6.82		(29)
Walls Type2	16.45	0	16.45	x 0.18	= 2.96		(29)
Roof Type1	2.81	0	2.81	x 0.13	= 0.37		(30)
Roof Type2	0.6	0	0.6	x 0.13	= 0.08		(30)
Roof Type3	4.3	0	4.3	x 0.13	= 0.56		(30)
Roof Type4	18.16	0	18.16	x 0.13	= 2.36		(30)
Roof Type5	20.46	0.92	19.54	x 0.13	= 2.54		(30)
Total area of elements, m²			158.34				(31)
Party wall			113.49	x 0	= 0		(32)

TER WorkSheet: New dwelling as built

Internal wall **	178.58		(32c)
Internal floor	52.69		(32d)
Internal ceiling	52.69		(32e)

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

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

Fabric heat loss, W/K = $S(A \times U)$	(26)...(30) + (32) =	44.7	(33)
Heat capacity $C_m = S(A \times k)$	((28)...(30) + (32) + (32a)...(32e) =	16827.99	(34)
Thermal mass parameter (TMP = $C_m \div TFA$) 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 : $S(L \times Y)$ calculated using Appendix K		15.33	(36)
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if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss	(33) + (36) =	60.03	(37)
Ventilation heat loss calculated monthly	(38)m = $0.33 \times (25)m \times (5)$		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.53	45.28	45.03	43.87	43.65	42.64	42.64	42.45	43.03	43.65	44.09	44.55	(38)

Heat transfer coefficient, W/K											(39)m = (37) + (38)m		
(39)m=	105.56	105.31	105.06	103.9	103.68	102.66	102.66	102.48	103.06	103.68	104.12	104.58	
Average = Sum(39) _{1...12} /12=												103.89	(39)

Heat loss parameter (HLP), W/m²K											(40)m = (39)m ÷ (4)			
(40)m=	1.14	1.13	1.13	1.12	1.11	1.1	1.1	1.1	1.11	1.11	1.12	1.12		
Average = Sum(40) _{1...12} /12=													1.12	(40)

Number of days in month (Table 1a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N	2.66	(42)
if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$		
if TFA ≤ 13.9, N = 1		

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$	97.48	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	107.23	103.33	99.43	95.53	91.63	87.73	87.73	91.63	95.53	99.43	103.33	107.23	
	Total = Sum(44) _{1...12} =											1169.78	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times nm \times DTm / 3600$ kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	159.02	139.08	143.52	125.12	120.06	103.6	96	110.16	111.48	129.92	141.81	154		
Total = Sum(45) _{1...12} =													1533.76	(45)

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

(46)m=	23.85	20.86	21.53	18.77	18.01	15.54	14.4	16.52	16.72	19.49	21.27	23.1	(46)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	------

Water storage loss:		
Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)

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

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

TER WorkSheet: New dwelling as built

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0

(54)

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

0

(55)

Water storage loss calculated for each month

((56)m = (55) x (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 x (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 x (41)m

(61)m= 50.96 46.03 50.67 47.11 46.69 43.27 44.71 46.69 47.11 50.67 49.32 50.96

(61)

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

(62)m= 209.98 185.11 194.19 172.23 166.75 146.87 140.71 156.86 158.59 180.59 191.13 204.96

(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= 209.98 185.11 194.19 172.23 166.75 146.87 140.71 156.86 158.59 180.59 191.13 204.96

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

2107.94

(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= 65.61 57.75 60.39 53.38 51.59 45.26 43.1 48.3 48.84 55.86 59.48 63.94

(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= 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22

(66)

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

(67)m= 22.35 19.85 16.14 12.22 9.14 7.71 8.33 10.83 14.54 18.46 21.55 22.97

(67)

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

(68)m= 244.47 247.01 240.62 227.01 209.83 193.68 182.89 180.36 186.75 200.36 217.54 233.69

(68)

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

(69)m= 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32

(69)

Pumps and fans gains (Table 5a)

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

(70)

TER WorkSheet: New dwelling as built

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

(71)m=

-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

88.19	85.94	81.16	74.14	69.34	62.87	57.93	64.92	67.84	75.09	82.61	85.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

420.98	418.76	403.89	379.34	354.27	330.23	315.12	322.08	335.1	359.87	387.67	408.57
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>10.63</td></tr></table>	10.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>2.14</td></tr></table> (74)	2.14
0.77																		
0.66																		
10.63																		
0.63																		
0.7																		
2.14																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>20.32</td></tr></table>	20.32	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.1</td></tr></table> (74)	4.1
0.77																		
0.66																		
20.32																		
0.63																		
0.7																		
4.1																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>34.53</td></tr></table>	34.53	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>6.96</td></tr></table> (74)	6.96
0.77																		
0.66																		
34.53																		
0.63																		
0.7																		
6.96																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>55.46</td></tr></table>	55.46	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>11.19</td></tr></table> (74)	11.19
0.77																		
0.66																		
55.46																		
0.63																		
0.7																		
11.19																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>74.72</td></tr></table>	74.72	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>15.07</td></tr></table> (74)	15.07
0.77																		
0.66																		
74.72																		
0.63																		
0.7																		
15.07																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>79.99</td></tr></table>	79.99	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>16.13</td></tr></table> (74)	16.13
0.77																		
0.66																		
79.99																		
0.63																		
0.7																		
16.13																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>74.68</td></tr></table>	74.68	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>15.06</td></tr></table> (74)	15.06
0.77																		
0.66																		
74.68																		
0.63																		
0.7																		
15.06																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>59.25</td></tr></table>	59.25	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>11.95</td></tr></table> (74)	11.95
0.77																		
0.66																		
59.25																		
0.63																		
0.7																		
11.95																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>41.52</td></tr></table>	41.52	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>8.37</td></tr></table> (74)	8.37
0.77																		
0.66																		
41.52																		
0.63																		
0.7																		
8.37																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>24.19</td></tr></table>	24.19	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.88</td></tr></table> (74)	4.88
0.77																		
0.66																		
24.19																		
0.63																		
0.7																		
4.88																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>13.12</td></tr></table>	13.12	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>2.65</td></tr></table> (74)	2.65
0.77																		
0.66																		
13.12																		
0.63																		
0.7																		
2.65																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>8.86</td></tr></table>	8.86	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>1.79</td></tr></table> (74)	1.79
0.77																		
0.66																		
8.86																		
0.63																		
0.7																		
1.79																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>8.14</td></tr></table> (75)	8.14
0.77																		
2.36																		
11.28																		
0.63																		
0.7																		
8.14																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>16.56</td></tr></table> (75)	16.56
0.77																		
2.36																		
22.97																		
0.63																		
0.7																		
16.56																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>29.84</td></tr></table> (75)	29.84
0.77																		
2.36																		
41.38																		
0.63																		
0.7																		
29.84																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>49.01</td></tr></table> (75)	49.01
0.77																		
2.36																		
67.96																		
0.63																		
0.7																		
49.01																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>65.88</td></tr></table> (75)	65.88
0.77																		
2.36																		
91.35																		
0.63																		
0.7																		
65.88																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>70.24</td></tr></table> (75)	70.24
0.77																		
2.36																		
97.38																		
0.63																		
0.7																		
70.24																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>65.71</td></tr></table> (75)	65.71
0.77																		
2.36																		
91.1																		
0.63																		
0.7																		
65.71																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>52.38</td></tr></table> (75)	52.38
0.77																		
2.36																		
72.63																		
0.63																		
0.7																		
52.38																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>36.37</td></tr></table> (75)	36.37
0.77																		
2.36																		
50.42																		
0.63																		
0.7																		
36.37																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>20.24</td></tr></table> (75)	20.24
0.77																		
2.36																		
28.07																		
0.63																		
0.7																		
20.24																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>10.24</td></tr></table> (75)	10.24
0.77																		
2.36																		
14.2																		
0.63																		
0.7																		
10.24																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>6.65</td></tr></table> (75)	6.65
0.77																		
2.36																		
9.21																		
0.63																		
0.7																		
6.65																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>94.34</td></tr></table> (77)	94.34
0.77																		
8.39																		
36.79																		
0.63																		
0.7																		
94.34																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>160.7</td></tr></table> (77)	160.7
0.77																		
8.39																		
62.67																		
0.63																		
0.7																		
160.7																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>219.88</td></tr></table> (77)	219.88
0.77																		
8.39																		
85.75																		
0.63																		
0.7																		
219.88																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>272.44</td></tr></table> (77)	272.44
0.77																		
8.39																		
106.25																		
0.63																		
0.7																		
272.44																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>305.15</td></tr></table> (77)	305.15
0.77																		
8.39																		
119.01																		
0.63																		
0.7																		
305.15																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>302.95</td></tr></table> (77)	302.95
0.77																		
8.39																		
118.15																		
0.63																		
0.7																		
302.95																		

TER WorkSheet: New dwelling as built

Southeast	0.9x	0.77	x	8.39	x	113.91	x	0.63	x	0.7	=	292.07	(77)
Southeast	0.9x	0.77	x	8.39	x	104.39	x	0.63	x	0.7	=	267.67	(77)
Southeast	0.9x	0.77	x	8.39	x	92.85	x	0.63	x	0.7	=	238.08	(77)
Southeast	0.9x	0.77	x	8.39	x	69.27	x	0.63	x	0.7	=	177.61	(77)
Southeast	0.9x	0.77	x	8.39	x	44.07	x	0.63	x	0.7	=	113	(77)
Southeast	0.9x	0.77	x	8.39	x	31.49	x	0.63	x	0.7	=	80.74	(77)
West	0.9x	0.77	x	0.66	x	19.64	x	0.63	x	0.7	=	3.96	(80)
West	0.9x	0.77	x	0.66	x	38.42	x	0.63	x	0.7	=	7.75	(80)
West	0.9x	0.77	x	0.66	x	63.27	x	0.63	x	0.7	=	12.76	(80)
West	0.9x	0.77	x	0.66	x	92.28	x	0.63	x	0.7	=	18.61	(80)
West	0.9x	0.77	x	0.66	x	113.09	x	0.63	x	0.7	=	22.81	(80)
West	0.9x	0.77	x	0.66	x	115.77	x	0.63	x	0.7	=	23.35	(80)
West	0.9x	0.77	x	0.66	x	110.22	x	0.63	x	0.7	=	22.23	(80)
West	0.9x	0.77	x	0.66	x	94.68	x	0.63	x	0.7	=	19.1	(80)
West	0.9x	0.77	x	0.66	x	73.59	x	0.63	x	0.7	=	14.84	(80)
West	0.9x	0.77	x	0.66	x	45.59	x	0.63	x	0.7	=	9.2	(80)
West	0.9x	0.77	x	0.66	x	24.49	x	0.63	x	0.7	=	4.94	(80)
West	0.9x	0.77	x	0.66	x	16.15	x	0.63	x	0.7	=	3.26	(80)
Northwest	0.9x	0.77	x	3.16	x	11.28	x	0.63	x	0.7	=	10.9	(81)
Northwest	0.9x	0.77	x	3.16	x	22.97	x	0.63	x	0.7	=	22.18	(81)
Northwest	0.9x	0.77	x	3.16	x	41.38	x	0.63	x	0.7	=	39.96	(81)
Northwest	0.9x	0.77	x	3.16	x	67.96	x	0.63	x	0.7	=	65.63	(81)
Northwest	0.9x	0.77	x	3.16	x	91.35	x	0.63	x	0.7	=	88.22	(81)
Northwest	0.9x	0.77	x	3.16	x	97.38	x	0.63	x	0.7	=	94.05	(81)
Northwest	0.9x	0.77	x	3.16	x	91.1	x	0.63	x	0.7	=	87.98	(81)
Northwest	0.9x	0.77	x	3.16	x	72.63	x	0.63	x	0.7	=	70.14	(81)
Northwest	0.9x	0.77	x	3.16	x	50.42	x	0.63	x	0.7	=	48.69	(81)
Northwest	0.9x	0.77	x	3.16	x	28.07	x	0.63	x	0.7	=	27.11	(81)
Northwest	0.9x	0.77	x	3.16	x	14.2	x	0.63	x	0.7	=	13.71	(81)
Northwest	0.9x	0.77	x	3.16	x	9.21	x	0.63	x	0.7	=	8.9	(81)
Rooflights	0.9x	1	x	0.92	x	16.37	x	0.63	x	0.7	=	5.98	(82)
Rooflights	0.9x	1	x	0.92	x	33.68	x	0.63	x	0.7	=	12.3	(82)
Rooflights	0.9x	1	x	0.92	x	62.13	x	0.63	x	0.7	=	22.69	(82)
Rooflights	0.9x	1	x	0.92	x	104.87	x	0.63	x	0.7	=	38.29	(82)
Rooflights	0.9x	1	x	0.92	x	143.66	x	0.63	x	0.7	=	52.46	(82)
Rooflights	0.9x	1	x	0.92	x	154.33	x	0.63	x	0.7	=	56.35	(82)
Rooflights	0.9x	1	x	0.92	x	143.9	x	0.63	x	0.7	=	52.55	(82)
Rooflights	0.9x	1	x	0.92	x	113.05	x	0.63	x	0.7	=	41.28	(82)
Rooflights	0.9x	1	x	0.92	x	76.56	x	0.63	x	0.7	=	27.96	(82)
Rooflights	0.9x	1	x	0.92	x	41.49	x	0.63	x	0.7	=	15.15	(82)
Rooflights	0.9x	1	x	0.92	x	20.65	x	0.63	x	0.7	=	7.54	(82)

TER WorkSheet: New dwelling as built

Rooflights $0.9 \times \boxed{1} \times \boxed{0.92} \times \boxed{13.34} \times \boxed{0.63} \times \boxed{0.7} = \boxed{4.87}$ (82)

Solar gains in watts, calculated for each month

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

(83)m=

125.46	223.59	332.1	455.17	549.59	563.07	535.6	462.51	374.31	254.18	152.08	106.2
--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	-------

 (83)

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

(84)m=

546.44	642.36	735.99	834.51	903.87	893.3	850.72	784.59	709.41	614.06	539.74	514.77
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

$\boxed{21}$

(85)

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	0.99	0.96	0.86	0.69	0.52	0.58	0.84	0.98	1	1

 (86)

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

(87)m=

19.77	19.93	20.19	20.53	20.81	20.96	20.99	20.99	20.88	20.51	20.08	19.74
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

(88)m=

19.97	19.97	19.98	19.99	19.99	20	20	20	19.99	19.99	19.98	19.98
-------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------

 (88)

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

(89)m=

1	0.99	0.98	0.94	0.82	0.6	0.41	0.47	0.77	0.96	0.99	1
---	------	------	------	------	-----	------	------	------	------	------	---

 (89)

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

(90)m=

18.33	18.57	18.95	19.44	19.81	19.97	19.99	19.99	19.9	19.42	18.79	18.29
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

$\boxed{0.16}$

(91)

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

(92)m=

18.56	18.79	19.15	19.62	19.97	20.13	20.16	20.15	20.06	19.6	19	18.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	----	-------

 (92)

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

(93)m=

18.56	18.79	19.15	19.62	19.97	20.13	20.16	20.15	20.06	19.6	19	18.53
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	----	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=

1	0.99	0.98	0.93	0.81	0.61	0.43	0.48	0.77	0.96	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (94)

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

(95)m=

544.41	636.85	719.39	777.36	736.31	546.87	362.56	379.91	547.86	587.72	535.44	513.34
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

1505.42	1462.52	1329.06	1113.44	857.47	567.79	365.16	384.79	614.15	932.9	1238.73	1498.34
---------	---------	---------	---------	--------	--------	--------	--------	--------	-------	---------	---------

 (97)

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

(98)m=

714.99	554.85	453.6	241.98	90.15	0	0	0	0	256.82	506.37	732.84
--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------

 (98)

Total per year (kWh/year) = Sum(98)m...5,9...12 =

$\boxed{3551.59}$

(98)

Space heating requirement in kWh/m²/year

$\boxed{38.19}$

(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

$\boxed{0}$

(201)

TER WorkSheet: New dwelling as built

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		93.4	(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)												
714.99	554.85	453.6	241.98	90.15	0	0	0	0	256.82	506.37	732.84	
(211)m = {[[(98)m x (204)] } x 100 ÷ (206)												
765.52	594.06	485.65	259.08	96.52	0	0	0	0	274.97	542.15	784.62	
Total (kWh/year) = Sum(211) _{1..5,10...12} =												3802.56
(211)												

Space heating fuel (secondary), kWh/month												
= {[[(98)m x (201)] } x 100 ÷ (208)												
(215)m=	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =												0
(215)												

Water heating

Output from water heater (calculated above)												
209.98	185.11	194.19	172.23	166.75	146.87	140.71	156.86	158.59	180.59	191.13	204.96	
Efficiency of water heater												80.3
(217)m=	87.89	87.64	87.12	85.91	83.58	80.3	80.3	80.3	80.3	85.94	87.39	87.98
(217)												
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	238.91	211.21	222.91	200.49	199.52	182.9	175.23	195.34	197.5	210.14	218.71	232.96
Total = Sum(219a) _{1..12} =												2485.79
(219)												

Annual totals

Space heating fuel used, main system 1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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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	= 821.35
Space heating (secondary)	(215) x	0.519	= 0
Water heating	(219) x	0.216	= 536.93
Space and water heating	(261) + (262) + (263) + (264) =		1358.28
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93

TER WorkSheet: New dwelling as built

Electricity for lighting	(232)	x	0.519	=	204.84	(268)
Total CO2, kg/year			sum of (265)...(271)	=	1602.05	(272)
TER	=				17.23	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 14 March 2023 at 14:54:55

Project Information:

Assessed By: Matt Fitzpatrick (STRO003572)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 92.39m²

Site Reference : Swansea Road

Plot Reference: 2 As Built

Address : 30 Swansea Road, READING, RG1 8HA

Client Details:

Name: Helix

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.78 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.27 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 47.0 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 40.1 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.32	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 512, product index 018738): Boiler systems with radiators or underfloor heating - mains gas Brand name: Baxi Model: ASSURE Model qualifier: 36 COMBI (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: North West 4.61m²
 Windows facing: South East 6.85m²
 Windows facing: South East 1.44m²
 Roof windows facing: North West 0.92m²
 Ventilation rate: 4.00
 Blinds/curtains: None
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

SAP Input

Property Details: 2 As Built

Address: 30 Swansea Road, READING, RG1 8HA
 Located in: England
 Region: Thames valley
 UPRN: UPRN-521180259777
 Date of assessment: 14 March 2023
 Date of certificate: 14 March 2023
 Assessment type: New dwelling as built
 Transaction type: New dwelling
 Tenure type: Unknown
 Related party disclosure: No related party
 Thermal Mass Parameter: Calculated 151.53
 Water use <= 125 litres/person/day: True
 PCDF Version: 512

Property description:

Dwelling type: House
 Detachment: Mid-terrace
 Year Completed: 2023
 Floor Location: Floor area: Storey height:
 Floor 0 39.7 m² 2.5 m
 Floor 1 35.42 m² 2.7 m
 Floor 2 17.27 m² 2.323 m
 Living area: 15.13 m² (fraction 0.163)
 Front of dwelling faces: North West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front	Manufacturer	Solid			Wood
1	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
1	Manufacturer	Roof Windows	low-E, En = 0.1, soft coat	No	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front	mm	0.7	0.63	1.5	2.12	1
1	12mm	0	0.39	1.3	4.61	1
2	12mm	0	0.39	1.3	6.85	1
2	12mm	0	0.39	1.3	1.44	1
1	12mm	0.7	0.63	1.2	0.92	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front		Brick	North West	0	0
1		Brick	North West	0	0
2		Brick	South East	0	0
2		Timber stud	South East	0	0
1		Sloping roof	North West	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Brick	47.24	13.58	33.66	0.25	0	False	60
Timber stud	16.45	1.44	15.01	0.25	0	False	9

SAP Input

Cold roof	2.81	0	2.81	0.11	0	9
Bay roof	0.6	0	0.6	0.11	0	9
Kitchen roof	4.3	0	4.3	0.11	0	9
Loft roof	18.16	0	18.16	0.11	0	9
Sloping roof	20.46	0.92	19.54	0.15	0	9
Suspended floor	39.7			0.11		75
<u>Internal Elements</u>						
Metal stud	178.58					9
Int ceiling	52.69					9
Int Floor	52.69					18
<u>Party Elements</u>						
Party wall	120.65					45

Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.0779				
	Length	Psi-value			
	9.83	0.05	E2	Other lintels (including other steel lintels)	
	6.42	0.034	E3	Sill	
	22.8	0.04	E4	Jamb	
	7.6	0.06	E5	Ground floor (normal)	
	0	0.32	E20	Exposed floor (normal)	
	0	0.32	E21	Exposed floor (inverted)	
	6.09	0	E6	Intermediate floor within a dwelling	
	11.96	0.123	E10	Eaves (insulation at ceiling level)	
	13.5	0.24	E24	Eaves (insulation at ceiling level - inverted)	
	0	0.033	E11	Eaves (insulation at rafter level)	
	0	0.063	E12	Gable (insulation at ceiling level)	
	0	0.08	E13	Gable (insulation at rafter level)	
	7.35	0.05	E16	Corner (normal)	
	7.35	-0.069	E17	Corner (inverted internal area greater than external area)	
	20.09	0.072	E18	Party wall between dwellings	
	0	0.12	E25	Staggered party wall between dwellings	
	20.91	0.043	P1	Ground floor	
	34.11	0	P2	Intermediate floor within a dwelling	
	0	0.16	P7	Exposed floor (normal)	
	8.46	0.055	P4	Roof (insulation at ceiling level)	
	9.88	0.069	P5	Roof (insulation at rafter level)	
	0.98	0.08	R1	Head	
	0.98	0.06	R2	Sill	
	1.96	0.08	R3	Jamb	
	7.64	0.06	R6	Flat ceiling	
	12.92	0.06	R8	Roof wall (rafter)	

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Decentralised whole house extract
	Number of fans in Wetroom: Kitchen 1 Other 3
	Ductwork: ,
	Approved Installation Scheme: True
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.32 (Assessed dwelling is tested)

Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database

SAP Input

Database: (rev 512, product index 018738) Efficiency: Winter 86.7 % Summer: 89.9
Brand name: Baxi
Model: ASSURE
Model qualifier: 36 COMBI
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes

Main heating Control:

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

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Low rise urban / suburban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 2 As Built

Address : 30 Swansea Road, READING, RG1 8HA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	39.7	(1a) x	2.5	(2a) =	99.25 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.39	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	235 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.32000017166138 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.22 (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) =		0.18 (21)

Infiltration rate modified for monthly wind speed

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

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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DER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

	0.23	0.23	0.22	0.2	0.2	0.17	0.17	0.17	0.18	0.2	0.21	0.22
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)
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d) If natural ventilation or whole house positive input ventilation from loft

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

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(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
Doors			2.12	x 1.5	= 3.18		(26)
Windows Type 1			4.61	x 1/[1/(1.3) + 0.04]	= 5.7		(27)
Windows Type 2			6.85	x 1/[1/(1.3) + 0.04]	= 8.46		(27)
Windows Type 3			1.44	x 1/[1/(1.3) + 0.04]	= 1.78		(27)
Rooflights			0.92	x 1/[1/(1.2) + 0.04]	= 1.104		(27b)
Floor			39.7	x 0.11	= 4.367	75	2977.5 (28)
Walls Type1	47.24	13.58	33.66	x 0.25	= 8.42	60	2019.6 (29)
Walls Type2	16.45	1.44	15.01	x 0.25	= 3.75	9	135.09 (29)
Roof Type1	2.81	0	2.81	x 0.11	= 0.31	9	25.29 (30)
Roof Type2	0.6	0	0.6	x 0.11	= 0.07	9	5.4 (30)
Roof Type3	4.3	0	4.3	x 0.11	= 0.47	9	38.7 (30)
Roof Type4	18.16	0	18.16	x 0.11	= 2	9	163.44 (30)
Roof Type5	20.46	0.92	19.54	x 0.15	= 2.93	9	175.86 (30)
Total area of elements, m²			149.72				(31)
Party wall			120.65	x 0	= 0	45	5429.25 (32)
Internal wall **			178.58			9	1607.22 (32c)
Internal floor			52.69			18	948.42 (32d)

DER WorkSheet: New dwelling as built

Internal ceiling

52.69

9

474.21

(32e)

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

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

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) =

42.49

(33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

13999.98

(34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

= (34) ÷ (4) =

151.53

(35)

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

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

11.67

(36)

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

Total fabric heat loss

(33) + (36) =

54.16

(37)

Ventilation heat loss calculated monthly

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

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

92.93

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
------	------	------	------	------	------	------	------	------	------	------	------

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

1.01

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.3

(43)

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

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

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

(44)m=

107.04	103.14	99.25	95.36	91.47	87.57	87.57	91.47	95.36	99.25	103.14	107.04
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1167.66

(44)

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

(45)m=

158.73	138.83	143.26	124.89	119.84	103.41	95.83	109.96	111.28	129.68	141.56	153.72
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1530.98

(45)

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

(46)m=

23.81	20.82	21.49	18.73	17.98	15.51	14.37	16.49	16.69	19.45	21.23	23.06
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

DER WorkSheet: New dwelling as built

Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)											
b) If manufacturer's declared cylinder loss factor is not known:														
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)											
If community heating see section 4.3														
Volume factor from Table 2a		0	(52)											
Temperature factor from Table 2b		0	(53)											
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)											
Enter (50) or (54) in (55)		0	(55)											
Water storage loss calculated for each month	((56)m = (55) x (41)m													
(56)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(56)
0	0	0	0	0	0	0	0	0	0	0	0			
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=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(57)
0	0	0	0	0	0	0	0	0	0	0	0			
Primary circuit loss (annual) from Table 3		0	(58)											
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m														
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)														
(59)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(59)
0	0	0	0	0	0	0	0	0	0	0	0			
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m														
(61)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">11.82</td> <td style="border: 1px solid black; width: 30px; text-align: center;">10.67</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.8</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.39</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.75</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.35</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.71</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.74</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.37</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.78</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.42</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.82</td> </tr> </table>	11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82	(61)
11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82			
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m														
(62)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">170.55</td> <td style="border: 1px solid black; width: 30px; text-align: center;">149.5</td> <td style="border: 1px solid black; width: 30px; text-align: center;">155.06</td> <td style="border: 1px solid black; width: 30px; text-align: center;">136.29</td> <td style="border: 1px solid black; width: 30px; text-align: center;">131.59</td> <td style="border: 1px solid black; width: 30px; text-align: center;">114.76</td> <td style="border: 1px solid black; width: 30px; text-align: center;">107.54</td> <td style="border: 1px solid black; width: 30px; text-align: center;">121.7</td> <td style="border: 1px solid black; width: 30px; text-align: center;">122.65</td> <td style="border: 1px solid black; width: 30px; text-align: center;">141.46</td> <td style="border: 1px solid black; width: 30px; text-align: center;">152.98</td> <td style="border: 1px solid black; width: 30px; text-align: center;">165.54</td> </tr> </table>	170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54	(62)
170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54			
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=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(63)
0	0	0	0	0	0	0	0	0	0	0	0			
Output from water heater														
(64)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">170.55</td> <td style="border: 1px solid black; width: 30px; text-align: center;">149.5</td> <td style="border: 1px solid black; width: 30px; text-align: center;">155.06</td> <td style="border: 1px solid black; width: 30px; text-align: center;">136.29</td> <td style="border: 1px solid black; width: 30px; text-align: center;">131.59</td> <td style="border: 1px solid black; width: 30px; text-align: center;">114.76</td> <td style="border: 1px solid black; width: 30px; text-align: center;">107.54</td> <td style="border: 1px solid black; width: 30px; text-align: center;">121.7</td> <td style="border: 1px solid black; width: 30px; text-align: center;">122.65</td> <td style="border: 1px solid black; width: 30px; text-align: center;">141.46</td> <td style="border: 1px solid black; width: 30px; text-align: center;">152.98</td> <td style="border: 1px solid black; width: 30px; text-align: center;">165.54</td> </tr> </table>	170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54	
170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54			
Output from water heater (annual) _{1...12}											1669.61	(64)		
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]														
(65)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">55.73</td> <td style="border: 1px solid black; width: 30px; text-align: center;">48.83</td> <td style="border: 1px solid black; width: 30px; text-align: center;">50.58</td> <td style="border: 1px solid black; width: 30px; text-align: center;">44.38</td> <td style="border: 1px solid black; width: 30px; text-align: center;">42.78</td> <td style="border: 1px solid black; width: 30px; text-align: center;">37.22</td> <td style="border: 1px solid black; width: 30px; text-align: center;">34.79</td> <td style="border: 1px solid black; width: 30px; text-align: center;">39.5</td> <td style="border: 1px solid black; width: 30px; text-align: center;">39.84</td> <td style="border: 1px solid black; width: 30px; text-align: center;">46.06</td> <td style="border: 1px solid black; width: 30px; text-align: center;">49.92</td> <td style="border: 1px solid black; width: 30px; text-align: center;">54.07</td> </tr> </table>	55.73	48.83	50.58	44.38	42.78	37.22	34.79	39.5	39.84	46.06	49.92	54.07	(65)
55.73	48.83	50.58	44.38	42.78	37.22	34.79	39.5	39.84	46.06	49.92	54.07			
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=	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
(67)m=	22.89	20.33	16.53	12.52	9.36	7.9	8.53	11.09	14.89	18.91	22.07	23.52
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
(68)m=	243.41	245.93	239.57	226.02	208.91	192.84	182.1	179.57	185.94	199.49	216.59	232.67
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29
Pumps and fans gains (Table 5a)												
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3
Losses e.g. evaporation (negative values) (Table 5)												
(71)m=	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28

DER WorkSheet: New dwelling as built

Water heating gains (Table 5)

(72)m=

74.91	72.66	67.99	61.63	57.51	51.7	46.76	53.09	55.34	61.91	69.34	72.67
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

407.06	404.78	389.94	366.02	341.63	318.29	303.25	309.61	322.02	346.16	373.85	394.72
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Southeast 0.9x	0.77	x	6.85	x	36.79	x	0.39	x	1.11	=	75.69	(77)
Southeast 0.9x	0.77	x	1.44	x	36.79	x	0.39	x	1.11	=	15.91	(77)
Southeast 0.9x	0.77	x	6.85	x	62.67	x	0.39	x	1.11	=	128.92	(77)
Southeast 0.9x	0.77	x	1.44	x	62.67	x	0.39	x	1.11	=	27.1	(77)
Southeast 0.9x	0.77	x	6.85	x	85.75	x	0.39	x	1.11	=	176.4	(77)
Southeast 0.9x	0.77	x	1.44	x	85.75	x	0.39	x	1.11	=	37.08	(77)
Southeast 0.9x	0.77	x	6.85	x	106.25	x	0.39	x	1.11	=	218.57	(77)
Southeast 0.9x	0.77	x	1.44	x	106.25	x	0.39	x	1.11	=	45.95	(77)
Southeast 0.9x	0.77	x	6.85	x	119.01	x	0.39	x	1.11	=	244.81	(77)
Southeast 0.9x	0.77	x	1.44	x	119.01	x	0.39	x	1.11	=	51.46	(77)
Southeast 0.9x	0.77	x	6.85	x	118.15	x	0.39	x	1.11	=	243.04	(77)
Southeast 0.9x	0.77	x	1.44	x	118.15	x	0.39	x	1.11	=	51.09	(77)
Southeast 0.9x	0.77	x	6.85	x	113.91	x	0.39	x	1.11	=	234.32	(77)
Southeast 0.9x	0.77	x	1.44	x	113.91	x	0.39	x	1.11	=	49.26	(77)
Southeast 0.9x	0.77	x	6.85	x	104.39	x	0.39	x	1.11	=	214.74	(77)
Southeast 0.9x	0.77	x	1.44	x	104.39	x	0.39	x	1.11	=	45.14	(77)
Southeast 0.9x	0.77	x	6.85	x	92.85	x	0.39	x	1.11	=	191	(77)
Southeast 0.9x	0.77	x	1.44	x	92.85	x	0.39	x	1.11	=	40.15	(77)
Southeast 0.9x	0.77	x	6.85	x	69.27	x	0.39	x	1.11	=	142.49	(77)
Southeast 0.9x	0.77	x	1.44	x	69.27	x	0.39	x	1.11	=	29.95	(77)
Southeast 0.9x	0.77	x	6.85	x	44.07	x	0.39	x	1.11	=	90.66	(77)
Southeast 0.9x	0.77	x	1.44	x	44.07	x	0.39	x	1.11	=	19.06	(77)
Southeast 0.9x	0.77	x	6.85	x	31.49	x	0.39	x	1.11	=	64.77	(77)
Southeast 0.9x	0.77	x	1.44	x	31.49	x	0.39	x	1.11	=	13.62	(77)
Northwest 0.9x	0.77	x	4.61	x	11.28	x	0.39	x	1.11	=	15.62	(81)
Northwest 0.9x	0.77	x	4.61	x	22.97	x	0.39	x	1.11	=	31.79	(81)
Northwest 0.9x	0.77	x	4.61	x	41.38	x	0.39	x	1.11	=	57.28	(81)
Northwest 0.9x	0.77	x	4.61	x	67.96	x	0.39	x	1.11	=	94.08	(81)
Northwest 0.9x	0.77	x	4.61	x	91.35	x	0.39	x	1.11	=	126.46	(81)
Northwest 0.9x	0.77	x	4.61	x	97.38	x	0.39	x	1.11	=	134.82	(81)
Northwest 0.9x	0.77	x	4.61	x	91.1	x	0.39	x	1.11	=	126.12	(81)
Northwest 0.9x	0.77	x	4.61	x	72.63	x	0.39	x	1.11	=	100.54	(81)

DER WorkSheet: New dwelling as built

Northwest 0.9x	0.77	x	4.61	x	50.42	x	0.39	x	1.11	=	69.8	(81)
Northwest 0.9x	0.77	x	4.61	x	28.07	x	0.39	x	1.11	=	38.86	(81)
Northwest 0.9x	0.77	x	4.61	x	14.2	x	0.39	x	1.11	=	19.65	(81)
Northwest 0.9x	0.77	x	4.61	x	9.21	x	0.39	x	1.11	=	12.76	(81)
Rooflights 0.9x	1	x	0.92	x	16.37	x	0.63	x	0.7	=	5.98	(82)
Rooflights 0.9x	1	x	0.92	x	33.68	x	0.63	x	0.7	=	12.3	(82)
Rooflights 0.9x	1	x	0.92	x	62.13	x	0.63	x	0.7	=	22.69	(82)
Rooflights 0.9x	1	x	0.92	x	104.87	x	0.63	x	0.7	=	38.29	(82)
Rooflights 0.9x	1	x	0.92	x	143.66	x	0.63	x	0.7	=	52.46	(82)
Rooflights 0.9x	1	x	0.92	x	154.33	x	0.63	x	0.7	=	56.35	(82)
Rooflights 0.9x	1	x	0.92	x	143.9	x	0.63	x	0.7	=	52.55	(82)
Rooflights 0.9x	1	x	0.92	x	113.05	x	0.63	x	0.7	=	41.28	(82)
Rooflights 0.9x	1	x	0.92	x	76.56	x	0.63	x	0.7	=	27.96	(82)
Rooflights 0.9x	1	x	0.92	x	41.49	x	0.63	x	0.7	=	15.15	(82)
Rooflights 0.9x	1	x	0.92	x	20.65	x	0.63	x	0.7	=	7.54	(82)
Rooflights 0.9x	1	x	0.92	x	13.34	x	0.63	x	0.7	=	4.87	(82)

Solar gains in watts, calculated for each month

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

(83)m=	113.19	200.12	293.45	396.88	475.19	485.3	462.24	401.7	328.91	226.45	136.91	96.02	(83)
--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	-------	------

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

(84)m=	520.25	604.9	683.39	762.9	816.82	803.59	765.49	711.31	650.93	572.61	510.76	490.73	(84)
--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.81	0.66	0.51	0.56	0.79	0.94	0.98	0.99	(86)

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

(87)m=	19.41	19.61	19.94	20.34	20.69	20.9	20.97	20.96	20.8	20.34	19.79	19.35	(87)
--------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	------

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

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.95	0.89	0.77	0.59	0.41	0.46	0.72	0.92	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.94	18.24	18.71	19.28	19.75	19.99	20.06	20.05	19.89	19.28	18.49	17.85	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.16

(91)

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

(92)m=	18.18	18.46	18.91	19.45	19.9	20.14	20.21	20.2	20.04	19.46	18.7	18.1	(92)
--------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	------	------	------

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

(93)m=	18.18	18.46	18.91	19.45	19.9	20.14	20.21	20.2	20.04	19.46	18.7	18.1	(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 as built

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.94	0.88	0.76	0.59	0.43	0.48	0.72	0.91	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	510.18	584.82	641.65	669.35	623.19	476.21	327.14	340.26	469.68	519.17	494.46	482.88	(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=	1289.69	1260.27	1153.04	980.41	762.09	515.12	335.58	353.24	551.9	823.17	1078.19	1291.6	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	-------	--------	---------	--------	------

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

(98)m=	579.95	453.9	380.48	223.96	103.34	0	0	0	0	226.17	420.28	601.68	(98)
--------	--------	-------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

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

2989.78

Space heating requirement in kWh/m²/year

32.36

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

89.9

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)

579.95	453.9	380.48	223.96	103.34	0	0	0	0	226.17	420.28	601.68
--------	-------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

645.11	504.89	423.23	249.12	114.95	0	0	0	0	251.58	467.5	669.28
--------	--------	--------	--------	--------	---	---	---	---	--------	-------	--------

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

3325.67

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)

170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Efficiency of water heater

86.7

(217)m=

89.15	89.09	88.95	88.66	88.08	86.7	86.7	86.7	86.7	88.64	89.02	89.19
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.31	167.82	174.32	153.71	149.4	132.36	124.03	140.37	141.46	159.59	171.84	185.6	(219)
---------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	-------	-------

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

1891.82

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3325.67

Water heating fuel used

1891.82

Electricity for pumps, fans and electric keep-hot

DER WorkSheet: New dwelling as built

mechanical ventilation - balanced, extract or positive input from outside	68.4	(230a)
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	143.4 (231)
Electricity for lighting		404.2 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5765.08 (238)

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 =	718.34 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	408.63 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1126.98 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	74.42 (267)
Electricity for lighting	(232) x	0.519 =	209.78 (268)
Total CO2, kg/year		sum of (265)...(271) =	1411.18 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	15.27 (273)
El rating (section 14)			86 (274)

TER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 2 As Built

Address : 30 Swansea Road, READING, RG1 8HA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	39.7	(1a) x	2.5	(2a) =	99.25 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.39	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	235 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	0 (6b)
Number of intermittent fans				3	x 10 = 30 (7a)
Number of passive vents				0	x 10 = 0 (7b)
Number of flueless gas fires				0	x 40 = 0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)				0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.32	(21)
Infiltration rate modified for monthly wind speed					

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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TER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1	= 2.12		(26)
Windows Type 1			4.61	x1/[1/(1.4)+ 0.04] =	6.11		(27)
Windows Type 2			6.85	x1/[1/(1.4)+ 0.04] =	9.08		(27)
Windows Type 3			1.44	x1/[1/(1.4)+ 0.04] =	1.91		(27)
Rooflights			0.92	x1/[1/(1.7) + 0.04] =	1.564		(27b)
Floor			39.7	x 0.13	= 5.161		(28)
Walls Type1	47.24	13.58	33.66	x 0.18	= 6.06		(29)
Walls Type2	16.45	1.44	15.01	x 0.18	= 2.7		(29)
Roof Type1	2.81	0	2.81	x 0.13	= 0.37		(30)
Roof Type2	0.6	0	0.6	x 0.13	= 0.08		(30)
Roof Type3	4.3	0	4.3	x 0.13	= 0.56		(30)
Roof Type4	18.16	0	18.16	x 0.13	= 2.36		(30)
Roof Type5	20.46	0.92	19.54	x 0.13	= 2.54		(30)
Total area of elements, m²			149.72				(31)
Party wall			120.65	x 0	= 0		(32)
Internal wall **			178.58				(32c)
Internal floor			52.69				(32d)

TER WorkSheet: New dwelling as built

Internal ceiling

52.69

(32e)

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

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

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) =

40.51

(33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

13999.98

(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

13.34

(36)

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

Total fabric heat loss

(33) + (36) =

53.85

(37)

Ventilation heat loss calculated monthly

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

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
45.27	45.02	44.77	43.61	43.39	42.38	42.38	42.19	42.77	43.39	43.83	44.29

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

99.12	98.87	98.62	97.46	97.24	96.23	96.23	96.04	96.62	97.24	97.68	98.14
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Average = Sum(39)_{1...12} /12=

97.46

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.07	1.07	1.07	1.05	1.05	1.04	1.04	1.04	1.05	1.05	1.06	1.06
------	------	------	------	------	------	------	------	------	------	------	------

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

1.05

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.3

(43)

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

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

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

(44)m=

107.04	103.14	99.25	95.36	91.47	87.57	87.57	91.47	95.36	99.25	103.14	107.04
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Total = Sum(44)_{1...12} =

1167.66

(44)

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

(45)m=

158.73	138.83	143.26	124.89	119.84	103.41	95.83	109.96	111.28	129.68	141.56	153.72
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1530.98

(45)

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

(46)m=

23.81	20.82	21.49	18.73	17.98	15.51	14.37	16.49	16.69	19.45	21.23	23.06
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(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

TER WorkSheet: New dwelling as built

Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)												
b) If manufacturer's declared cylinder loss factor is not known:															
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)												
If community heating see section 4.3															
Volume factor from Table 2a		0	(52)												
Temperature factor from Table 2b		0	(53)												
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)												
Enter (50) or (54) in (55)		0	(55)												
Water storage loss calculated for each month	((56)m = (55) x (41)m														
(56)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(56)
0	0	0	0	0	0	0	0	0	0	0	0				
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=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(57)
0	0	0	0	0	0	0	0	0	0	0	0				
Primary circuit loss (annual) from Table 3		0	(58)												
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m															
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)															
(59)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(59)
0	0	0	0	0	0	0	0	0	0	0	0				
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m															
(61)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>50.96</td><td>46.03</td><td>50.58</td><td>47.03</td><td>46.61</td><td>43.19</td><td>44.63</td><td>46.61</td><td>47.03</td><td>50.58</td><td>49.32</td><td>50.96</td> </tr> </table>	50.96	46.03	50.58	47.03	46.61	43.19	44.63	46.61	47.03	50.58	49.32	50.96		(61)
50.96	46.03	50.58	47.03	46.61	43.19	44.63	46.61	47.03	50.58	49.32	50.96				
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m															
(62)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>209.69</td><td>184.85</td><td>193.83</td><td>171.92</td><td>166.45</td><td>146.6</td><td>140.45</td><td>156.57</td><td>158.3</td><td>180.26</td><td>190.87</td><td>204.68</td> </tr> </table>	209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68		(62)
209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68				
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=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(63)
0	0	0	0	0	0	0	0	0	0	0	0				
Output from water heater															
(64)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>209.69</td><td>184.85</td><td>193.83</td><td>171.92</td><td>166.45</td><td>146.6</td><td>140.45</td><td>156.57</td><td>158.3</td><td>180.26</td><td>190.87</td><td>204.68</td> </tr> </table>	209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68		
209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68				
											Output from water heater (annual) ^{1...12}	2104.48	(64)		
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]															
(65)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>65.52</td><td>57.67</td><td>60.28</td><td>53.28</td><td>51.5</td><td>45.18</td><td>43.02</td><td>48.22</td><td>48.76</td><td>55.76</td><td>59.4</td><td>63.85</td> </tr> </table>	65.52	57.67	60.28	53.28	51.5	45.18	43.02	48.22	48.76	55.76	59.4	63.85		(65)
65.52	57.67	60.28	53.28	51.5	45.18	43.02	48.22	48.76	55.76	59.4	63.85				
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=	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	22.89	20.33	16.53	12.52	9.36	7.9	8.53	11.09	14.89	18.91	22.07	23.52	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	243.41	245.93	239.57	226.02	208.91	192.84	182.1	179.57	185.94	199.49	216.59	232.67	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	(71)

TER WorkSheet: New dwelling as built

Water heating gains (Table 5)

(72)m=

88.06	85.81	81.02	74.01	69.22	62.75	57.82	64.81	67.72	74.95	82.5	85.82
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

 (72)

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

(73)m=

420.21	417.93	402.97	378.39	353.34	329.34	314.31	321.33	334.4	359.2	387.01	407.87
--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>77.03</td></tr></table>	77.03	(77)
0.77																		
6.85																		
36.79																		
0.63																		
0.7																		
77.03																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>16.19</td></tr></table>	16.19	(77)
0.77																		
1.44																		
36.79																		
0.63																		
0.7																		
16.19																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>131.2</td></tr></table>	131.2	(77)
0.77																		
6.85																		
62.67																		
0.63																		
0.7																		
131.2																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>27.58</td></tr></table>	27.58	(77)
0.77																		
1.44																		
62.67																		
0.63																		
0.7																		
27.58																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>179.52</td></tr></table>	179.52	(77)
0.77																		
6.85																		
85.75																		
0.63																		
0.7																		
179.52																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>37.74</td></tr></table>	37.74	(77)
0.77																		
1.44																		
85.75																		
0.63																		
0.7																		
37.74																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>222.43</td></tr></table>	222.43	(77)
0.77																		
6.85																		
106.25																		
0.63																		
0.7																		
222.43																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>46.76</td></tr></table>	46.76	(77)
0.77																		
1.44																		
106.25																		
0.63																		
0.7																		
46.76																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>249.14</td></tr></table>	249.14	(77)
0.77																		
6.85																		
119.01																		
0.63																		
0.7																		
249.14																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>52.37</td></tr></table>	52.37	(77)
0.77																		
1.44																		
119.01																		
0.63																		
0.7																		
52.37																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>247.34</td></tr></table>	247.34	(77)
0.77																		
6.85																		
118.15																		
0.63																		
0.7																		
247.34																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>52</td></tr></table>	52	(77)
0.77																		
1.44																		
118.15																		
0.63																		
0.7																		
52																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>113.91</td></tr></table>	113.91	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>238.46</td></tr></table>	238.46	(77)
0.77																		
6.85																		
113.91																		
0.63																		
0.7																		
238.46																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>113.91</td></tr></table>	113.91	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>50.13</td></tr></table>	50.13	(77)
0.77																		
1.44																		
113.91																		
0.63																		
0.7																		
50.13																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>104.39</td></tr></table>	104.39	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>218.54</td></tr></table>	218.54	(77)
0.77																		
6.85																		
104.39																		
0.63																		
0.7																		
218.54																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>104.39</td></tr></table>	104.39	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>45.94</td></tr></table>	45.94	(77)
0.77																		
1.44																		
104.39																		
0.63																		
0.7																		
45.94																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>92.85</td></tr></table>	92.85	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>194.38</td></tr></table>	194.38	(77)
0.77																		
6.85																		
92.85																		
0.63																		
0.7																		
194.38																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>92.85</td></tr></table>	92.85	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>40.86</td></tr></table>	40.86	(77)
0.77																		
1.44																		
92.85																		
0.63																		
0.7																		
40.86																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>69.27</td></tr></table>	69.27	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>145.01</td></tr></table>	145.01	(77)
0.77																		
6.85																		
69.27																		
0.63																		
0.7																		
145.01																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>69.27</td></tr></table>	69.27	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>30.48</td></tr></table>	30.48	(77)
0.77																		
1.44																		
69.27																		
0.63																		
0.7																		
30.48																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>44.07</td></tr></table>	44.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>92.26</td></tr></table>	92.26	(77)
0.77																		
6.85																		
44.07																		
0.63																		
0.7																		
92.26																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>44.07</td></tr></table>	44.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>19.39</td></tr></table>	19.39	(77)
0.77																		
1.44																		
44.07																		
0.63																		
0.7																		
19.39																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>31.49</td></tr></table>	31.49	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>65.92</td></tr></table>	65.92	(77)
0.77																		
6.85																		
31.49																		
0.63																		
0.7																		
65.92																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>31.49</td></tr></table>	31.49	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>13.86</td></tr></table>	13.86	(77)
0.77																		
1.44																		
31.49																		
0.63																		
0.7																		
13.86																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>15.9</td></tr></table>	15.9	(81)
0.77																		
4.61																		
11.28																		
0.63																		
0.7																		
15.9																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>32.36</td></tr></table>	32.36	(81)
0.77																		
4.61																		
22.97																		
0.63																		
0.7																		
32.36																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>58.3</td></tr></table>	58.3	(81)
0.77																		
4.61																		
41.38																		
0.63																		
0.7																		
58.3																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>95.74</td></tr></table>	95.74	(81)
0.77																		
4.61																		
67.96																		
0.63																		
0.7																		
95.74																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>128.7</td></tr></table>	128.7	(81)
0.77																		
4.61																		
91.35																		
0.63																		
0.7																		
128.7																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>137.2</td></tr></table>	137.2	(81)
0.77																		
4.61																		
97.38																		
0.63																		
0.7																		
137.2																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>128.35</td></tr></table>	128.35	(81)
0.77																		
4.61																		
91.1																		
0.63																		
0.7																		
128.35																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>102.32</td></tr></table>	102.32	(81)
0.77																		
4.61																		
72.63																		
0.63																		
0.7																		
102.32																		

TER WorkSheet: New dwelling as built

Northwest 0.9x	0.77	x	4.61	x	50.42	x	0.63	x	0.7	=	71.04	(81)
Northwest 0.9x	0.77	x	4.61	x	28.07	x	0.63	x	0.7	=	39.54	(81)
Northwest 0.9x	0.77	x	4.61	x	14.2	x	0.63	x	0.7	=	20	(81)
Northwest 0.9x	0.77	x	4.61	x	9.21	x	0.63	x	0.7	=	12.98	(81)
Rooflights 0.9x	1	x	0.92	x	16.37	x	0.63	x	0.7	=	5.98	(82)
Rooflights 0.9x	1	x	0.92	x	33.68	x	0.63	x	0.7	=	12.3	(82)
Rooflights 0.9x	1	x	0.92	x	62.13	x	0.63	x	0.7	=	22.69	(82)
Rooflights 0.9x	1	x	0.92	x	104.87	x	0.63	x	0.7	=	38.29	(82)
Rooflights 0.9x	1	x	0.92	x	143.66	x	0.63	x	0.7	=	52.46	(82)
Rooflights 0.9x	1	x	0.92	x	154.33	x	0.63	x	0.7	=	56.35	(82)
Rooflights 0.9x	1	x	0.92	x	143.9	x	0.63	x	0.7	=	52.55	(82)
Rooflights 0.9x	1	x	0.92	x	113.05	x	0.63	x	0.7	=	41.28	(82)
Rooflights 0.9x	1	x	0.92	x	76.56	x	0.63	x	0.7	=	27.96	(82)
Rooflights 0.9x	1	x	0.92	x	41.49	x	0.63	x	0.7	=	15.15	(82)
Rooflights 0.9x	1	x	0.92	x	20.65	x	0.63	x	0.7	=	7.54	(82)
Rooflights 0.9x	1	x	0.92	x	13.34	x	0.63	x	0.7	=	4.87	(82)

Solar gains in watts, calculated for each month

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

(83)m=

115.09	203.44	298.24	403.23	482.67	492.89	469.49	408.08	334.24	230.19	139.19	97.63
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (83)

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

(84)m=

535.3	621.37	701.21	781.62	836.01	822.24	783.8	729.4	668.63	589.38	526.2	505.5
-------	--------	--------	--------	--------	--------	-------	-------	--------	--------	-------	-------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	0.99	0.96	0.87	0.7	0.53	0.59	0.84	0.98	1	1

 (86)

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

(87)m=

19.84	20	20.24	20.56	20.82	20.96	20.99	20.99	20.89	20.55	20.14	19.82
-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

(88)m=

20.02	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.03
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

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

(89)m=

1	0.99	0.98	0.95	0.83	0.62	0.42	0.48	0.77	0.97	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (89)

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

(90)m=

18.48	18.7	19.05	19.51	19.86	20.02	20.05	20.05	19.96	19.51	18.91	18.44
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

0.16

(91)

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

(92)m=

18.7	18.91	19.25	19.68	20.02	20.18	20.2	20.2	20.11	19.68	19.12	18.67
------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------

 (92)

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

(93)m=

18.7	18.91	19.25	19.68	20.02	20.18	20.2	20.2	20.11	19.68	19.12	18.67
------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------

 (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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

TER WorkSheet: New dwelling as built

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.83	0.63	0.44	0.49	0.78	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	533.48	616.55	687.12	733.79	693.52	517.1	344.26	360.71	521.18	565.49	522.3	504.21	(95)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1427.35	1385.34	1257.26	1051	809.05	536.59	346.54	364.94	580.87	883.03	1173.67	1420.05	(97)
--------	---------	---------	---------	------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	665.04	516.62	424.18	228.39	85.95	0	0	0	0	236.25	468.99	681.38	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

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

3306.82

Space heating requirement in kWh/m²/year

35.79

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

93.4

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)

665.04	516.62	424.18	228.39	85.95	0	0	0	0	236.25	468.99	681.38
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

712.04	553.13	454.16	244.53	92.03	0	0	0	0	252.95	502.13	729.53
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

3540.49

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

0

Water heating

Output from water heater (calculated above)

209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68
--------	--------	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------

Efficiency of water heater

80.3

(217)m=	87.75	87.5	86.97	85.77	83.48	80.3	80.3	80.3	80.3	85.73	87.23	87.85	(217)
---------	-------	------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	238.95	211.26	222.88	200.45	199.4	182.56	174.91	194.98	197.14	210.25	218.82	232.99
---------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

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

2484.61

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3540.49

Water heating fuel used

2484.61

Electricity for pumps, fans and electric keep-hot

TER WorkSheet: New dwelling as built

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		404.2	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6504.3	(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	=	764.75	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	536.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1301.42	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	209.78	(268)
Total CO2, kg/year		sum of (265)...(271) =			1550.13	(272)
TER =					16.78	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 02 March 2023 at 13:02:34

Project Information:

Assessed By: Matt Fitzpatrick (STRO003572)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 92.39m²

Site Reference : Swansea Road

Plot Reference: 3 As Built

Address : 28A Swansea Road, READING, RG1 8HA

Client Details:

Name: Helix

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.78 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.27 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 47.0 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 40.0 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.29	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 512, product index 018738): Boiler systems with radiators or underfloor heating - mains gas Brand name: Baxi Model: ASSURE Model qualifier: 36 COMBI (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: North West 4.61m²
 Windows facing: South East 6.85m²
 Windows facing: South East 1.44m²
 Roof windows facing: North West 0.92m²
 Ventilation rate: 4.00
 Blinds/curtains: None
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

SAP Input

Property Details: 3 As Built

Address: 28A Swansea Road, READING, RG1 8HA
 Located in: England
 Region: Thames valley
 UPRN: UPRN-523158256458
 Date of assessment: 02 March 2023
 Date of certificate: 02 March 2023
 Assessment type: New dwelling as built
 Transaction type: New dwelling
 Tenure type: Unknown
 Related party disclosure: No related party
 Thermal Mass Parameter: Calculated 151.53
 Water use <= 125 litres/person/day: True
 PCDF Version: 512

Property description:

Dwelling type: House
 Detachment: Mid-terrace
 Year Completed: 2023
 Floor Location: Floor area: Storey height:
 Floor 0 39.7 m² 2.5 m
 Floor 1 35.42 m² 2.7 m
 Floor 2 17.27 m² 2.323 m
 Living area: 15.13 m² (fraction 0.163)
 Front of dwelling faces: North West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:	
Front	Manufacturer	Solid			Wood	
1	BFRC	Windows	low-E, En = 0.1, soft coat	No		
2	BFRC	Windows	low-E, En = 0.1, soft coat	No		
2	BFRC	Windows	low-E, En = 0.1, soft coat	No		
1	Manufacturer	Roof Windows	low-E, En = 0.1, soft coat	No	Wood	
Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front	mm	0.7	0.63	1.5	2.12	1
1	12mm	0	0.39	1.3	4.61	1
2	12mm	0	0.39	1.3	6.85	1
2	12mm	0	0.39	1.3	1.44	1
1	12mm	0.7	0.63	1.2	0.92	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front		Brick	North West	0	0
1		Brick	North West	0	0
2		Brick	South East	0	0
2		Timber stud	South East	0	0
1		Sloping roof	North West	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Brick	47.24	13.58	33.66	0.25	0	False	60
Timber stud	16.45	1.44	15.01	0.25	0	False	9

SAP Input

Cold roof	2.81	0	2.81	0.11	0	9
Bay roof	0.6	0	0.6	0.11	0	9
Kitchen roof	4.3	0	4.3	0.11	0	9
Loft roof	18.16	0	18.16	0.11	0	9
Sloping roof	20.46	0.92	19.54	0.15	0	9
Suspended floor	39.7			0.11		75
<u>Internal Elements</u>						
Metal stud	178.58					9
Int ceiling	52.69					9
Int Floor	52.69					18
<u>Party Elements</u>						
Party wall	120.65					45

Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.0779				
	Length	Psi-value			
	9.83	0.05	E2	Other lintels (including other steel lintels)	
	6.42	0.034	E3	Sill	
	22.8	0.04	E4	Jamb	
	7.6	0.06	E5	Ground floor (normal)	
	0	0.32	E20	Exposed floor (normal)	
	0	0.32	E21	Exposed floor (inverted)	
	6.09	0	E6	Intermediate floor within a dwelling	
	11.96	0.123	E10	Eaves (insulation at ceiling level)	
	13.5	0.24	E24	Eaves (insulation at ceiling level - inverted)	
	0	0.033	E11	Eaves (insulation at rafter level)	
	0	0.063	E12	Gable (insulation at ceiling level)	
	0	0.08	E13	Gable (insulation at rafter level)	
	7.35	0.05	E16	Corner (normal)	
	7.35	-0.069	E17	Corner (inverted internal area greater than external area)	
	20.09	0.072	E18	Party wall between dwellings	
	0	0.12	E25	Staggered party wall between dwellings	
	20.91	0.043	P1	Ground floor	
	34.11	0	P2	Intermediate floor within a dwelling	
	0	0.16	P7	Exposed floor (normal)	
	8.46	0.055	P4	Roof (insulation at ceiling level)	
	9.88	0.069	P5	Roof (insulation at rafter level)	
	0.98	0.08	R1	Head	
	0.98	0.06	R2	Sill	
	1.96	0.08	R3	Jamb	
	7.64	0.06	R6	Flat ceiling	
	12.92	0.06	R8	Roof wall (rafter)	

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Decentralised whole house extract
	Number of fans in Wetroom: Kitchen 1 Other 3
	Ductwork: ,
	Approved Installation Scheme: True
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.29 (Assessed dwelling is tested)

Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database

SAP Input

Database: (rev 512, product index 018738) Efficiency: Winter 86.7 % Summer: 89.9
Brand name: Baxi
Model: ASSURE
Model qualifier: 36 COMBI
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes

Main heating Control:

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

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Low rise urban / suburban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 3 As Built

Address : 28A Swansea Road, READING, RG1 8HA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	39.7	(1a) x	2.5	(2a) =	99.25 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.39	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	235 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.28999996185303	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.21	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.18	(21)
Infiltration rate modified for monthly wind speed				

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

DER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.23	0.23	0.22	0.2	0.2	0.17	0.17	0.17	0.18	0.2	0.21	0.21
--	------	------	------	-----	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(24c)

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

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

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

(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1.5	= 3.18		(26)
Windows Type 1			4.61	x1/[1/(1.3)+ 0.04]	= 5.7		(27)
Windows Type 2			6.85	x1/[1/(1.3)+ 0.04]	= 8.46		(27)
Windows Type 3			1.44	x1/[1/(1.3)+ 0.04]	= 1.78		(27)
Rooflights			0.92	x1/[1/(1.2) + 0.04]	= 1.104		(27b)
Floor			39.7	x 0.11	= 4.367	75	2977.5 (28)
Walls Type1	47.24	13.58	33.66	x 0.25	= 8.42	60	2019.6 (29)
Walls Type2	16.45	1.44	15.01	x 0.25	= 3.75	9	135.09 (29)
Roof Type1	2.81	0	2.81	x 0.11	= 0.31	9	25.29 (30)
Roof Type2	0.6	0	0.6	x 0.11	= 0.07	9	5.4 (30)
Roof Type3	4.3	0	4.3	x 0.11	= 0.47	9	38.7 (30)
Roof Type4	18.16	0	18.16	x 0.11	= 2	9	163.44 (30)
Roof Type5	20.46	0.92	19.54	x 0.15	= 2.93	9	175.86 (30)
Total area of elements, m²			149.72				(31)
Party wall			120.65	x 0	= 0	45	5429.25 (32)
Internal wall **			178.58			9	1607.22 (32c)
Internal floor			52.69			18	948.42 (32d)

DER WorkSheet: New dwelling as built

Internal ceiling

52.69

9

474.21

(32e)

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

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

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) =

42.49

(33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

13999.98

(34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

= (34) ÷ (4) =

151.53

(35)

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

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

11.67

(36)

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

Total fabric heat loss

(33) + (36) =

54.16

(37)

Ventilation heat loss calculated monthly

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

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

92.93

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
------	------	------	------	------	------	------	------	------	------	------	------

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

1.01

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.3

(43)

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

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

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

(44)m=

107.04	103.14	99.25	95.36	91.47	87.57	87.57	91.47	95.36	99.25	103.14	107.04
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1167.66

(44)

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

(45)m=

158.73	138.83	143.26	124.89	119.84	103.41	95.83	109.96	111.28	129.68	141.56	153.72
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1530.98

(45)

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

(46)m=

23.81	20.82	21.49	18.73	17.98	15.51	14.37	16.49	16.69	19.45	21.23	23.06
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

DER WorkSheet: New dwelling as built

Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)												
b) If manufacturer's declared cylinder loss factor is not known:															
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)												
If community heating see section 4.3															
Volume factor from Table 2a		0	(52)												
Temperature factor from Table 2b		0	(53)												
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)												
Enter (50) or (54) in (55)		0	(55)												
Water storage loss calculated for each month	((56)m = (55) x (41)m														
(56)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(56)
0	0	0	0	0	0	0	0	0	0	0	0				
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=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(57)
0	0	0	0	0	0	0	0	0	0	0	0				
Primary circuit loss (annual) from Table 3		0	(58)												
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m															
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)															
(59)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(59)
0	0	0	0	0	0	0	0	0	0	0	0				
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m															
(61)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">11.82</td> <td style="border: 1px solid black; width: 30px; text-align: center;">10.67</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.8</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.39</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.75</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.35</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.71</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.74</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.37</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.78</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.42</td> <td style="border: 1px solid black; width: 30px; text-align: center;">11.82</td> </tr> </table>	11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82		(61)
11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82				
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m															
(62)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">170.55</td> <td style="border: 1px solid black; width: 30px; text-align: center;">149.5</td> <td style="border: 1px solid black; width: 30px; text-align: center;">155.06</td> <td style="border: 1px solid black; width: 30px; text-align: center;">136.29</td> <td style="border: 1px solid black; width: 30px; text-align: center;">131.59</td> <td style="border: 1px solid black; width: 30px; text-align: center;">114.76</td> <td style="border: 1px solid black; width: 30px; text-align: center;">107.54</td> <td style="border: 1px solid black; width: 30px; text-align: center;">121.7</td> <td style="border: 1px solid black; width: 30px; text-align: center;">122.65</td> <td style="border: 1px solid black; width: 30px; text-align: center;">141.46</td> <td style="border: 1px solid black; width: 30px; text-align: center;">152.98</td> <td style="border: 1px solid black; width: 30px; text-align: center;">165.54</td> </tr> </table>	170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54		(62)
170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54				
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=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> <td style="border: 1px solid black; width: 30px; text-align: center;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(63)
0	0	0	0	0	0	0	0	0	0	0	0				
Output from water heater															
(64)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">170.55</td> <td style="border: 1px solid black; width: 30px; text-align: center;">149.5</td> <td style="border: 1px solid black; width: 30px; text-align: center;">155.06</td> <td style="border: 1px solid black; width: 30px; text-align: center;">136.29</td> <td style="border: 1px solid black; width: 30px; text-align: center;">131.59</td> <td style="border: 1px solid black; width: 30px; text-align: center;">114.76</td> <td style="border: 1px solid black; width: 30px; text-align: center;">107.54</td> <td style="border: 1px solid black; width: 30px; text-align: center;">121.7</td> <td style="border: 1px solid black; width: 30px; text-align: center;">122.65</td> <td style="border: 1px solid black; width: 30px; text-align: center;">141.46</td> <td style="border: 1px solid black; width: 30px; text-align: center;">152.98</td> <td style="border: 1px solid black; width: 30px; text-align: center;">165.54</td> </tr> </table>	170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54		
170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54				
Output from water heater (annual) ^{1...12}											1669.61	(64)			
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]															
(65)m=	<table style="display: inline-table; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 30px; text-align: center;">55.73</td> <td style="border: 1px solid black; width: 30px; text-align: center;">48.83</td> <td style="border: 1px solid black; width: 30px; text-align: center;">50.58</td> <td style="border: 1px solid black; width: 30px; text-align: center;">44.38</td> <td style="border: 1px solid black; width: 30px; text-align: center;">42.78</td> <td style="border: 1px solid black; width: 30px; text-align: center;">37.22</td> <td style="border: 1px solid black; width: 30px; text-align: center;">34.79</td> <td style="border: 1px solid black; width: 30px; text-align: center;">39.5</td> <td style="border: 1px solid black; width: 30px; text-align: center;">39.84</td> <td style="border: 1px solid black; width: 30px; text-align: center;">46.06</td> <td style="border: 1px solid black; width: 30px; text-align: center;">49.92</td> <td style="border: 1px solid black; width: 30px; text-align: center;">54.07</td> </tr> </table>	55.73	48.83	50.58	44.38	42.78	37.22	34.79	39.5	39.84	46.06	49.92	54.07		(65)
55.73	48.83	50.58	44.38	42.78	37.22	34.79	39.5	39.84	46.06	49.92	54.07				
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=	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
(67)m=	22.89	20.33	16.53	12.52	9.36	7.9	8.53	11.09	14.89	18.91	22.07	23.52
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
(68)m=	243.41	245.93	239.57	226.02	208.91	192.84	182.1	179.57	185.94	199.49	216.59	232.67
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29
Pumps and fans gains (Table 5a)												
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3
Losses e.g. evaporation (negative values) (Table 5)												
(71)m=	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28

DER WorkSheet: New dwelling as built

Water heating gains (Table 5)

(72)m=

74.91	72.66	67.99	61.63	57.51	51.7	46.76	53.09	55.34	61.91	69.34	72.67
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

407.06	404.78	389.94	366.02	341.63	318.29	303.25	309.61	322.02	346.16	373.85	394.72
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)							
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>75.69</td></tr></table>	75.69	(77)
0.77																		
6.85																		
36.79																		
0.39																		
1.11																		
75.69																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>15.91</td></tr></table>	15.91	(77)
0.77																		
1.44																		
36.79																		
0.39																		
1.11																		
15.91																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>128.92</td></tr></table>	128.92	(77)
0.77																		
6.85																		
62.67																		
0.39																		
1.11																		
128.92																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>27.1</td></tr></table>	27.1	(77)
0.77																		
1.44																		
62.67																		
0.39																		
1.11																		
27.1																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>176.4</td></tr></table>	176.4	(77)
0.77																		
6.85																		
85.75																		
0.39																		
1.11																		
176.4																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>37.08</td></tr></table>	37.08	(77)
0.77																		
1.44																		
85.75																		
0.39																		
1.11																		
37.08																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>218.57</td></tr></table>	218.57	(77)
0.77																		
6.85																		
106.25																		
0.39																		
1.11																		
218.57																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>45.95</td></tr></table>	45.95	(77)
0.77																		
1.44																		
106.25																		
0.39																		
1.11																		
45.95																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>244.81</td></tr></table>	244.81	(77)
0.77																		
6.85																		
119.01																		
0.39																		
1.11																		
244.81																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>51.46</td></tr></table>	51.46	(77)
0.77																		
1.44																		
119.01																		
0.39																		
1.11																		
51.46																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>243.04</td></tr></table>	243.04	(77)
0.77																		
6.85																		
118.15																		
0.39																		
1.11																		
243.04																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>51.09</td></tr></table>	51.09	(77)
0.77																		
1.44																		
118.15																		
0.39																		
1.11																		
51.09																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>113.91</td></tr></table>	113.91	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>234.32</td></tr></table>	234.32	(77)
0.77																		
6.85																		
113.91																		
0.39																		
1.11																		
234.32																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>113.91</td></tr></table>	113.91	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>49.26</td></tr></table>	49.26	(77)
0.77																		
1.44																		
113.91																		
0.39																		
1.11																		
49.26																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>104.39</td></tr></table>	104.39	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>214.74</td></tr></table>	214.74	(77)
0.77																		
6.85																		
104.39																		
0.39																		
1.11																		
214.74																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>104.39</td></tr></table>	104.39	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>45.14</td></tr></table>	45.14	(77)
0.77																		
1.44																		
104.39																		
0.39																		
1.11																		
45.14																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>92.85</td></tr></table>	92.85	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>191</td></tr></table>	191	(77)
0.77																		
6.85																		
92.85																		
0.39																		
1.11																		
191																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>92.85</td></tr></table>	92.85	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>40.15</td></tr></table>	40.15	(77)
0.77																		
1.44																		
92.85																		
0.39																		
1.11																		
40.15																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>69.27</td></tr></table>	69.27	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>142.49</td></tr></table>	142.49	(77)
0.77																		
6.85																		
69.27																		
0.39																		
1.11																		
142.49																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>69.27</td></tr></table>	69.27	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>29.95</td></tr></table>	29.95	(77)
0.77																		
1.44																		
69.27																		
0.39																		
1.11																		
29.95																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>44.07</td></tr></table>	44.07	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>90.66</td></tr></table>	90.66	(77)
0.77																		
6.85																		
44.07																		
0.39																		
1.11																		
90.66																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>44.07</td></tr></table>	44.07	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>19.06</td></tr></table>	19.06	(77)
0.77																		
1.44																		
44.07																		
0.39																		
1.11																		
19.06																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>31.49</td></tr></table>	31.49	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>64.77</td></tr></table>	64.77	(77)
0.77																		
6.85																		
31.49																		
0.39																		
1.11																		
64.77																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>31.49</td></tr></table>	31.49	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>13.62</td></tr></table>	13.62	(77)
0.77																		
1.44																		
31.49																		
0.39																		
1.11																		
13.62																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>15.62</td></tr></table>	15.62	(81)
0.77																		
4.61																		
11.28																		
0.39																		
1.11																		
15.62																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>31.79</td></tr></table>	31.79	(81)
0.77																		
4.61																		
22.97																		
0.39																		
1.11																		
31.79																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>57.28</td></tr></table>	57.28	(81)
0.77																		
4.61																		
41.38																		
0.39																		
1.11																		
57.28																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>94.08</td></tr></table>	94.08	(81)
0.77																		
4.61																		
67.96																		
0.39																		
1.11																		
94.08																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>126.46</td></tr></table>	126.46	(81)
0.77																		
4.61																		
91.35																		
0.39																		
1.11																		
126.46																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>134.82</td></tr></table>	134.82	(81)
0.77																		
4.61																		
97.38																		
0.39																		
1.11																		
134.82																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>126.12</td></tr></table>	126.12	(81)
0.77																		
4.61																		
91.1																		
0.39																		
1.11																		
126.12																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>100.54</td></tr></table>	100.54	(81)
0.77																		
4.61																		
72.63																		
0.39																		
1.11																		
100.54																		

DER WorkSheet: New dwelling as built

Northwest 0.9x	0.77	x	4.61	x	50.42	x	0.39	x	1.11	=	69.8	(81)
Northwest 0.9x	0.77	x	4.61	x	28.07	x	0.39	x	1.11	=	38.86	(81)
Northwest 0.9x	0.77	x	4.61	x	14.2	x	0.39	x	1.11	=	19.65	(81)
Northwest 0.9x	0.77	x	4.61	x	9.21	x	0.39	x	1.11	=	12.76	(81)
Rooflights 0.9x	1	x	0.92	x	16.37	x	0.63	x	0.7	=	5.98	(82)
Rooflights 0.9x	1	x	0.92	x	33.68	x	0.63	x	0.7	=	12.3	(82)
Rooflights 0.9x	1	x	0.92	x	62.13	x	0.63	x	0.7	=	22.69	(82)
Rooflights 0.9x	1	x	0.92	x	104.87	x	0.63	x	0.7	=	38.29	(82)
Rooflights 0.9x	1	x	0.92	x	143.66	x	0.63	x	0.7	=	52.46	(82)
Rooflights 0.9x	1	x	0.92	x	154.33	x	0.63	x	0.7	=	56.35	(82)
Rooflights 0.9x	1	x	0.92	x	143.9	x	0.63	x	0.7	=	52.55	(82)
Rooflights 0.9x	1	x	0.92	x	113.05	x	0.63	x	0.7	=	41.28	(82)
Rooflights 0.9x	1	x	0.92	x	76.56	x	0.63	x	0.7	=	27.96	(82)
Rooflights 0.9x	1	x	0.92	x	41.49	x	0.63	x	0.7	=	15.15	(82)
Rooflights 0.9x	1	x	0.92	x	20.65	x	0.63	x	0.7	=	7.54	(82)
Rooflights 0.9x	1	x	0.92	x	13.34	x	0.63	x	0.7	=	4.87	(82)

Solar gains in watts, calculated for each month

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

(83)m=	113.19	200.12	293.45	396.88	475.19	485.3	462.24	401.7	328.91	226.45	136.91	96.02	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	520.25	604.9	683.39	762.9	816.82	803.59	765.49	711.31	650.93	572.61	510.76	490.73	(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	0.81	0.66	0.51	0.56	0.79	0.94	0.98	0.99	(86)

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

(87)m=	19.41	19.61	19.94	20.34	20.69	20.9	20.97	20.96	20.8	20.34	19.79	19.35	(87)
--------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	------

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

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.95	0.89	0.77	0.59	0.41	0.46	0.72	0.92	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.94	18.24	18.71	19.28	19.75	19.99	20.06	20.05	19.89	19.28	18.49	17.85	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.16

(91)

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

(92)m=	18.18	18.46	18.91	19.45	19.9	20.14	20.21	20.2	20.04	19.46	18.7	18.1	(92)
--------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	------	------	------

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

(93)m=	18.18	18.46	18.91	19.45	19.9	20.14	20.21	20.2	20.04	19.46	18.7	18.1	(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 as built

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.94	0.88	0.76	0.59	0.43	0.48	0.72	0.91	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	510.18	584.82	641.65	669.35	623.19	476.21	327.14	340.26	469.68	519.17	494.46	482.88	(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=	1289.69	1260.27	1153.04	980.41	762.09	515.12	335.58	353.24	551.9	823.17	1078.19	1291.6	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	-------	--------	---------	--------	------

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

(98)m=	579.95	453.9	380.48	223.96	103.34	0	0	0	0	226.17	420.28	601.68	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												2989.78	(98)

Space heating requirement in kWh/m²/year

32.36	(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 89.9 (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)

579.95	453.9	380.48	223.96	103.34	0	0	0	0	226.17	420.28	601.68
--------	-------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

645.11	504.89	423.23	249.12	114.95	0	0	0	0	251.58	467.5	669.28		
Total (kWh/year) =Sum(211) _{1...5,10...12} =												3325.67	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Efficiency of water heater 86.7 (216)

(217)m= 89.15 89.09 88.95 88.66 88.08 86.7 86.7 86.7 86.7 88.64 89.02 89.19 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.31	167.82	174.32	153.71	149.4	132.36	124.03	140.37	141.46	159.59	171.84	185.6	
Total = Sum(219a) _{1...12} =												1891.82	(219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1 3325.67

Water heating fuel used 1891.82

Electricity for pumps, fans and electric keep-hot

DER WorkSheet: New dwelling as built

mechanical ventilation - balanced, extract or positive input from outside		68.4	(230a)
central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	143.4	(231)
Electricity for lighting		404.2	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5765.08	(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	=	718.34 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	408.63 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1126.98 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	74.42 (267)
Electricity for lighting	(232) x	0.519	=	209.78 (268)
Total CO2, kg/year		sum of (265)...(271) =		1411.18 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		15.27 (273)
El rating (section 14)				86 (274)

TER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 3 As Built

Address : 28A Swansea Road, READING, RG1 8HA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	39.7	(1a) x	2.5	(2a) =	99.25 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.39	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	235 (5)

2. Ventilation rate:

	main heating	+	secondary heating	+	other	=	total		m ³ per hour
Number of chimneys	0		0		0	=	0	x 40 =	0 (6a)
Number of open flues	0		0		0	=	0	x 20 =	0 (6b)
Number of intermittent fans							3	x 10 =	30 (7a)
Number of passive vents							0	x 10 =	0 (7b)
Number of flueless gas fires							0	x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (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) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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TER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1	= 2.12		(26)
Windows Type 1			4.61	x1/[1/(1.4)+ 0.04] =	6.11		(27)
Windows Type 2			6.85	x1/[1/(1.4)+ 0.04] =	9.08		(27)
Windows Type 3			1.44	x1/[1/(1.4)+ 0.04] =	1.91		(27)
Rooflights			0.92	x1/[1/(1.7) + 0.04] =	1.564		(27b)
Floor			39.7	x 0.13	= 5.161		(28)
Walls Type1	47.24	13.58	33.66	x 0.18	= 6.06		(29)
Walls Type2	16.45	1.44	15.01	x 0.18	= 2.7		(29)
Roof Type1	2.81	0	2.81	x 0.13	= 0.37		(30)
Roof Type2	0.6	0	0.6	x 0.13	= 0.08		(30)
Roof Type3	4.3	0	4.3	x 0.13	= 0.56		(30)
Roof Type4	18.16	0	18.16	x 0.13	= 2.36		(30)
Roof Type5	20.46	0.92	19.54	x 0.13	= 2.54		(30)
Total area of elements, m²			149.72				(31)
Party wall			120.65	x 0	= 0		(32)
Internal wall **			178.58				(32c)
Internal floor			52.69				(32d)

TER WorkSheet: New dwelling as built

Internal ceiling

52.69

(32e)

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

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

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) =

40.51

(33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

13999.98

(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

13.34

(36)

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

Total fabric heat loss

(33) + (36) =

53.85

(37)

Ventilation heat loss calculated monthly

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

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
45.27	45.02	44.77	43.61	43.39	42.38	42.38	42.19	42.77	43.39	43.83	44.29

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

99.12	98.87	98.62	97.46	97.24	96.23	96.23	96.04	96.62	97.24	97.68	98.14
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Average = Sum(39)_{1...12} /12=

97.46

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.07	1.07	1.07	1.05	1.05	1.04	1.04	1.04	1.05	1.05	1.06	1.06
------	------	------	------	------	------	------	------	------	------	------	------

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

1.05

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

if TFA ≤ 13.9, N = 1

2.66

(42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.3

(43)

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

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

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

(44)m=

107.04	103.14	99.25	95.36	91.47	87.57	87.57	91.47	95.36	99.25	103.14	107.04
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1167.66

(44)

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

(45)m=

158.73	138.83	143.26	124.89	119.84	103.41	95.83	109.96	111.28	129.68	141.56	153.72
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1530.98

(45)

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

(46)m=

23.81	20.82	21.49	18.73	17.98	15.51	14.37	16.49	16.69	19.45	21.23	23.06
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

TER WorkSheet: New dwelling as built

Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)												
b) If manufacturer's declared cylinder loss factor is not known:															
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)												
If community heating see section 4.3															
Volume factor from Table 2a		0	(52)												
Temperature factor from Table 2b		0	(53)												
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)												
Enter (50) or (54) in (55)		0	(55)												
Water storage loss calculated for each month	((56)m = (55) x (41)m														
(56)m=		<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(56)
0	0	0	0	0	0	0	0	0	0	0	0				
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=		<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(57)
0	0	0	0	0	0	0	0	0	0	0	0				
Primary circuit loss (annual) from Table 3		0	(58)												
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m															
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)															
(59)m=		<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(59)
0	0	0	0	0	0	0	0	0	0	0	0				
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m															
(61)m=		<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr><td>50.96</td><td>46.03</td><td>50.58</td><td>47.03</td><td>46.61</td><td>43.19</td><td>44.63</td><td>46.61</td><td>47.03</td><td>50.58</td><td>49.32</td><td>50.96</td></tr> </table>	50.96	46.03	50.58	47.03	46.61	43.19	44.63	46.61	47.03	50.58	49.32	50.96	(61)
50.96	46.03	50.58	47.03	46.61	43.19	44.63	46.61	47.03	50.58	49.32	50.96				
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m															
(62)m=		<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr><td>209.69</td><td>184.85</td><td>193.83</td><td>171.92</td><td>166.45</td><td>146.6</td><td>140.45</td><td>156.57</td><td>158.3</td><td>180.26</td><td>190.87</td><td>204.68</td></tr> </table>	209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68	(62)
209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68				
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=		<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(63)
0	0	0	0	0	0	0	0	0	0	0	0				
Output from water heater															
(64)m=		<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr><td>209.69</td><td>184.85</td><td>193.83</td><td>171.92</td><td>166.45</td><td>146.6</td><td>140.45</td><td>156.57</td><td>158.3</td><td>180.26</td><td>190.87</td><td>204.68</td></tr> </table>	209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68	
209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68				
			Output from water heater (annual) ^{1...12}												
			2104.48												
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]															
(65)m=		<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr><td>65.52</td><td>57.67</td><td>60.28</td><td>53.28</td><td>51.5</td><td>45.18</td><td>43.02</td><td>48.22</td><td>48.76</td><td>55.76</td><td>59.4</td><td>63.85</td></tr> </table>	65.52	57.67	60.28	53.28	51.5	45.18	43.02	48.22	48.76	55.76	59.4	63.85	(65)
65.52	57.67	60.28	53.28	51.5	45.18	43.02	48.22	48.76	55.76	59.4	63.85				
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=	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
(67)m=	22.89	20.33	16.53	12.52	9.36	7.9	8.53	11.09	14.89	18.91	22.07	23.52
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
(68)m=	243.41	245.93	239.57	226.02	208.91	192.84	182.1	179.57	185.94	199.49	216.59	232.67
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29
Pumps and fans gains (Table 5a)												
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3
Losses e.g. evaporation (negative values) (Table 5)												
(71)m=	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28

TER WorkSheet: New dwelling as built

Water heating gains (Table 5)

(72)m=

88.06	85.81	81.02	74.01	69.22	62.75	57.82	64.81	67.72	74.95	82.5	85.82
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

 (72)

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

(73)m=

420.21	417.93	402.97	378.39	353.34	329.34	314.31	321.33	334.4	359.2	387.01	407.87
--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>77.03</td></tr></table>	77.03	(77)
0.77																		
6.85																		
36.79																		
0.63																		
0.7																		
77.03																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>16.19</td></tr></table>	16.19	(77)
0.77																		
1.44																		
36.79																		
0.63																		
0.7																		
16.19																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>131.2</td></tr></table>	131.2	(77)
0.77																		
6.85																		
62.67																		
0.63																		
0.7																		
131.2																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>27.58</td></tr></table>	27.58	(77)
0.77																		
1.44																		
62.67																		
0.63																		
0.7																		
27.58																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>179.52</td></tr></table>	179.52	(77)
0.77																		
6.85																		
85.75																		
0.63																		
0.7																		
179.52																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>37.74</td></tr></table>	37.74	(77)
0.77																		
1.44																		
85.75																		
0.63																		
0.7																		
37.74																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>222.43</td></tr></table>	222.43	(77)
0.77																		
6.85																		
106.25																		
0.63																		
0.7																		
222.43																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>46.76</td></tr></table>	46.76	(77)
0.77																		
1.44																		
106.25																		
0.63																		
0.7																		
46.76																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>249.14</td></tr></table>	249.14	(77)
0.77																		
6.85																		
119.01																		
0.63																		
0.7																		
249.14																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>52.37</td></tr></table>	52.37	(77)
0.77																		
1.44																		
119.01																		
0.63																		
0.7																		
52.37																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>247.34</td></tr></table>	247.34	(77)
0.77																		
6.85																		
118.15																		
0.63																		
0.7																		
247.34																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>52</td></tr></table>	52	(77)
0.77																		
1.44																		
118.15																		
0.63																		
0.7																		
52																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>113.91</td></tr></table>	113.91	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>238.46</td></tr></table>	238.46	(77)
0.77																		
6.85																		
113.91																		
0.63																		
0.7																		
238.46																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>113.91</td></tr></table>	113.91	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>50.13</td></tr></table>	50.13	(77)
0.77																		
1.44																		
113.91																		
0.63																		
0.7																		
50.13																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>104.39</td></tr></table>	104.39	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>218.54</td></tr></table>	218.54	(77)
0.77																		
6.85																		
104.39																		
0.63																		
0.7																		
218.54																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>104.39</td></tr></table>	104.39	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>45.94</td></tr></table>	45.94	(77)
0.77																		
1.44																		
104.39																		
0.63																		
0.7																		
45.94																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>92.85</td></tr></table>	92.85	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>194.38</td></tr></table>	194.38	(77)
0.77																		
6.85																		
92.85																		
0.63																		
0.7																		
194.38																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>92.85</td></tr></table>	92.85	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>40.86</td></tr></table>	40.86	(77)
0.77																		
1.44																		
92.85																		
0.63																		
0.7																		
40.86																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>69.27</td></tr></table>	69.27	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>145.01</td></tr></table>	145.01	(77)
0.77																		
6.85																		
69.27																		
0.63																		
0.7																		
145.01																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>69.27</td></tr></table>	69.27	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>30.48</td></tr></table>	30.48	(77)
0.77																		
1.44																		
69.27																		
0.63																		
0.7																		
30.48																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>44.07</td></tr></table>	44.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>92.26</td></tr></table>	92.26	(77)
0.77																		
6.85																		
44.07																		
0.63																		
0.7																		
92.26																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>44.07</td></tr></table>	44.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>19.39</td></tr></table>	19.39	(77)
0.77																		
1.44																		
44.07																		
0.63																		
0.7																		
19.39																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>31.49</td></tr></table>	31.49	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>65.92</td></tr></table>	65.92	(77)
0.77																		
6.85																		
31.49																		
0.63																		
0.7																		
65.92																		
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>31.49</td></tr></table>	31.49	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>13.86</td></tr></table>	13.86	(77)
0.77																		
1.44																		
31.49																		
0.63																		
0.7																		
13.86																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>15.9</td></tr></table>	15.9	(81)
0.77																		
4.61																		
11.28																		
0.63																		
0.7																		
15.9																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>32.36</td></tr></table>	32.36	(81)
0.77																		
4.61																		
22.97																		
0.63																		
0.7																		
32.36																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>58.3</td></tr></table>	58.3	(81)
0.77																		
4.61																		
41.38																		
0.63																		
0.7																		
58.3																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>95.74</td></tr></table>	95.74	(81)
0.77																		
4.61																		
67.96																		
0.63																		
0.7																		
95.74																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>128.7</td></tr></table>	128.7	(81)
0.77																		
4.61																		
91.35																		
0.63																		
0.7																		
128.7																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>137.2</td></tr></table>	137.2	(81)
0.77																		
4.61																		
97.38																		
0.63																		
0.7																		
137.2																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>128.35</td></tr></table>	128.35	(81)
0.77																		
4.61																		
91.1																		
0.63																		
0.7																		
128.35																		
Northwest 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>102.32</td></tr></table>	102.32	(81)
0.77																		
4.61																		
72.63																		
0.63																		
0.7																		
102.32																		

TER WorkSheet: New dwelling as built

Northwest 0.9x	0.77	x	4.61	x	50.42	x	0.63	x	0.7	=	71.04	(81)
Northwest 0.9x	0.77	x	4.61	x	28.07	x	0.63	x	0.7	=	39.54	(81)
Northwest 0.9x	0.77	x	4.61	x	14.2	x	0.63	x	0.7	=	20	(81)
Northwest 0.9x	0.77	x	4.61	x	9.21	x	0.63	x	0.7	=	12.98	(81)
Rooflights 0.9x	1	x	0.92	x	16.37	x	0.63	x	0.7	=	5.98	(82)
Rooflights 0.9x	1	x	0.92	x	33.68	x	0.63	x	0.7	=	12.3	(82)
Rooflights 0.9x	1	x	0.92	x	62.13	x	0.63	x	0.7	=	22.69	(82)
Rooflights 0.9x	1	x	0.92	x	104.87	x	0.63	x	0.7	=	38.29	(82)
Rooflights 0.9x	1	x	0.92	x	143.66	x	0.63	x	0.7	=	52.46	(82)
Rooflights 0.9x	1	x	0.92	x	154.33	x	0.63	x	0.7	=	56.35	(82)
Rooflights 0.9x	1	x	0.92	x	143.9	x	0.63	x	0.7	=	52.55	(82)
Rooflights 0.9x	1	x	0.92	x	113.05	x	0.63	x	0.7	=	41.28	(82)
Rooflights 0.9x	1	x	0.92	x	76.56	x	0.63	x	0.7	=	27.96	(82)
Rooflights 0.9x	1	x	0.92	x	41.49	x	0.63	x	0.7	=	15.15	(82)
Rooflights 0.9x	1	x	0.92	x	20.65	x	0.63	x	0.7	=	7.54	(82)
Rooflights 0.9x	1	x	0.92	x	13.34	x	0.63	x	0.7	=	4.87	(82)

Solar gains in watts, calculated for each month

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

(83)m=	115.09	203.44	298.24	403.23	482.67	492.89	469.49	408.08	334.24	230.19	139.19	97.63	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(84)m=	535.3	621.37	701.21	781.62	836.01	822.24	783.8	729.4	668.63	589.38	526.2	505.5	(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=	1	1	0.99	0.96	0.87	0.7	0.53	0.59	0.84	0.98	1	1	(86)

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

(87)m=	19.84	20	20.24	20.56	20.82	20.96	20.99	20.99	20.89	20.55	20.14	19.82	(87)
--------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.02	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.03	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.98	0.95	0.83	0.62	0.42	0.48	0.77	0.97	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.48	18.7	19.05	19.51	19.86	20.02	20.05	20.05	19.96	19.51	18.91	18.44	(90)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.16 (91)

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

(92)m=	18.7	18.91	19.25	19.68	20.02	20.18	20.2	20.2	20.11	19.68	19.12	18.67	(92)
--------	------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

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

(93)m=	18.7	18.91	19.25	19.68	20.02	20.18	20.2	20.2	20.11	19.68	19.12	18.67	(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
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

TER WorkSheet: New dwelling as built

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.83	0.63	0.44	0.49	0.78	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	533.48	616.55	687.12	733.79	693.52	517.1	344.26	360.71	521.18	565.49	522.3	504.21	(95)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1427.35	1385.34	1257.26	1051	809.05	536.59	346.54	364.94	580.87	883.03	1173.67	1420.05	(97)
--------	---------	---------	---------	------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	665.04	516.62	424.18	228.39	85.95	0	0	0	0	236.25	468.99	681.38	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

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

3306.82

Space heating requirement in kWh/m²/year

35.79

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) x [1 – (203)] =

1

Efficiency of main space heating system 1

93.4

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)

665.04	516.62	424.18	228.39	85.95	0	0	0	0	236.25	468.99	681.38
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

712.04	553.13	454.16	244.53	92.03	0	0	0	0	252.95	502.13	729.53
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

3540.49

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

0

Water heating

Output from water heater (calculated above)

209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68
--------	--------	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------

Efficiency of water heater

80.3

(217)m=	87.75	87.5	86.97	85.77	83.48	80.3	80.3	80.3	80.3	85.73	87.23	87.85	(217)
---------	-------	------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	238.95	211.26	222.88	200.45	199.4	182.56	174.91	194.98	197.14	210.25	218.82	232.99
---------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

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

2484.61

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3540.49

Water heating fuel used

2484.61

Electricity for pumps, fans and electric keep-hot

TER WorkSheet: New dwelling as built

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		404.2	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6504.3	(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	=	764.75	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	536.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1301.42	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	209.78	(268)
Total CO2, kg/year		sum of (265)...(271) =			1550.13	(272)
 TER =					 16.78	 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 02 March 2023 at 13:02:34

Project Information:

Assessed By: Matt Fitzpatrick (STRO003572)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 92.99m²

Site Reference : Swansea Road

Plot Reference: 4 As Built

Address : 28 Swansea Road, READING, RG1 8HA

Client Details:

Name: Helix

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 18.46 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.28 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 56.6 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 49.6 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.39	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 512, product index 018738): Boiler systems with radiators or underfloor heating - mains gas Brand name: Baxi Model: ASSURE Model qualifier: 36 COMBI (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: North West 3.16m²
 Windows facing: North 0.66m²
 Windows facing: West 0.66m²
 Windows facing: North East 2.36m²
 Windows facing: South East 8.39m²
 Roof windows facing: North West 0.92m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K

SAP Input

Property Details: 4 As Built

Address: 28 Swansea Road, READING, RG1 8HA
 Located in: England
 Region: Thames valley
 UPRN: UPRN-550153256479
 Date of assessment: 02 March 2023
 Date of certificate: 02 March 2023
 Assessment type: New dwelling as built
 Transaction type: New dwelling
 Tenure type: Unknown
 Related party disclosure: No related party
 Thermal Mass Parameter: Calculated 158.11
 Water use <= 125 litres/person/day: True
 PCDF Version: 512

Property description:

Dwelling type: House
 Detachment: End-terrace
 Year Completed: 2023
 Floor Location: Floor area: Storey height:
 Floor 0 40.3 m² 2.5 m
 Floor 1 35.42 m² 2.7 m
 Floor 2 17.27 m² 2.323 m
 Living area: 15.13 m² (fraction 0.163)
 Front of dwelling faces: North West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front	Manufacturer	Solid			Wood
1	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
3	BFRC	Windows	low-E, En = 0.1, soft coat	No	
4	BFRC	Windows	low-E, En = 0.1, soft coat	No	
1	Manufacturer	Roof Windows	low-E, En = 0.1, soft coat	No	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front	mm	0.7	0.63	1.5	2.12	1
1	12mm	0	0.39	1.3	3.16	1
2	12mm	0	0.39	1.3	0.66	1
2	12mm	0	0.39	1.3	0.66	1
3	12mm	0	0.39	1.3	2.36	1
4	12mm	0	0.39	1.3	8.39	1
1	12mm	0.7	0.63	1.2	0.92	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front		Brick	North West	0	0
1		Brick	North West	0	0
2		Brick	North	0	0
2		Brick	West	0	0
3		Brick	North East	0	0
4		Brick	South East	0	0
1		Sloping roof	North West	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
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SAP Input

External Elements

Brick	102.78	17.35	85.43	0.25	0	False	60
Timber stud	16.45	0	16.45	0.25	0	False	9
Cold roof	2.81	0	2.81	0.11	0		9
Bay roof	0.6	0	0.6	0.11	0		9
Kitchen roof	4.3	0	4.3	0.11	0		9
Loft roof	18.16	0	18.16	0.11	0		9
Sloping roof	20.46	0.92	19.54	0.15	0		9
Suspended floor	40.3			0.11			75

Internal Elements

Metal stud	178.58						9
Int ceiling	52.69						9
Int Floor	52.69						18

Party Elements

Party wall	65.95						45
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Thermal bridges:

Thermal bridges:

User-defined (individual PSI-values) Y-Value = 0.0673

Length	Psi-value		
12.25	0.05	E2	Other lintels (including other steel lintels)
8.85	0.034	E3	Sill
33.6	0.04	E4	Jamb
18.4	0.06	E5	Ground floor (normal)
0	0.32	E20	Exposed floor (normal)
0	0.32	E21	Exposed floor (inverted)
15.33	0	E6	Intermediate floor within a dwelling
21.12	0.123	E10	Eaves (insulation at ceiling level)
15.32	0.24	E24	Eaves (insulation at ceiling level - inverted)
0	0.033	E11	Eaves (insulation at rafter level)
0.74	0.063	E12	Gable (insulation at ceiling level)
3.87	0.08	E13	Gable (insulation at rafter level)
27.39	0.05	E16	Corner (normal)
12.35	-0.069	E17	Corner (inverted internal area greater than external area)
15.05	0.072	E18	Party wall between dwellings
0	0.12	E25	Staggered party wall between dwellings
10.45	0.043	P1	Ground floor
15.45	0	P2	Intermediate floor within a dwelling
0	0.16	P7	Exposed floor (normal)
5	0.055	P4	Roof (insulation at ceiling level)
6.03	0.069	P5	Roof (insulation at rafter level)
0.98	0.08	R1	Head
0.98	0.06	R2	Sill
1.92	0.08	R3	Jamb
7.64	0.06	R6	Flat ceiling
6.33	0.06	R8	Roof wall (rafter)

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Decentralised whole house extract
	Number of fans in Wetroom: Kitchen 1 Other 3
	Ductwork: ,
	Approved Installation Scheme: True
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.39 (Assessed dwelling is tested)

SAP Input

Main heating system:

Main heating system: Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 512, product index 018738) Efficiency: Winter 86.7 % Summer: 89.9
Brand name: Baxi
Model: ASSURE
Model qualifier: 36 COMBI
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes

Main heating Control:

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

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Low rise urban / suburban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 4 As Built

Address : 28 Swansea Road, READING, RG1 8HA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.3	(1a) x	2.5	(2a) =	100.75 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.99	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	236.5 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.3899998664856 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.22 (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) =		0.19 (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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DER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

	0.24	0.23	0.23	0.21	0.2	0.18	0.18	0.17	0.19	0.2	0.21	0.22
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

(24b)

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(24c)

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

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

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

(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1.5	= 3.18		(26)
Windows Type 1			3.16	x 1/[1/(1.3)+ 0.04]	= 3.9		(27)
Windows Type 2			0.66	x 1/[1/(1.3)+ 0.04]	= 0.82		(27)
Windows Type 3			0.66	x 1/[1/(1.3)+ 0.04]	= 0.82		(27)
Windows Type 4			2.36	x 1/[1/(1.3)+ 0.04]	= 2.92		(27)
Windows Type 5			8.39	x 1/[1/(1.3)+ 0.04]	= 10.37		(27)
Rooflights			0.92	x 1/[1/(1.2) + 0.04]	= 1.104		(27b)
Floor			40.3	x 0.11	= 4.433	75	3022.5 (28)
Walls Type1	102.78	17.35	85.43	x 0.25	= 21.36	60	5125.8 (29)
Walls Type2	16.45	0	16.45	x 0.25	= 4.11	9	148.05 (29)
Roof Type1	2.81	0	2.81	x 0.11	= 0.31	9	25.29 (30)
Roof Type2	0.6	0	0.6	x 0.11	= 0.07	9	5.4 (30)
Roof Type3	4.3	0	4.3	x 0.11	= 0.47	9	38.7 (30)
Roof Type4	18.16	0	18.16	x 0.11	= 2	9	163.44 (30)
Roof Type5	20.46	0.92	19.54	x 0.15	= 2.93	9	175.86 (30)
Total area of elements, m²			205.86				(31)
Party wall			65.95	x 0	= 0	45	2967.75 (32)

DER WorkSheet: New dwelling as built

Internal wall **	178.58	9	1607.22 (32c)
Internal floor	52.69	18	948.42 (32d)
Internal ceiling	52.69	9	474.21 (32e)

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

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

Fabric heat loss, W/K = $S(A \times U)$	(26)...(30) + (32) =	58.73 (33)
Heat capacity $C_m = S(A \times k)$	((28)...(30) + (32) + (32a)...(32e) =	14702.64 (34)
Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m ² K	= (34) $\div$ (4) =	158.11 (35)

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

Thermal bridges : $S(L \times Y)$ calculated using Appendix K	13.86 (36)
---	------------

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

Total fabric heat loss	(33) + (36) =	72.6 (37)
------------------------	---------------	-----------

Ventilation heat loss calculated monthly	(38)m = $0.33 \times (25)m \times (5)$
--	--

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	(38)

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

(39)m=	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	
	Average = Sum(39) _{1...12} /12=											111.62	(39)

Heat loss parameter (HLP), W/m ² K	(40)m = (39)m $\div$ (4)
---	--------------------------

(40)m=	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
	Average = Sum(40) _{1...12} /12=											1.2	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N	2.66 (42)
if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$	
if TFA $\leq$ 13.9, $N = 1$	

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$	97.48 (43)
---	------------

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	107.23	103.33	99.43	95.53	91.63	87.73	87.73	91.63	95.53	99.43	103.33	107.23	
	Total = Sum(44) _{1...12} =											1169.78	(44)

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

(45)m=	159.02	139.08	143.52	125.12	120.06	103.6	96	110.16	111.48	129.92	141.81	154	
	Total = Sum(45) _{1...12} =											1533.76	(45)

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

(46)m=	23.85	20.86	21.53	18.77	18.01	15.54	14.4	16.52	16.72	19.49	21.27	23.1	(46)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0 (47)
---	--------

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

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

DER WorkSheet: New dwelling as built

Water storage loss:

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

0	(48)
---	------

Temperature factor from Table 2b

0	(49)
---	------

Energy lost from water storage, kWh/year

(48) x (49) =

0	(50)
---	------

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

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

0	(51)
---	------

If community heating see section 4.3

Volume factor from Table 2a

0	(52)
---	------

Temperature factor from Table 2b

0	(53)
---	------

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0	(54)
---	------

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

0	(55)
---	------

Water storage loss calculated for each month

((56)m = (55) x (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 x (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 x (41)m

(61)m=

11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82	(61)
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(62)m=

170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82	(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=

170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82	(64)
--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	------

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

1672.39

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=

55.83	48.91	50.67	44.45	42.86	37.28	34.85	39.56	39.91	46.14	50.01	54.16	(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	
133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	(66)

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

(67)m=

22.35	19.85	16.14	12.22	9.14	7.71	8.33	10.83	14.54	18.46	21.55	22.97	(67)
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=

244.47	247.01	240.62	227.01	209.83	193.68	182.89	180.36	186.75	200.36	217.54	233.69	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=

36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3	(70)
---	---	---	---	---	---	---	---	---	---	---	---	------

DER WorkSheet: New dwelling as built

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

(71)m=

-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

75.04	72.79	68.1	61.74	57.6	51.78	46.84	53.18	55.43	62.02	69.46	72.79
-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

407.83	405.61	390.83	366.93	342.53	319.14	304.03	310.33	322.69	346.81	374.51	395.42
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor	Area			Flux			g_			FF			Gains	
	Table 6d		m²		Table 6a		Table 6b		Table 6c				(W)		
North	0.9x	0.77	x	0.66	x	10.63	x	0.39	x	1.11	=	2.11	(74)		
North	0.9x	0.77	x	0.66	x	20.32	x	0.39	x	1.11	=	4.03	(74)		
North	0.9x	0.77	x	0.66	x	34.53	x	0.39	x	1.11	=	6.84	(74)		
North	0.9x	0.77	x	0.66	x	55.46	x	0.39	x	1.11	=	10.99	(74)		
North	0.9x	0.77	x	0.66	x	74.72	x	0.39	x	1.11	=	14.81	(74)		
North	0.9x	0.77	x	0.66	x	79.99	x	0.39	x	1.11	=	15.85	(74)		
North	0.9x	0.77	x	0.66	x	74.68	x	0.39	x	1.11	=	14.8	(74)		
North	0.9x	0.77	x	0.66	x	59.25	x	0.39	x	1.11	=	11.74	(74)		
North	0.9x	0.77	x	0.66	x	41.52	x	0.39	x	1.11	=	8.23	(74)		
North	0.9x	0.77	x	0.66	x	24.19	x	0.39	x	1.11	=	4.79	(74)		
North	0.9x	0.77	x	0.66	x	13.12	x	0.39	x	1.11	=	2.6	(74)		
North	0.9x	0.77	x	0.66	x	8.86	x	0.39	x	1.11	=	1.76	(74)		
Northeast	0.9x	0.77	x	2.36	x	11.28	x	0.39	x	1.11	=	8	(75)		
Northeast	0.9x	0.77	x	2.36	x	22.97	x	0.39	x	1.11	=	16.28	(75)		
Northeast	0.9x	0.77	x	2.36	x	41.38	x	0.39	x	1.11	=	29.33	(75)		
Northeast	0.9x	0.77	x	2.36	x	67.96	x	0.39	x	1.11	=	48.16	(75)		
Northeast	0.9x	0.77	x	2.36	x	91.35	x	0.39	x	1.11	=	64.74	(75)		
Northeast	0.9x	0.77	x	2.36	x	97.38	x	0.39	x	1.11	=	69.02	(75)		
Northeast	0.9x	0.77	x	2.36	x	91.1	x	0.39	x	1.11	=	64.56	(75)		
Northeast	0.9x	0.77	x	2.36	x	72.63	x	0.39	x	1.11	=	51.47	(75)		
Northeast	0.9x	0.77	x	2.36	x	50.42	x	0.39	x	1.11	=	35.73	(75)		
Northeast	0.9x	0.77	x	2.36	x	28.07	x	0.39	x	1.11	=	19.89	(75)		
Northeast	0.9x	0.77	x	2.36	x	14.2	x	0.39	x	1.11	=	10.06	(75)		
Northeast	0.9x	0.77	x	2.36	x	9.21	x	0.39	x	1.11	=	6.53	(75)		
Southeast	0.9x	0.77	x	8.39	x	36.79	x	0.39	x	1.11	=	92.7	(77)		
Southeast	0.9x	0.77	x	8.39	x	62.67	x	0.39	x	1.11	=	157.91	(77)		
Southeast	0.9x	0.77	x	8.39	x	85.75	x	0.39	x	1.11	=	216.06	(77)		
Southeast	0.9x	0.77	x	8.39	x	106.25	x	0.39	x	1.11	=	267.7	(77)		
Southeast	0.9x	0.77	x	8.39	x	119.01	x	0.39	x	1.11	=	299.85	(77)		
Southeast	0.9x	0.77	x	8.39	x	118.15	x	0.39	x	1.11	=	297.68	(77)		

DER WorkSheet: New dwelling as built

Southeast	0.9x	0.77	x	8.39	x	113.91	x	0.39	x	1.11	=	287	(77)
Southeast	0.9x	0.77	x	8.39	x	104.39	x	0.39	x	1.11	=	263.01	(77)
Southeast	0.9x	0.77	x	8.39	x	92.85	x	0.39	x	1.11	=	233.94	(77)
Southeast	0.9x	0.77	x	8.39	x	69.27	x	0.39	x	1.11	=	174.52	(77)
Southeast	0.9x	0.77	x	8.39	x	44.07	x	0.39	x	1.11	=	111.04	(77)
Southeast	0.9x	0.77	x	8.39	x	31.49	x	0.39	x	1.11	=	79.33	(77)
West	0.9x	0.77	x	0.66	x	19.64	x	0.39	x	1.11	=	3.89	(80)
West	0.9x	0.77	x	0.66	x	38.42	x	0.39	x	1.11	=	7.61	(80)
West	0.9x	0.77	x	0.66	x	63.27	x	0.39	x	1.11	=	12.54	(80)
West	0.9x	0.77	x	0.66	x	92.28	x	0.39	x	1.11	=	18.29	(80)
West	0.9x	0.77	x	0.66	x	113.09	x	0.39	x	1.11	=	22.41	(80)
West	0.9x	0.77	x	0.66	x	115.77	x	0.39	x	1.11	=	22.95	(80)
West	0.9x	0.77	x	0.66	x	110.22	x	0.39	x	1.11	=	21.85	(80)
West	0.9x	0.77	x	0.66	x	94.68	x	0.39	x	1.11	=	18.76	(80)
West	0.9x	0.77	x	0.66	x	73.59	x	0.39	x	1.11	=	14.59	(80)
West	0.9x	0.77	x	0.66	x	45.59	x	0.39	x	1.11	=	9.04	(80)
West	0.9x	0.77	x	0.66	x	24.49	x	0.39	x	1.11	=	4.85	(80)
West	0.9x	0.77	x	0.66	x	16.15	x	0.39	x	1.11	=	3.2	(80)
Northwest	0.9x	0.77	x	3.16	x	11.28	x	0.39	x	1.11	=	10.71	(81)
Northwest	0.9x	0.77	x	3.16	x	22.97	x	0.39	x	1.11	=	21.79	(81)
Northwest	0.9x	0.77	x	3.16	x	41.38	x	0.39	x	1.11	=	39.27	(81)
Northwest	0.9x	0.77	x	3.16	x	67.96	x	0.39	x	1.11	=	64.49	(81)
Northwest	0.9x	0.77	x	3.16	x	91.35	x	0.39	x	1.11	=	86.68	(81)
Northwest	0.9x	0.77	x	3.16	x	97.38	x	0.39	x	1.11	=	92.41	(81)
Northwest	0.9x	0.77	x	3.16	x	91.1	x	0.39	x	1.11	=	86.45	(81)
Northwest	0.9x	0.77	x	3.16	x	72.63	x	0.39	x	1.11	=	68.92	(81)
Northwest	0.9x	0.77	x	3.16	x	50.42	x	0.39	x	1.11	=	47.85	(81)
Northwest	0.9x	0.77	x	3.16	x	28.07	x	0.39	x	1.11	=	26.63	(81)
Northwest	0.9x	0.77	x	3.16	x	14.2	x	0.39	x	1.11	=	13.47	(81)
Northwest	0.9x	0.77	x	3.16	x	9.21	x	0.39	x	1.11	=	8.74	(81)
Rooflights	0.9x	1	x	0.92	x	16.37	x	0.63	x	0.7	=	5.98	(82)
Rooflights	0.9x	1	x	0.92	x	33.68	x	0.63	x	0.7	=	12.3	(82)
Rooflights	0.9x	1	x	0.92	x	62.13	x	0.63	x	0.7	=	22.69	(82)
Rooflights	0.9x	1	x	0.92	x	104.87	x	0.63	x	0.7	=	38.29	(82)
Rooflights	0.9x	1	x	0.92	x	143.66	x	0.63	x	0.7	=	52.46	(82)
Rooflights	0.9x	1	x	0.92	x	154.33	x	0.63	x	0.7	=	56.35	(82)
Rooflights	0.9x	1	x	0.92	x	143.9	x	0.63	x	0.7	=	52.55	(82)
Rooflights	0.9x	1	x	0.92	x	113.05	x	0.63	x	0.7	=	41.28	(82)
Rooflights	0.9x	1	x	0.92	x	76.56	x	0.63	x	0.7	=	27.96	(82)
Rooflights	0.9x	1	x	0.92	x	41.49	x	0.63	x	0.7	=	15.15	(82)
Rooflights	0.9x	1	x	0.92	x	20.65	x	0.63	x	0.7	=	7.54	(82)

DER WorkSheet: New dwelling as built

Rooflights 0.9x

 x

 x

 x

 x

 =

 (82)

Solar gains in watts, calculated for each month

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

(83)m=

123.38	219.92	326.72	447.93	540.95	554.26	527.2	455.19	368.29	250.03	149.56	104.44
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 (83)

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

(84)m=

531.21	625.53	717.55	814.86	883.48	873.41	831.24	765.52	690.98	596.84	524.07	499.86
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

(85)

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.97	0.92	0.83	0.69	0.55	0.6	0.81	0.95	0.98	0.99

 (86)

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

(87)m=

19.12	19.34	19.7	20.16	20.58	20.84	20.95	20.93	20.71	20.16	19.54	19.06
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

(88)m=

19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

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

(89)m=

0.99	0.98	0.96	0.9	0.79	0.61	0.43	0.49	0.75	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=

17.41	17.73	18.25	18.9	19.47	19.79	19.89	19.88	19.65	18.92	18.03	17.33
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

(91)

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

(92)m=

17.69	17.99	18.49	19.11	19.65	19.96	20.06	20.05	19.82	19.12	18.28	17.61
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

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

(93)m=

17.69	17.99	18.49	19.11	19.65	19.96	20.06	20.05	19.82	19.12	18.28	17.61
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=

0.98	0.97	0.94	0.88	0.78	0.61	0.45	0.5	0.74	0.91	0.97	0.98
------	------	------	------	------	------	------	-----	------	------	------	------

 (94)

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

(95)m=

521.35	605.74	675.88	720.18	685.82	535.53	371.32	384.1	513.63	545.64	508.35	492.14
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (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=

1494.51	1461.16	1337.81	1139.17	887	598.75	386.71	407.26	638.68	951.47	1247.6	1496.72
---------	---------	---------	---------	-----	--------	--------	--------	--------	--------	--------	---------

 (97)

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

(98)m=

724.03	574.85	492.47	301.67	149.67	0	0	0	0	301.93	532.26	747.41
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

(98)

Space heating requirement in kWh/m²/year

(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

(201)

DER WorkSheet: New dwelling as built

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		89.9	(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)

724.03	574.85	492.47	301.67	149.67	0	0	0	0	301.93	532.26	747.41
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

(211)

805.38	639.43	547.8	335.56	166.49	0	0	0	0	335.86	592.06	831.38
--------	--------	-------	--------	--------	---	---	---	---	--------	--------	--------

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

4253.95 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

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

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

0 (215)

Water heating

Output from water heater (calculated above)

170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82
--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------

Efficiency of water heater

86.7 (216)

89.27	89.22	89.11	88.88	88.37	86.7	86.7	86.7	86.7	88.85	89.16	89.3
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	------

(217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

191.38	167.85	174.29	153.6	149.15	132.58	124.24	140.6	141.69	159.47	171.86	185.68
--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------

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

1892.39 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

4253.95

Water heating fuel used

1892.39

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

68.83 (230a)

central heating pump:

30 (230c)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

143.83 (231)

Electricity for lighting

394.69 (232)

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

6684.86 (238)

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) ×	0.216	= 918.85 (261)
Space heating (secondary)	(215) ×	0.519	= 0 (263)
Water heating	(219) ×	0.216	= 408.76 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1327.61 (265)

DER WorkSheet: New dwelling as built

Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	74.65	(267)
Electricity for lighting	(232) x	0.519	=	204.84	(268)
Total CO2, kg/year		sum of (265)...(271) =		1607.1	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		17.28	(273)
El rating (section 14)				84	(274)

TER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 4 As Built

Address : 28 Swansea Road, READING, RG1 8HA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.3	(1a) x	2.5	(2a) =	100.75 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.99	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	236.5 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	0 (6b)
Number of intermittent fans				3	x 10 = 30 (7a)
Number of passive vents				0	x 10 = 0 (7b)
Number of flueless gas fires				0	x 40 = 0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (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) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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TER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1	= 2.12		(26)
Windows Type 1			3.16	x1/[1/(1.4)+ 0.04] =	4.19		(27)
Windows Type 2			0.66	x1/[1/(1.4)+ 0.04] =	0.88		(27)
Windows Type 3			0.66	x1/[1/(1.4)+ 0.04] =	0.88		(27)
Windows Type 4			2.36	x1/[1/(1.4)+ 0.04] =	3.13		(27)
Windows Type 5			8.39	x1/[1/(1.4)+ 0.04] =	11.12		(27)
Rooflights			0.92	x1/[1/(1.7) + 0.04] =	1.564		(27b)
Floor			40.3	x 0.13	= 5.239		(28)
Walls Type1	102.78	17.35	85.43	x 0.18	= 15.38		(29)
Walls Type2	16.45	0	16.45	x 0.18	= 2.96		(29)
Roof Type1	2.81	0	2.81	x 0.13	= 0.37		(30)
Roof Type2	0.6	0	0.6	x 0.13	= 0.08		(30)
Roof Type3	4.3	0	4.3	x 0.13	= 0.56		(30)
Roof Type4	18.16	0	18.16	x 0.13	= 2.36		(30)
Roof Type5	20.46	0.92	19.54	x 0.13	= 2.54		(30)
Total area of elements, m²			205.86				(31)
Party wall			65.95	x 0	= 0		(32)

TER WorkSheet: New dwelling as built

Internal wall **	178.58		(32c)
Internal floor	52.69		(32d)
Internal ceiling	52.69		(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 53.26 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14702.64 (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 16.28 (36)

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

Total fabric heat loss (33) + (36) = 69.54 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.53	45.28	45.03	43.87	43.65	42.64	42.64	42.45	43.03	43.65	44.09	44.55	(38)

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

(39)m=	115.07	114.82	114.57	113.41	113.19	112.17	112.17	111.99	112.56	113.19	113.63	114.09	
Average = Sum(39) _{1...12} /12=												113.4	(39)

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

(40)m=	1.24	1.23	1.23	1.22	1.22	1.21	1.21	1.2	1.21	1.22	1.22	1.23	
Average = Sum(40) _{1...12} /12=												1.22	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.48 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.23	103.33	99.43	95.53	91.63	87.73	87.73	91.63	95.53	99.43	103.33	107.23	
Total = Sum(44) _{1...12} =												1169.78	(44)

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

(45)m=	159.02	139.08	143.52	125.12	120.06	103.6	96	110.16	111.48	129.92	141.81	154	
Total = Sum(45) _{1...12} =												1533.76	(45)

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

(46)m=	23.85	20.86	21.53	18.77	18.01	15.54	14.4	16.52	16.72	19.49	21.27	23.1	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

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

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

TER WorkSheet: New dwelling as built

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0

(54)

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

0

(55)

Water storage loss calculated for each month

((56)m = (55) x (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 x (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 x (41)m

(61)m= 50.96 46.03 50.67 47.11 46.69 43.27 44.71 46.69 47.11 50.67 49.32 50.96

(61)

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

(62)m= 209.98 185.11 194.19 172.23 166.75 146.87 140.71 156.86 158.59 180.59 191.13 204.96

(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= 209.98 185.11 194.19 172.23 166.75 146.87 140.71 156.86 158.59 180.59 191.13 204.96

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

2107.94

(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= 65.61 57.75 60.39 53.38 51.59 45.26 43.1 48.3 48.84 55.86 59.48 63.94

(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= 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22

(66)

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

(67)m= 22.35 19.85 16.14 12.22 9.14 7.71 8.33 10.83 14.54 18.46 21.55 22.97

(67)

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

(68)m= 244.47 247.01 240.62 227.01 209.83 193.68 182.89 180.36 186.75 200.36 217.54 233.69

(68)

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

(69)m= 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32

(69)

Pumps and fans gains (Table 5a)

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

(70)

TER WorkSheet: New dwelling as built

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

(71)m=

-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58
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 (71)

Water heating gains (Table 5)

(72)m=

88.19	85.94	81.16	74.14	69.34	62.87	57.93	64.92	67.84	75.09	82.61	85.95
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 (72)

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

(73)m=

420.98	418.76	403.89	379.34	354.27	330.23	315.12	322.08	335.1	359.87	387.67	408.57
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>10.63</td></tr></table>	10.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>2.14</td></tr></table> (74)	2.14
0.77																		
0.66																		
10.63																		
0.63																		
0.7																		
2.14																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>20.32</td></tr></table>	20.32	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.1</td></tr></table> (74)	4.1
0.77																		
0.66																		
20.32																		
0.63																		
0.7																		
4.1																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>34.53</td></tr></table>	34.53	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>6.96</td></tr></table> (74)	6.96
0.77																		
0.66																		
34.53																		
0.63																		
0.7																		
6.96																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>55.46</td></tr></table>	55.46	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>11.19</td></tr></table> (74)	11.19
0.77																		
0.66																		
55.46																		
0.63																		
0.7																		
11.19																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>74.72</td></tr></table>	74.72	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>15.07</td></tr></table> (74)	15.07
0.77																		
0.66																		
74.72																		
0.63																		
0.7																		
15.07																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>79.99</td></tr></table>	79.99	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>16.13</td></tr></table> (74)	16.13
0.77																		
0.66																		
79.99																		
0.63																		
0.7																		
16.13																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>74.68</td></tr></table>	74.68	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>15.06</td></tr></table> (74)	15.06
0.77																		
0.66																		
74.68																		
0.63																		
0.7																		
15.06																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>59.25</td></tr></table>	59.25	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>11.95</td></tr></table> (74)	11.95
0.77																		
0.66																		
59.25																		
0.63																		
0.7																		
11.95																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>41.52</td></tr></table>	41.52	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>8.37</td></tr></table> (74)	8.37
0.77																		
0.66																		
41.52																		
0.63																		
0.7																		
8.37																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>24.19</td></tr></table>	24.19	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.88</td></tr></table> (74)	4.88
0.77																		
0.66																		
24.19																		
0.63																		
0.7																		
4.88																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>13.12</td></tr></table>	13.12	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>2.65</td></tr></table> (74)	2.65
0.77																		
0.66																		
13.12																		
0.63																		
0.7																		
2.65																		
North	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>8.86</td></tr></table>	8.86	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>1.79</td></tr></table> (74)	1.79
0.77																		
0.66																		
8.86																		
0.63																		
0.7																		
1.79																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>8.14</td></tr></table> (75)	8.14
0.77																		
2.36																		
11.28																		
0.63																		
0.7																		
8.14																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>16.56</td></tr></table> (75)	16.56
0.77																		
2.36																		
22.97																		
0.63																		
0.7																		
16.56																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>29.84</td></tr></table> (75)	29.84
0.77																		
2.36																		
41.38																		
0.63																		
0.7																		
29.84																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>49.01</td></tr></table> (75)	49.01
0.77																		
2.36																		
67.96																		
0.63																		
0.7																		
49.01																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>65.88</td></tr></table> (75)	65.88
0.77																		
2.36																		
91.35																		
0.63																		
0.7																		
65.88																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>70.24</td></tr></table> (75)	70.24
0.77																		
2.36																		
97.38																		
0.63																		
0.7																		
70.24																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>65.71</td></tr></table> (75)	65.71
0.77																		
2.36																		
91.1																		
0.63																		
0.7																		
65.71																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>52.38</td></tr></table> (75)	52.38
0.77																		
2.36																		
72.63																		
0.63																		
0.7																		
52.38																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>36.37</td></tr></table> (75)	36.37
0.77																		
2.36																		
50.42																		
0.63																		
0.7																		
36.37																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>20.24</td></tr></table> (75)	20.24
0.77																		
2.36																		
28.07																		
0.63																		
0.7																		
20.24																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>10.24</td></tr></table> (75)	10.24
0.77																		
2.36																		
14.2																		
0.63																		
0.7																		
10.24																		
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>6.65</td></tr></table> (75)	6.65
0.77																		
2.36																		
9.21																		
0.63																		
0.7																		
6.65																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>94.34</td></tr></table> (77)	94.34
0.77																		
8.39																		
36.79																		
0.63																		
0.7																		
94.34																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>160.7</td></tr></table> (77)	160.7
0.77																		
8.39																		
62.67																		
0.63																		
0.7																		
160.7																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>219.88</td></tr></table> (77)	219.88
0.77																		
8.39																		
85.75																		
0.63																		
0.7																		
219.88																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>272.44</td></tr></table> (77)	272.44
0.77																		
8.39																		
106.25																		
0.63																		
0.7																		
272.44																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>305.15</td></tr></table> (77)	305.15
0.77																		
8.39																		
119.01																		
0.63																		
0.7																		
305.15																		
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>8.39</td></tr></table>	8.39	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>302.95</td></tr></table> (77)	302.95
0.77																		
8.39																		
118.15																		
0.63																		
0.7																		
302.95																		

TER WorkSheet: New dwelling as built

Southeast	0.9x	0.77	x	8.39	x	113.91	x	0.63	x	0.7	=	292.07	(77)
Southeast	0.9x	0.77	x	8.39	x	104.39	x	0.63	x	0.7	=	267.67	(77)
Southeast	0.9x	0.77	x	8.39	x	92.85	x	0.63	x	0.7	=	238.08	(77)
Southeast	0.9x	0.77	x	8.39	x	69.27	x	0.63	x	0.7	=	177.61	(77)
Southeast	0.9x	0.77	x	8.39	x	44.07	x	0.63	x	0.7	=	113	(77)
Southeast	0.9x	0.77	x	8.39	x	31.49	x	0.63	x	0.7	=	80.74	(77)
West	0.9x	0.77	x	0.66	x	19.64	x	0.63	x	0.7	=	3.96	(80)
West	0.9x	0.77	x	0.66	x	38.42	x	0.63	x	0.7	=	7.75	(80)
West	0.9x	0.77	x	0.66	x	63.27	x	0.63	x	0.7	=	12.76	(80)
West	0.9x	0.77	x	0.66	x	92.28	x	0.63	x	0.7	=	18.61	(80)
West	0.9x	0.77	x	0.66	x	113.09	x	0.63	x	0.7	=	22.81	(80)
West	0.9x	0.77	x	0.66	x	115.77	x	0.63	x	0.7	=	23.35	(80)
West	0.9x	0.77	x	0.66	x	110.22	x	0.63	x	0.7	=	22.23	(80)
West	0.9x	0.77	x	0.66	x	94.68	x	0.63	x	0.7	=	19.1	(80)
West	0.9x	0.77	x	0.66	x	73.59	x	0.63	x	0.7	=	14.84	(80)
West	0.9x	0.77	x	0.66	x	45.59	x	0.63	x	0.7	=	9.2	(80)
West	0.9x	0.77	x	0.66	x	24.49	x	0.63	x	0.7	=	4.94	(80)
West	0.9x	0.77	x	0.66	x	16.15	x	0.63	x	0.7	=	3.26	(80)
Northwest	0.9x	0.77	x	3.16	x	11.28	x	0.63	x	0.7	=	10.9	(81)
Northwest	0.9x	0.77	x	3.16	x	22.97	x	0.63	x	0.7	=	22.18	(81)
Northwest	0.9x	0.77	x	3.16	x	41.38	x	0.63	x	0.7	=	39.96	(81)
Northwest	0.9x	0.77	x	3.16	x	67.96	x	0.63	x	0.7	=	65.63	(81)
Northwest	0.9x	0.77	x	3.16	x	91.35	x	0.63	x	0.7	=	88.22	(81)
Northwest	0.9x	0.77	x	3.16	x	97.38	x	0.63	x	0.7	=	94.05	(81)
Northwest	0.9x	0.77	x	3.16	x	91.1	x	0.63	x	0.7	=	87.98	(81)
Northwest	0.9x	0.77	x	3.16	x	72.63	x	0.63	x	0.7	=	70.14	(81)
Northwest	0.9x	0.77	x	3.16	x	50.42	x	0.63	x	0.7	=	48.69	(81)
Northwest	0.9x	0.77	x	3.16	x	28.07	x	0.63	x	0.7	=	27.11	(81)
Northwest	0.9x	0.77	x	3.16	x	14.2	x	0.63	x	0.7	=	13.71	(81)
Northwest	0.9x	0.77	x	3.16	x	9.21	x	0.63	x	0.7	=	8.9	(81)
Rooflights	0.9x	1	x	0.92	x	16.37	x	0.63	x	0.7	=	5.98	(82)
Rooflights	0.9x	1	x	0.92	x	33.68	x	0.63	x	0.7	=	12.3	(82)
Rooflights	0.9x	1	x	0.92	x	62.13	x	0.63	x	0.7	=	22.69	(82)
Rooflights	0.9x	1	x	0.92	x	104.87	x	0.63	x	0.7	=	38.29	(82)
Rooflights	0.9x	1	x	0.92	x	143.66	x	0.63	x	0.7	=	52.46	(82)
Rooflights	0.9x	1	x	0.92	x	154.33	x	0.63	x	0.7	=	56.35	(82)
Rooflights	0.9x	1	x	0.92	x	143.9	x	0.63	x	0.7	=	52.55	(82)
Rooflights	0.9x	1	x	0.92	x	113.05	x	0.63	x	0.7	=	41.28	(82)
Rooflights	0.9x	1	x	0.92	x	76.56	x	0.63	x	0.7	=	27.96	(82)
Rooflights	0.9x	1	x	0.92	x	41.49	x	0.63	x	0.7	=	15.15	(82)
Rooflights	0.9x	1	x	0.92	x	20.65	x	0.63	x	0.7	=	7.54	(82)

TER WorkSheet: New dwelling as built

Rooflights 0.9x

 x

 x

 x

 x

 =

 (82)

Solar gains in watts, calculated for each month

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

(83)m=

125.46	223.59	332.1	455.17	549.59	563.07	535.6	462.51	374.31	254.18	152.08	106.2
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 (83)

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

(84)m=

546.44	642.36	735.99	834.51	903.87	893.3	850.72	784.59	709.41	614.06	539.74	514.77
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	0.99	0.96	0.88	0.73	0.56	0.62	0.86	0.98	1	1

 (86)

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

(87)m=

19.63	19.8	20.07	20.43	20.75	20.93	20.98	20.97	20.84	20.43	19.96	19.6
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (87)

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

(88)m=

19.89	19.89	19.89	19.9	19.91	19.91	19.91	19.92	19.91	19.91	19.9	19.9
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	------

 (88)

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

(89)m=

1	0.99	0.98	0.95	0.84	0.63	0.43	0.49	0.79	0.97	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (89)

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

(90)m=

18.07	18.32	18.71	19.24	19.66	19.87	19.91	19.91	19.78	19.24	18.56	18.04
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 (90)

fLA = Living area ÷ (4) =

0.16

(91)

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

(92)m=

18.33	18.56	18.93	19.43	19.83	20.04	20.08	20.08	19.95	19.43	18.79	18.29
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

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

(93)m=

18.33	18.56	18.93	19.43	19.83	20.04	20.08	20.08	19.95	19.43	18.79	18.29
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=

1	0.99	0.98	0.94	0.84	0.64	0.45	0.51	0.8	0.96	0.99	1
---	------	------	------	------	------	------	------	-----	------	------	---

 (94)

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

(95)m=

544.31	636.85	720.27	783	754.94	576.13	385.88	403.26	564.74	589.8	535.43	513.24
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 (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=

1613.91	1567.96	1424.57	1194.18	920.69	610.51	390.84	412.12	658.49	999.29	1328.3	1607.55
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 (97)

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

(98)m=

795.79	625.7	524	296.05	123.32	0	0	0	0	304.66	570.87	814.17
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 (98)

Total per year (kWh/year) = Sum(98).....5,9...12 =

4054.56

(98)

Space heating requirement in kWh/m²/year

43.6

(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

(201)

TER WorkSheet: New dwelling as built

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		93.4	(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)												
795.79	625.7	524	296.05	123.32	0	0	0	0	304.66	570.87	814.17	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												
852.02	669.92	561.03	316.97	132.03	0	0	0	0	326.19	611.21	871.7	
Total (kWh/year) = Sum(211) _{1..5,10...12} =												4341.07
(211)												

Space heating fuel (secondary), kWh/month												
= {[(98)m × (201)] } × 100 ÷ (208)												
(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =												0
(215)												

Water heating

Output from water heater (calculated above)												
209.98	185.11	194.19	172.23	166.75	146.87	140.71	156.86	158.59	180.59	191.13	204.96	
Efficiency of water heater												80.3
(217)m =	88.09	87.88	87.43	86.4	84.3	80.3	80.3	80.3	80.3	86.36	87.64	88.17
(217)												
Fuel for water heating, kWh/month												
(219)m = (64)m × 100 ÷ (217)m												
(219)m =	238.37	210.64	222.11	199.34	197.8	182.9	175.23	195.34	197.5	209.11	218.1	232.46
Total = Sum(219a) _{1..12} =												2478.89
(219)												

Annual totals

Space heating fuel used, main system 1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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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) ×		0.216	=	937.67
Space heating (secondary)	(215) ×		0.519	=	0
Water heating	(219) ×		0.216	=	535.44
Space and water heating	(261) + (262) + (263) + (264) =				1473.11
Electricity for pumps, fans and electric keep-hot	(231) ×		0.519	=	38.93

TER WorkSheet: New dwelling as built

Electricity for lighting	(232)	x	0.519	=	204.84	(268)
Total CO2, kg/year			sum of (265)...(271)	=	1716.88	(272)
TER	=				18.46	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 02 March 2023 at 13:02:33

Project Information:

Assessed By: Matt Fitzpatrick (STRO003572)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 91.8m²

Site Reference : Swansea Road

Plot Reference: 5 As Built

Address : 26 Swansea Road, READING, RG1 8HA

Client Details:

Name: Helix

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 19.98 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.33 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 64.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 56.5 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.59	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 512, product index 018738): Boiler systems with radiators or underfloor heating - mains gas Brand name: Baxi Model: ASSURE Model qualifier: 36 COMBI (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: North West 6.85m²
 Windows facing: North 1.03m²
 Windows facing: West 1.03m²
 Windows facing: South West 4.38m²
 Windows facing: South East 5.05m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K
 Photovoltaic array

SAP Input

Property Details: 5 As Built

Address: 26 Swansea Road, READING, RG1 8HA
 Located in: England
 Region: Thames valley
 UPRN: UPRN-547143256411
 Date of assessment: 02 March 2023
 Date of certificate: 02 March 2023
 Assessment type: New dwelling as built
 Transaction type: New dwelling
 Tenure type: Unknown
 Related party disclosure: No related party
 Thermal Mass Parameter: Calculated 154.97
 Water use <= 125 litres/person/day: True
 PCDF Version: 512

Property description:

Dwelling type: House
 Detachment: End-terrace
 Year Completed: 2023
 Floor Location: Floor area: Storey height:
 Floor 0 36.34 m² 2.5 m
 Floor 1 55.46 m² 2.7 m
 Living area: 26.57 m² (fraction 0.289)
 Front of dwelling faces: North West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front	Manufacturer	Solid			Wood
1	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
3	BFRC	Windows	low-E, En = 0.1, soft coat	No	
4	BFRC	Windows	low-E, En = 0.1, soft coat	No	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front	mm	0.7	0.63	1.5	2.12	1
1	12mm	0	0.39	1.3	6.85	1
2	12mm	0	0.39	1.3	1.03	1
2	12mm	0	0.39	1.3	1.03	1
3	12mm	0	0.39	1.3	4.38	1
4	12mm	0	0.39	1.3	5.05	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front		Brick	North West	0	0
1		Brick	North West	0	0
2		Brick	North	0	0
2		Brick	West	0	0
3		Brick	South West	0	0
4		Brick	South East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Brick	136.84	20.46	116.38	0.25	0	False	60

SAP Input

Cold roof	55.46	0	55.46	0.11	0	9
Bay roof	0.6	0	0.6	0.11	0	9
Suspended floor	36.34			0.11		75
Floor over drive through	19.73			0.15		20
<u>Internal Elements</u>						
Metal stud	178.58					9
Int ceiling	52.69					9
Int Floor	52.69					18
<u>Party Elements</u>						
Party wall	13.09					45

Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.0592				
	Length	Psi-value			
	14.82	0.05	E2	Other lintels (including other steel lintels)	
	12.31	0.034	E3	Sill	
	43.2	0.04	E4	Jamb	
	24.79	0.06	E5	Ground floor (normal)	
	8.11	0.32	E20	Exposed floor (normal)	
	4.85	0.32	E21	Exposed floor (inverted)	
	37.38	0	E6	Intermediate floor within a dwelling	
	29.89	0.123	E10	Eaves (insulation at ceiling level)	
	1.82	0.24	E24	Eaves (insulation at ceiling level - inverted)	
	0	0.033	E11	Eaves (insulation at rafter level)	
	0	0.063	E12	Gable (insulation at ceiling level)	
	0	0.08	E13	Gable (insulation at rafter level)	
	20.4	0.05	E16	Corner (normal)	
	5	-0.069	E17	Corner (inverted internal area greater than external area)	
	5.4	0.072	E18	Party wall between dwellings	
	0	0.12	E25	Staggered party wall between dwellings	
	0	0.043	P1	Ground floor	
	0	0	P2	Intermediate floor within a dwelling	
	4.85	0.16	P7	Exposed floor (normal)	
	4.85	0.055	P4	Roof (insulation at ceiling level)	
	0	0.069	P5	Roof (insulation at rafter level)	
	0	0.08	R1	Head	
	0	0.06	R2	Sill	
	0	0.08	R3	Jamb	
	0	0.06	R6	Flat ceiling	
	0	0.06	R8	Roof wall (rafter)	

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Decentralised whole house extract
	Number of fans in Wetroom: Kitchen 1 Other 1
	Ductwork: ,
	Approved Installation Scheme: True
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.59 (Assessed dwelling is tested)

Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database

SAP Input

Database: (rev 512, product index 018738) Efficiency: Winter 86.7 % Summer: 89.9
Brand name: Baxi
Model: ASSURE
Model qualifier: 36 COMBI
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes

Main heating Control:

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

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Low rise urban / suburban
EPC language: English
Wind turbine: No
Photovoltaics: Photovoltaic 1
Installed Peak power: 2.1
Tilt of collector: 45°
Overshading: None or very little
Collector Orientation: South East
Assess Zero Carbon Home: No

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 5 As Built

Address : 26 Swansea Road, READING, RG1 8HA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	36.34 (1a)	x	2.5 (2a)	=	90.85 (3a)
First floor	55.46 (1b)	x	2.7 (2b)	=	149.74 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.8 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	240.59 (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				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.59000015258789 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.23 (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) =		0.2 (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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DER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

	0.25	0.24	0.24	0.21	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23
--	------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

(24c)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (24c)

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

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

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

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

(25)m= 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1.5	= 3.18		(26)
Windows Type 1			6.85	x1/[1/(1.3)+ 0.04]	= 8.46		(27)
Windows Type 2			1.03	x1/[1/(1.3)+ 0.04]	= 1.27		(27)
Windows Type 3			1.03	x1/[1/(1.3)+ 0.04]	= 1.27		(27)
Windows Type 4			4.38	x1/[1/(1.3)+ 0.04]	= 5.41		(27)
Windows Type 5			5.05	x1/[1/(1.3)+ 0.04]	= 6.24		(27)
Floor Type 1			36.34	x 0.11	= 3.9974	75	2725.5 (28)
Floor Type 2			19.73	x 0.15	= 2.9595	20	394.6 (28)
Walls	136.84	20.46	116.38	x 0.25	= 29.09	60	6982.8 (29)
Roof Type1	55.46	0	55.46	x 0.11	= 6.1	9	499.14 (30)
Roof Type2	0.6	0	0.6	x 0.11	= 0.07	9	5.4 (30)
Total area of elements, m²			248.97				(31)
Party wall			13.09	x 0	= 0	45	589.05 (32)
Internal wall **			178.58			9	1607.22 (32c)
Internal floor			52.69			18	948.42 (32d)
Internal ceiling			52.69			9	474.21 (32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 68.06 (33)

DER WorkSheet: New dwelling as built

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

$((28)...(30) + (32) + (32a)...(32e) =$ 14226.34 (34)

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

$= (34) \div (4) =$ 154.97 (35)

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

Thermal bridges : $S (L \times Y)$ calculated using Appendix K

14.74 (36)

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

Total fabric heat loss

$(33) + (36) =$ 82.8 (37)

Ventilation heat loss calculated monthly

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	(38)

Heat transfer coefficient, W/K

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

(39)m=	122.5	122.5	122.5	122.5	122.5	122.5	122.5	122.5	122.5	122.5	122.5	122.5	
Average = $\text{Sum}(39)_{1...12} / 12 =$												122.5	(39)

Heat loss parameter (HLP), W/m^2K

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

(40)m=	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	
Average = $\text{Sum}(40)_{1...12} / 12 =$												1.33	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$ 2.65 (42)

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

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

97.13 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	106.84	102.95	99.07	95.18	91.3	87.41	87.41	91.3	95.18	99.07	102.95	106.84	
Total = $\text{Sum}(44)_{1...12} =$												1165.53	(44)

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

(45)m=	158.44	138.57	142.99	124.67	119.62	103.22	95.65	109.76	111.07	129.44	141.3	153.44	
Total = $\text{Sum}(45)_{1...12} =$												1528.19	(45)

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

(46)m=	23.77	20.79	21.45	18.7	17.94	15.48	14.35	16.46	16.66	19.42	21.19	23.02	(46)
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Water storage loss:

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

0 (47)

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

$(48) \times (49) =$ 0 (50)

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

DER WorkSheet: New dwelling as built

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)												
Water storage loss calculated for each month	((56)m = (55) × (41)m													
(56)m=	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(56)
0	0	0	0	0	0	0	0	0	0	0	0			
If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H														
(57)m=	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(57)
0	0	0	0	0	0	0	0	0	0	0	0			
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=	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(59)
0	0	0	0	0	0	0	0	0	0	0	0			
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m														
(61)m=	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>11.82</td><td>10.67</td><td>11.8</td><td>11.39</td><td>11.75</td><td>11.35</td><td>11.71</td><td>11.74</td><td>11.37</td><td>11.78</td><td>11.42</td><td>11.82</td> </tr> </table>	11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82	(61)
11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82			
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=	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>170.26</td><td>149.25</td><td>154.79</td><td>136.06</td><td>131.37</td><td>114.57</td><td>107.36</td><td>121.5</td><td>122.44</td><td>141.22</td><td>152.72</td><td>165.26</td> </tr> </table>	170.26	149.25	154.79	136.06	131.37	114.57	107.36	121.5	122.44	141.22	152.72	165.26	(62)
170.26	149.25	154.79	136.06	131.37	114.57	107.36	121.5	122.44	141.22	152.72	165.26			
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=	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(63)
0	0	0	0	0	0	0	0	0	0	0	0			
Output from water heater														
(64)m=	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>170.26</td><td>149.25</td><td>154.79</td><td>136.06</td><td>131.37</td><td>114.57</td><td>107.36</td><td>121.5</td><td>122.44</td><td>141.22</td><td>152.72</td><td>165.26</td> </tr> </table>	170.26	149.25	154.79	136.06	131.37	114.57	107.36	121.5	122.44	141.22	152.72	165.26	
170.26	149.25	154.79	136.06	131.37	114.57	107.36	121.5	122.44	141.22	152.72	165.26			
Output from water heater (annual) _{1...12}											1666.81	(64)		
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]														
(65)m=	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>55.64</td><td>48.74</td><td>50.5</td><td>44.3</td><td>42.71</td><td>37.16</td><td>34.73</td><td>39.43</td><td>39.77</td><td>45.98</td><td>49.84</td><td>53.97</td> </tr> </table>	55.64	48.74	50.5	44.3	42.71	37.16	34.73	39.43	39.77	45.98	49.84	53.97	(65)
55.64	48.74	50.5	44.3	42.71	37.16	34.73	39.43	39.77	45.98	49.84	53.97			
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=	132.48	132.48	132.48	132.48	132.48	132.48	132.48	132.48	132.48	132.48	132.48	132.48
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
(67)m=	21.76	19.33	15.72	11.9	8.9	7.51	8.11	10.55	14.16	17.98	20.98	22.37
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
(68)m=	242.35	244.87	238.53	225.04	208.01	192	181.31	178.79	185.13	198.62	215.65	231.66
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
(69)m=	36.25	36.25	36.25	36.25	36.25	36.25	36.25	36.25	36.25	36.25	36.25	36.25
Pumps and fans gains (Table 5a)												
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3
Losses e.g. evaporation (negative values) (Table 5)												
(71)m=	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98
Water heating gains (Table 5)												
(72)m=	74.78	72.54	67.87	61.53	57.41	51.61	46.68	53	55.24	61.81	69.22	72.54

DER WorkSheet: New dwelling as built

Total internal gains =

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

(73)m=	404.64	402.47	387.86	364.21	340.05	316.86	301.85	308.08	320.27	344.15	371.59	392.31
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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.

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	1.03	x	10.63	x	0.39	x	1.11	=	3.29 (74)
North	0.9x	0.77	x	1.03	x	20.32	x	0.39	x	1.11	=	6.29 (74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.39	x	1.11	=	10.68 (74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.39	x	1.11	=	17.16 (74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.39	x	1.11	=	23.11 (74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.39	x	1.11	=	24.74 (74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.39	x	1.11	=	23.1 (74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.39	x	1.11	=	18.33 (74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.39	x	1.11	=	12.84 (74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.39	x	1.11	=	7.48 (74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.39	x	1.11	=	4.06 (74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.39	x	1.11	=	2.74 (74)
Southeast	0.9x	0.77	x	5.05	x	36.79	x	0.39	x	1.11	=	55.8 (77)
Southeast	0.9x	0.77	x	5.05	x	62.67	x	0.39	x	1.11	=	95.05 (77)
Southeast	0.9x	0.77	x	5.05	x	85.75	x	0.39	x	1.11	=	130.05 (77)
Southeast	0.9x	0.77	x	5.05	x	106.25	x	0.39	x	1.11	=	161.13 (77)
Southeast	0.9x	0.77	x	5.05	x	119.01	x	0.39	x	1.11	=	180.48 (77)
Southeast	0.9x	0.77	x	5.05	x	118.15	x	0.39	x	1.11	=	179.18 (77)
Southeast	0.9x	0.77	x	5.05	x	113.91	x	0.39	x	1.11	=	172.75 (77)
Southeast	0.9x	0.77	x	5.05	x	104.39	x	0.39	x	1.11	=	158.31 (77)
Southeast	0.9x	0.77	x	5.05	x	92.85	x	0.39	x	1.11	=	140.81 (77)
Southeast	0.9x	0.77	x	5.05	x	69.27	x	0.39	x	1.11	=	105.05 (77)
Southeast	0.9x	0.77	x	5.05	x	44.07	x	0.39	x	1.11	=	66.83 (77)
Southeast	0.9x	0.77	x	5.05	x	31.49	x	0.39	x	1.11	=	47.75 (77)
Southwest	0.9x	0.77	x	4.38	x	36.79		0.39	x	1.11	=	48.4 (79)
Southwest	0.9x	0.77	x	4.38	x	62.67		0.39	x	1.11	=	82.44 (79)
Southwest	0.9x	0.77	x	4.38	x	85.75		0.39	x	1.11	=	112.79 (79)
Southwest	0.9x	0.77	x	4.38	x	106.25		0.39	x	1.11	=	139.75 (79)
Southwest	0.9x	0.77	x	4.38	x	119.01		0.39	x	1.11	=	156.54 (79)
Southwest	0.9x	0.77	x	4.38	x	118.15		0.39	x	1.11	=	155.4 (79)
Southwest	0.9x	0.77	x	4.38	x	113.91		0.39	x	1.11	=	149.83 (79)
Southwest	0.9x	0.77	x	4.38	x	104.39		0.39	x	1.11	=	137.31 (79)
Southwest	0.9x	0.77	x	4.38	x	92.85		0.39	x	1.11	=	122.13 (79)
Southwest	0.9x	0.77	x	4.38	x	69.27		0.39	x	1.11	=	91.11 (79)

DER WorkSheet: New dwelling as built

Southwest	0.9x	0.77	x	4.38	x	44.07		0.39	x	1.11	=	57.97	(79)
Southwest	0.9x	0.77	x	4.38	x	31.49		0.39	x	1.11	=	41.42	(79)
West	0.9x	0.77	x	1.03	x	19.64	x	0.39	x	1.11	=	6.07	(80)
West	0.9x	0.77	x	1.03	x	38.42	x	0.39	x	1.11	=	11.88	(80)
West	0.9x	0.77	x	1.03	x	63.27	x	0.39	x	1.11	=	19.57	(80)
West	0.9x	0.77	x	1.03	x	92.28	x	0.39	x	1.11	=	28.54	(80)
West	0.9x	0.77	x	1.03	x	113.09	x	0.39	x	1.11	=	34.98	(80)
West	0.9x	0.77	x	1.03	x	115.77	x	0.39	x	1.11	=	35.81	(80)
West	0.9x	0.77	x	1.03	x	110.22	x	0.39	x	1.11	=	34.09	(80)
West	0.9x	0.77	x	1.03	x	94.68	x	0.39	x	1.11	=	29.28	(80)
West	0.9x	0.77	x	1.03	x	73.59	x	0.39	x	1.11	=	22.76	(80)
West	0.9x	0.77	x	1.03	x	45.59	x	0.39	x	1.11	=	14.1	(80)
West	0.9x	0.77	x	1.03	x	24.49	x	0.39	x	1.11	=	7.57	(80)
West	0.9x	0.77	x	1.03	x	16.15	x	0.39	x	1.11	=	5	(80)
Northwest	0.9x	0.77	x	6.85	x	11.28	x	0.39	x	1.11	=	23.21	(81)
Northwest	0.9x	0.77	x	6.85	x	22.97	x	0.39	x	1.11	=	47.24	(81)
Northwest	0.9x	0.77	x	6.85	x	41.38	x	0.39	x	1.11	=	85.12	(81)
Northwest	0.9x	0.77	x	6.85	x	67.96	x	0.39	x	1.11	=	139.79	(81)
Northwest	0.9x	0.77	x	6.85	x	91.35	x	0.39	x	1.11	=	187.9	(81)
Northwest	0.9x	0.77	x	6.85	x	97.38	x	0.39	x	1.11	=	200.33	(81)
Northwest	0.9x	0.77	x	6.85	x	91.1	x	0.39	x	1.11	=	187.4	(81)
Northwest	0.9x	0.77	x	6.85	x	72.63	x	0.39	x	1.11	=	149.4	(81)
Northwest	0.9x	0.77	x	6.85	x	50.42	x	0.39	x	1.11	=	103.72	(81)
Northwest	0.9x	0.77	x	6.85	x	28.07	x	0.39	x	1.11	=	57.74	(81)
Northwest	0.9x	0.77	x	6.85	x	14.2	x	0.39	x	1.11	=	29.2	(81)
Northwest	0.9x	0.77	x	6.85	x	9.21	x	0.39	x	1.11	=	18.95	(81)

Solar gains in watts, calculated for each month

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

(83)m=

136.77	242.89	358.21	486.37	583.01	595.45	567.16	492.62	402.26	275.47	165.64	115.86
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (83)

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

(84)m=

541.4	645.37	746.07	850.58	923.06	912.32	869.01	800.7	722.53	619.62	537.23	508.17
-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.96	0.92	0.83	0.7	0.56	0.61	0.81	0.94	0.98	0.99

 (86)

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

(87)m=

18.89	19.13	19.52	20.02	20.48	20.8	20.93	20.9	20.64	20.04	19.36	18.83
-------	-------	-------	-------	-------	------	-------	------	-------	-------	-------	-------

 (87)

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

(88)m=

19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81	19.81
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

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

(89)m=

0.99	0.98	0.95	0.9	0.79	0.61	0.43	0.49	0.75	0.93	0.98	0.99
------	------	------	-----	------	------	------	------	------	------	------	------

 (89)

DER WorkSheet: New dwelling as built

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

(90)m=	17.02	17.37	17.93	18.64	19.27	19.65	19.78	19.76	19.49	18.68	17.7	16.93	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

$$fLA = \text{Living area} \div (4) = \boxed{0.29} \quad (91)$$

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	17.56	17.88	18.39	19.04	19.62	19.98	20.11	20.09	19.82	19.07	18.18	17.48	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	17.56	17.88	18.39	19.04	19.62	19.98	20.11	20.09	19.82	19.07	18.18	17.48	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	0.98	0.96	0.94	0.88	0.78	0.63	0.47	0.52	0.75	0.91	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	529.96	622.43	698.93	747.94	717.71	570.45	404.88	416.01	539.99	563.91	519.35	499.16	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1624.67	1589.67	1456.81	1242.14	969.96	659.17	429.87	451.78	700.81	1037.91	1357.64	1626.95	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	---------	---------	------

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

(98)m=	814.47	649.99	563.86	355.82	187.67	0	0	0	0	352.66	603.57	839.08	
Total per year ($kWh/year$) = $\text{Sum}(98)_{1..5,9..12} =$												4367.11	(98)

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

47.57	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system $\boxed{0}$ (201)

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

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

Efficiency of main space heating system 1 89.9 (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)

814.47	649.99	563.86	355.82	187.67	0	0	0	0	352.66	603.57	839.08
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

905.97	723.01	627.21	395.8	208.76	0	0	0	0	392.28	671.38	933.34
--------	--------	--------	-------	--------	---	---	---	---	--------	--------	--------

$$\text{Total } (kWh/year) = \text{Sum}(211)_{1..5,10..12} = \boxed{4857.74} \quad (211)$$

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

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

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

Water heating

Output from water heater (calculated above)

170.26	149.25	154.79	136.06	131.37	114.57	107.36	121.5	122.44	141.22	152.72	165.26
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Efficiency of water heater 86.7 (216)

DER WorkSheet: New dwelling as built

$$(217)m = \begin{bmatrix} 89.33 & 89.28 & 89.19 & 88.99 & 88.55 & 86.7 & 86.7 & 86.7 & 86.7 & 88.96 & 89.23 & 89.36 \end{bmatrix} \quad (217)$$

Fuel for water heating, kWh/month

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

(219)m=	190.6	167.16	173.55	152.89	148.35	132.15	123.83	140.14	141.23	158.75	171.15	184.94	
Total = Sum(219a) _{i=12} =													1884.72 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

4857.74

Water heating fuel used

1884.72

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

71.05

(230a)

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

146.05

(231)

Electricity for lighting

384.3

(232)

Electricity generated by PVs

-1686.71

(233)

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

5586.1

(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	= 1049.27 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 407.1 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1456.37 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 75.8 (267)
Electricity for lighting	(232) x	0.519	= 199.45 (268)
Energy saving/generation technologies Item 1		0.519	= -875.4 (269)
Total CO2, kg/year	sum of (265)...(271) =		856.22 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		9.33 (273)
EI rating (section 14)			92 (274)

TER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 5 As Built

Address : 26 Swansea Road, READING, RG1 8HA

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	36.34 (1a)	x	2.5 (2a)	=	90.85 (3a)
First floor	55.46 (1b)	x	2.7 (2b)	=	149.74 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.8 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	240.59 (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				3	30 (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) =	30	÷ (5) =	0.12 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.37 (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) =		0.32 (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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TER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

	0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1	= 2.12		(26)
Windows Type 1			6.85	x1/[1/(1.4)+ 0.04] =	9.08		(27)
Windows Type 2			1.03	x1/[1/(1.4)+ 0.04] =	1.37		(27)
Windows Type 3			1.03	x1/[1/(1.4)+ 0.04] =	1.37		(27)
Windows Type 4			4.38	x1/[1/(1.4)+ 0.04] =	5.81		(27)
Windows Type 5			5.05	x1/[1/(1.4)+ 0.04] =	6.7		(27)
Floor Type 1			36.34	x 0.13	= 4.7242		(28)
Floor Type 2			19.73	x 0.13	= 2.5649		(28)
Walls	136.84	20.46	116.38	x 0.18	= 20.95		(29)
Roof Type1	55.46	0	55.46	x 0.13	= 7.21		(30)
Roof Type2	0.6	0	0.6	x 0.13	= 0.08		(30)
Total area of elements, m²			248.97				(31)
Party wall			13.09	x 0	= 0		(32)
Internal wall **			178.58				(32c)
Internal floor			52.69				(32d)
Internal ceiling			52.69				(32e)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 61.96 (33)

TER WorkSheet: New dwelling as built

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

$((28)...(30) + (32) + (32a)...(32e) =$ 14226.34 (34)

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

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 : $S(L \times Y)$ calculated using Appendix K

16.93 (36)

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

Total fabric heat loss

$(33) + (36) =$ 78.89 (37)

Ventilation heat loss calculated monthly

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	46.24	45.99	45.74	44.57	44.35	43.33	43.33	43.14	43.72	44.35	44.79	45.26	(38)

Heat transfer coefficient, W/K

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

(39)m=	125.13	124.88	124.63	123.46	123.24	122.22	122.22	122.03	122.61	123.24	123.68	124.15	
Average = $\text{Sum}(39)_{1...12} / 12 =$												123.46	(39)

Heat loss parameter (HLP), W/m^2K

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

(40)m=	1.36	1.36	1.36	1.34	1.34	1.33	1.33	1.33	1.34	1.34	1.35	1.35	
Average = $\text{Sum}(40)_{1...12} / 12 =$												1.34	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$ 2.65 (42)

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

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

97.13 (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=	106.84	102.95	99.07	95.18	91.3	87.41	87.41	91.3	95.18	99.07	102.95	106.84	
Total = $\text{Sum}(44)_{1...12} =$												1165.53	(44)

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

(45)m=	158.44	138.57	142.99	124.67	119.62	103.22	95.65	109.76	111.07	129.44	141.3	153.44	
Total = $\text{Sum}(45)_{1...12} =$												1528.19	(45)

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

(46)m=	23.77	20.79	21.45	18.7	17.94	15.48	14.35	16.46	16.66	19.42	21.19	23.02	(46)
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Water storage loss:

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

0 (47)

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

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

Water storage loss:

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

0 (48)

Temperature factor from Table 2b

0 (49)

Energy lost from water storage, kWh/year

$(48) \times (49) =$ 0 (50)

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

TER WorkSheet: New dwelling as built

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)

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

(56)m=

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

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m × [(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=

50.96	46.03	50.48	46.94	46.53	43.11	44.55	46.53	46.94	50.48	49.32	50.96
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

209.4	184.6	193.48	171.61	166.15	146.33	140.2	156.29	158.01	179.93	190.61	204.4
-------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------

 (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=

209.4	184.6	193.48	171.61	166.15	146.33	140.2	156.29	158.01	179.93	190.61	204.4
-------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------

Output from water heater (annual)_{1...12} 2101 (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=

65.42	57.58	60.17	53.19	51.41	45.1	42.94	48.13	48.67	55.66	59.31	63.76
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (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
132.48	132.48	132.48	132.48	132.48	132.48	132.48	132.48	132.48	132.48	132.48	132.48

 (66)

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

(67)m=

21.76	19.33	15.72	11.9	8.9	7.51	8.11	10.55	14.16	17.98	20.98	22.37
-------	-------	-------	------	-----	------	------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

242.35	244.87	238.53	225.04	208.01	192	181.31	178.79	185.13	198.62	215.65	231.66
--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

36.25	36.25	36.25	36.25	36.25	36.25	36.25	36.25	36.25	36.25	36.25	36.25
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

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

(71)m=

-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98	-105.98
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

87.93	85.69	80.87	73.87	69.09	62.64	57.72	64.69	67.59	74.81	82.38	85.7
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (72)

TER WorkSheet: New dwelling as built

Total internal gains =

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

(73)m=	417.79	415.62	400.86	376.55	351.74	327.89	312.88	319.77	332.62	357.15	384.75	405.46
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.03	x	10.63	x	0.63	x	0.7	=	3.35 (74)
North	0.9x	0.77	x	1.03	x	20.32	x	0.63	x	0.7	=	6.4 (74)
North	0.9x	0.77	x	1.03	x	34.53	x	0.63	x	0.7	=	10.87 (74)
North	0.9x	0.77	x	1.03	x	55.46	x	0.63	x	0.7	=	17.46 (74)
North	0.9x	0.77	x	1.03	x	74.72	x	0.63	x	0.7	=	23.52 (74)
North	0.9x	0.77	x	1.03	x	79.99	x	0.63	x	0.7	=	25.18 (74)
North	0.9x	0.77	x	1.03	x	74.68	x	0.63	x	0.7	=	23.51 (74)
North	0.9x	0.77	x	1.03	x	59.25	x	0.63	x	0.7	=	18.65 (74)
North	0.9x	0.77	x	1.03	x	41.52	x	0.63	x	0.7	=	13.07 (74)
North	0.9x	0.77	x	1.03	x	24.19	x	0.63	x	0.7	=	7.61 (74)
North	0.9x	0.77	x	1.03	x	13.12	x	0.63	x	0.7	=	4.13 (74)
North	0.9x	0.77	x	1.03	x	8.86	x	0.63	x	0.7	=	2.79 (74)
Southeast	0.9x	0.77	x	5.05	x	36.79	x	0.63	x	0.7	=	56.79 (77)
Southeast	0.9x	0.77	x	5.05	x	62.67	x	0.63	x	0.7	=	96.73 (77)
Southeast	0.9x	0.77	x	5.05	x	85.75	x	0.63	x	0.7	=	132.35 (77)
Southeast	0.9x	0.77	x	5.05	x	106.25	x	0.63	x	0.7	=	163.98 (77)
Southeast	0.9x	0.77	x	5.05	x	119.01	x	0.63	x	0.7	=	183.67 (77)
Southeast	0.9x	0.77	x	5.05	x	118.15	x	0.63	x	0.7	=	182.35 (77)
Southeast	0.9x	0.77	x	5.05	x	113.91	x	0.63	x	0.7	=	175.8 (77)
Southeast	0.9x	0.77	x	5.05	x	104.39	x	0.63	x	0.7	=	161.11 (77)
Southeast	0.9x	0.77	x	5.05	x	92.85	x	0.63	x	0.7	=	143.3 (77)
Southeast	0.9x	0.77	x	5.05	x	69.27	x	0.63	x	0.7	=	106.9 (77)
Southeast	0.9x	0.77	x	5.05	x	44.07	x	0.63	x	0.7	=	68.02 (77)
Southeast	0.9x	0.77	x	5.05	x	31.49	x	0.63	x	0.7	=	48.6 (77)
Southwest	0.9x	0.77	x	4.38	x	36.79		0.63	x	0.7	=	49.25 (79)
Southwest	0.9x	0.77	x	4.38	x	62.67		0.63	x	0.7	=	83.89 (79)
Southwest	0.9x	0.77	x	4.38	x	85.75		0.63	x	0.7	=	114.79 (79)
Southwest	0.9x	0.77	x	4.38	x	106.25		0.63	x	0.7	=	142.23 (79)
Southwest	0.9x	0.77	x	4.38	x	119.01		0.63	x	0.7	=	159.31 (79)
Southwest	0.9x	0.77	x	4.38	x	118.15		0.63	x	0.7	=	158.15 (79)
Southwest	0.9x	0.77	x	4.38	x	113.91		0.63	x	0.7	=	152.48 (79)
Southwest	0.9x	0.77	x	4.38	x	104.39		0.63	x	0.7	=	139.74 (79)
Southwest	0.9x	0.77	x	4.38	x	92.85		0.63	x	0.7	=	124.29 (79)
Southwest	0.9x	0.77	x	4.38	x	69.27		0.63	x	0.7	=	92.72 (79)

TER WorkSheet: New dwelling as built

Southwest	0.9x	0.77	x	4.38	x	44.07		0.63	x	0.7	=	58.99	(79)
Southwest	0.9x	0.77	x	4.38	x	31.49		0.63	x	0.7	=	42.15	(79)
West	0.9x	0.77	x	1.03	x	19.64	x	0.63	x	0.7	=	6.18	(80)
West	0.9x	0.77	x	1.03	x	38.42	x	0.63	x	0.7	=	12.09	(80)
West	0.9x	0.77	x	1.03	x	63.27	x	0.63	x	0.7	=	19.92	(80)
West	0.9x	0.77	x	1.03	x	92.28	x	0.63	x	0.7	=	29.05	(80)
West	0.9x	0.77	x	1.03	x	113.09	x	0.63	x	0.7	=	35.6	(80)
West	0.9x	0.77	x	1.03	x	115.77	x	0.63	x	0.7	=	36.44	(80)
West	0.9x	0.77	x	1.03	x	110.22	x	0.63	x	0.7	=	34.69	(80)
West	0.9x	0.77	x	1.03	x	94.68	x	0.63	x	0.7	=	29.8	(80)
West	0.9x	0.77	x	1.03	x	73.59	x	0.63	x	0.7	=	23.16	(80)
West	0.9x	0.77	x	1.03	x	45.59	x	0.63	x	0.7	=	14.35	(80)
West	0.9x	0.77	x	1.03	x	24.49	x	0.63	x	0.7	=	7.71	(80)
West	0.9x	0.77	x	1.03	x	16.15	x	0.63	x	0.7	=	5.08	(80)
Northwest	0.9x	0.77	x	6.85	x	11.28	x	0.63	x	0.7	=	23.62	(81)
Northwest	0.9x	0.77	x	6.85	x	22.97	x	0.63	x	0.7	=	48.08	(81)
Northwest	0.9x	0.77	x	6.85	x	41.38	x	0.63	x	0.7	=	86.62	(81)
Northwest	0.9x	0.77	x	6.85	x	67.96	x	0.63	x	0.7	=	142.26	(81)
Northwest	0.9x	0.77	x	6.85	x	91.35	x	0.63	x	0.7	=	191.23	(81)
Northwest	0.9x	0.77	x	6.85	x	97.38	x	0.63	x	0.7	=	203.87	(81)
Northwest	0.9x	0.77	x	6.85	x	91.1	x	0.63	x	0.7	=	190.72	(81)
Northwest	0.9x	0.77	x	6.85	x	72.63	x	0.63	x	0.7	=	152.04	(81)
Northwest	0.9x	0.77	x	6.85	x	50.42	x	0.63	x	0.7	=	105.55	(81)
Northwest	0.9x	0.77	x	6.85	x	28.07	x	0.63	x	0.7	=	58.76	(81)
Northwest	0.9x	0.77	x	6.85	x	14.2	x	0.63	x	0.7	=	29.72	(81)
Northwest	0.9x	0.77	x	6.85	x	9.21	x	0.63	x	0.7	=	19.29	(81)

Solar gains in watts, calculated for each month

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

(83)m=

139.19	247.19	364.54	494.98	593.33	605.99	577.2	501.34	409.38	280.35	168.57	117.91
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (83)

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

(84)m=

556.97	662.82	765.4	871.53	945.06	933.88	890.08	821.11	742	637.5	553.32	523.37
--------	--------	-------	--------	--------	--------	--------	--------	-----	-------	--------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.99	0.99	0.96	0.89	0.74	0.58	0.64	0.87	0.98	1	1

 (86)

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

(87)m=

19.49	19.67	19.96	20.35	20.69	20.91	20.98	20.96	20.8	20.35	19.85	19.46
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (87)

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

(88)m=

19.79	19.79	19.8	19.81	19.81	19.82	19.82	19.82	19.81	19.81	19.8	19.8
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	------

 (88)

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

(89)m=

1	0.99	0.98	0.94	0.84	0.64	0.44	0.5	0.79	0.96	0.99	1
---	------	------	------	------	------	------	-----	------	------	------	---

 (89)

TER WorkSheet: New dwelling as built

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

(90)m=	17.8	18.06	18.49	19.05	19.51	19.76	19.81	19.8	19.65	19.06	18.33	17.76	(90)
--------	------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.29	(91)
---------------------------	------	------

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

(92)m=	18.29	18.53	18.92	19.42	19.85	20.09	20.15	20.14	19.98	19.43	18.77	18.25	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.29	18.53	18.92	19.42	19.85	20.09	20.15	20.14	19.98	19.43	18.77	18.25	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.84	0.66	0.48	0.54	0.81	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	554.49	656.41	747.66	816.61	794.32	619.54	424.37	441.12	597.54	611.63	548.43	521.59	(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=	1750.16	1701.51	1547.31	1299.36	1004.6	670.91	433.42	456.28	721.3	1088.17	1442.92	1744.05	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	-------	---------	---------	---------	------

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

(98)m=	889.57	702.31	594.94	347.58	156.45	0	0	0	0	354.55	644.03	909.51		
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													4598.94	(98)

Space heating requirement in kWh/m²/year

50.1	(99)
------	------

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

Space heating:

Fraction of space heat from secondary/supplementary system

0	(201)
---	-------

Fraction of space heat from main system(s)

$$(202) = 1 - (201) =$$

1	(202)
---	-------

Fraction of total heating from main system 1

$$(204) = (202) \times [1 - (203)] =$$

1	(204)
---	-------

Efficiency of main space heating system 1

93.4	(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)

889.57	702.31	594.94	347.58	156.45	0	0	0	0	354.55	644.03	909.51
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

952.43	751.94	636.98	372.14	167.5	0	0	0	0	379.6	689.54	973.78
--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------

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

4923.92	(211)
---------	-------

Space heating fuel (secondary), kWh/month

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

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

Water heating

Output from water heater (calculated above)

209.4	184.6	193.48	171.61	166.15	146.33	140.2	156.29	158.01	179.93	190.61	204.4
-------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------

Efficiency of water heater

80.3	(216)
------	-------

TER WorkSheet: New dwelling as built

(217)m=

88.28	88.09	87.69	86.79	84.9	80.3	80.3	80.3	80.3	86.73	87.88	88.36
-------	-------	-------	-------	------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

237.19	209.55	220.63	197.72	195.7	182.23	174.59	194.63	196.78	207.46	216.91	231.32
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

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

2464.72

 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

4923.92

Water heating fuel used

2464.72

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

 (230c)

boiler with a fan-assisted flue

45

 (230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

 (231)

Electricity for lighting

384.3

 (232)

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

7847.94

 (238)

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	<table><tr><td>0.216</td></tr></table>	0.216	=	<table><tr><td>1063.57</td></tr></table> (261)	1063.57
0.216						
1063.57						
Space heating (secondary)	(215) x	<table><tr><td>0.519</td></tr></table>	0.519	=	<table><tr><td>0</td></tr></table> (263)	0
0.519						
0						
Water heating	(219) x	<table><tr><td>0.216</td></tr></table>	0.216	=	<table><tr><td>532.38</td></tr></table> (264)	532.38
0.216						
532.38						
Space and water heating	(261) + (262) + (263) + (264) =			<table><tr><td>1595.95</td></tr></table> (265)	1595.95	
1595.95						
Electricity for pumps, fans and electric keep-hot	(231) x	<table><tr><td>0.519</td></tr></table>	0.519	=	<table><tr><td>38.93</td></tr></table> (267)	38.93
0.519						
38.93						
Electricity for lighting	(232) x	<table><tr><td>0.519</td></tr></table>	0.519	=	<table><tr><td>199.45</td></tr></table> (268)	199.45
0.519						
199.45						
Total CO2, kg/year	sum of (265)...(271) =			<table><tr><td>1834.32</td></tr></table> (272)	1834.32	
1834.32						

TER =

19.98

 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 02 March 2023 at 13:02:32

Project Information:

Assessed By: Matt Fitzpatrick (STRO003572)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 92.99m²

Site Reference : Swansea Road

Plot Reference: 6 As Built

Address : 28 Northfield Road, READING, RG1 8AH

Client Details:

Name: Helix

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.55 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.38 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 51.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 43.9 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.33	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 512, product index 018738): Boiler systems with radiators or underfloor heating - mains gas Brand name: Baxi Model: ASSURE Model qualifier: 36 COMBI (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: South East 3.16m²
 Windows facing: East 0.66m²
 Windows facing: South 0.66m²
 Windows facing: North East 2.36m²
 Windows facing: North West 8.39m²
 Roof windows facing: South East 0.92m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K
 Photovoltaic array

SAP Input

Property Details: 6 As Built

Address: 28 Northfield Road, READING, RG1 8AH
Located in: England
Region: Thames valley
UPRN: UPRN-000310086471
Date of assessment: 02 March 2023
Date of certificate: 02 March 2023
Assessment type: New dwelling as built
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 180.97
Water use <= 125 litres/person/day: True
PCDF Version: 512

Property description:

Dwelling type: House
Detachment: End-terrace
Year Completed: 2023
Floor Location: Floor area: Storey height:
 Floor 0 40.3 m² 2.5 m
 Floor 1 35.42 m² 2.7 m
 Floor 2 17.27 m² 2.323 m
Living area: 15.13 m² (fraction 0.163)
Front of dwelling faces: South East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front	Manufacturer	Solid			Wood
1	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
3	BFRC	Windows	low-E, En = 0.1, soft coat	No	
4	BFRC	Windows	low-E, En = 0.1, soft coat	No	
1	Manufacturer	Roof Windows	low-E, En = 0.1, soft coat	No	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front	mm	0.7	0.63	1.5	2.12	1
1	12mm	0	0.39	1.3	3.16	1
2	12mm	0	0.39	1.3	0.66	1
2	12mm	0	0.39	1.3	0.66	1
3	12mm	0	0.39	1.3	2.36	1
4	12mm	0	0.39	1.3	8.39	1
1	12mm	0.7	0.63	1.2	0.92	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front		Brick	South East	0	0
1		Brick	South East	0	0
2		Brick	East	0	0
2		Brick	South	0	0
3		Brick	North East	0	0
4		Brick	North West	0	0
1		Sloping roof	South East	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type: Gross area: Openings: Net area: U-value: Ru value: Curtain wall: Kappa:

SAP Input

External Elements

Brick	55.26	17.35	37.91	0.25	0	False	60
Timber stud	16.45	0	16.45	0.25	0	False	9
Cold roof	2.81	0	2.81	0.11	0		9
Bay roof	0.6	0	0.6	0.11	0		9
Kitchen roof	4.3	0	4.3	0.11	0		9
Loft roof	18.16	0	18.16	0.11	0		9
Sloping roof	20.46	0.92	19.54	0.15	0		9
Suspended floor	40.3			0.11			75

Internal Elements

Metal stud	178.58						9
Int ceiling	52.69						9
Int Floor	52.69						18

Party Elements

Party wall	113.49						70
------------	--------	--	--	--	--	--	----

Thermal bridges:

Thermal bridges:

User-defined (individual PSI-values) Y-Value = 0.0818

Length	Psi-value		
10.19	0.05	E2	Other lintels (including other steel lintels)
6.79	0.034	E3	Sill
26.7	0.04	E4	Jamb
10.81	0.06	E5	Ground floor (normal)
0	0.32	E20	Exposed floor (normal)
0	0.32	E21	Exposed floor (inverted)
6.58	0	E6	Intermediate floor within a dwelling
16.99	0.123	E10	Eaves (insulation at ceiling level)
15.32	0.24	E24	Eaves (insulation at ceiling level - inverted)
0	0.033	E11	Eaves (insulation at rafter level)
0.74	0.063	E12	Gable (insulation at ceiling level)
0.45	0.08	E13	Gable (insulation at rafter level)
27.39	0.05	E16	Corner (normal)
12.35	-0.069	E17	Corner (inverted internal area greater than external area)
15.05	0.072	E18	Party wall between dwellings
0	0.12	E25	Staggered party wall between dwellings
18.05	0.043	P1	Ground floor
26.5	0	P2	Intermediate floor within a dwelling
0	0.16	P7	Exposed floor (normal)
8.46	0.055	P4	Roof (insulation at ceiling level)
9.88	0.069	P5	Roof (insulation at rafter level)
0.98	0.08	R1	Head
0.98	0.06	R2	Sill
1.92	0.08	R3	Jamb
7.64	0.06	R6	Flat ceiling
6.33	0.06	R8	Roof wall (rafter)

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Decentralised whole house extract
	Number of fans in Wetroom: Kitchen 1 Other 3
	Ductwork: ,
	Approved Installation Scheme: False
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.33 (Assessed dwelling is tested)

SAP Input

Main heating system:

Main heating system: Boiler systems with radiators or underfloor heating
 Gas boilers and oil boilers
 Fuel: mains gas
 Info Source: Boiler Database
 Database: (rev 512, product index 018738) Efficiency: Winter 86.7 % Summer: 89.9
 Brand name: Baxi
 Model: ASSURE
 Model qualifier: 36 COMBI
 (Combi boiler)
 Systems with radiators
 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature >45°C
 Open
 Boiler interlock: Yes

Main heating Control:

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

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
 Water code: 901
 Fuel :mains gas
 No hot water cylinder
 Solar panel: False

Others:

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 100%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: Photovoltaic 1
 Installed Peak power: 0.6
 Tilt of collector: 45°
 Overshading: None or very little
 Collector Orientation: South East
 Assess Zero Carbon Home: No

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 6 As Built

Address : 28 Northfield Road, READING, RG1 8AH

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.3	(1a) x	2.5	(2a) =	100.75 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.99	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	236.5 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<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			4.32999992370605 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.22 (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) =		0.18 (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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DER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

	0.23	0.23	0.23	0.2	0.2	0.17	0.17	0.17	0.18	0.2	0.21	0.22
--	------	------	------	-----	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-------

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

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

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

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1.5	= 3.18		(26)
Windows Type 1			3.16	x1/[1/(1.3)+ 0.04] =	3.9		(27)
Windows Type 2			0.66	x1/[1/(1.3)+ 0.04] =	0.82		(27)
Windows Type 3			0.66	x1/[1/(1.3)+ 0.04] =	0.82		(27)
Windows Type 4			2.36	x1/[1/(1.3)+ 0.04] =	2.92		(27)
Windows Type 5			8.39	x1/[1/(1.3)+ 0.04] =	10.37		(27)
Rooflights			0.92	x1/[1/(1.2) + 0.04] =	1.104		(27b)
Floor			40.3	x 0.11	= 4.433	75	3022.5 (28)
Walls Type1	55.26	17.35	37.91	x 0.25	= 9.48	60	2274.6 (29)
Walls Type2	16.45	0	16.45	x 0.25	= 4.11	9	148.05 (29)
Roof Type1	2.81	0	2.81	x 0.11	= 0.31	9	25.29 (30)
Roof Type2	0.6	0	0.6	x 0.11	= 0.07	9	5.4 (30)
Roof Type3	4.3	0	4.3	x 0.11	= 0.47	9	38.7 (30)
Roof Type4	18.16	0	18.16	x 0.11	= 2	9	163.44 (30)
Roof Type5	20.46	0.92	19.54	x 0.15	= 2.93	9	175.86 (30)
Total area of elements, m²			158.34				(31)
Party wall			113.49	x 0	= 0	70	7944.3 (32)

DER WorkSheet: New dwelling as built

Internal wall **	178.58	9	1607.22 (32c)
Internal floor	52.69	18	948.42 (32d)
Internal ceiling	52.69	9	474.21 (32e)

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

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

Fabric heat loss, W/K = $S(A \times U)$	(26)...(30) + (32) =	46.85 (33)
Heat capacity $C_m = S(A \times k)$	((28)...(30) + (32) + (32a)...(32e) =	16827.99 (34)
Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K	= (34) $\div$ (4) =	180.97 (35)

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

Thermal bridges : $S(L \times Y)$ calculated using Appendix K		12.96 (36)
---	--	------------

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

Total fabric heat loss	(33) + (36) =	59.81 (37)
Ventilation heat loss calculated monthly	(38)m = $0.33 \times (25)m \times (5)$	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	(38)

Heat transfer coefficient, W/K											(39)m = (37) + (38)m		
(39)m=	98.84	98.84	98.84	98.84	98.84	98.84	98.84	98.84	98.84	98.84	98.84		
Average = Sum(39) _{1...12} /12=												98.84	(39)

Heat loss parameter (HLP), W/m²K										(40)m = (39)m ÷ (4)			
(40)m=	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06		
Average = Sum(40) _{1...12} /12=												1.06	(40)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N	2.66 (42)
if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$	
if $TFA \leq 13.9$, $N = 1$	

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$	97.48 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	107.23	103.33	99.43	95.53	91.63	87.73	87.73	91.63	95.53	99.43	103.33	107.23	
	Total = $\text{Sum}(44)_{1...12} =$												1169.78 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	159.02	139.08	143.52	125.12	120.06	103.6	96	110.16	111.48	129.92	141.81	154		
Total = Sum(45) _{1...12} =													1533.76	(45)

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

(46)m=	23.85	20.86	21.53	18.77	18.01	15.54	14.4	16.52	16.72	19.49	21.27	23.1	(46)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0 (47)
---	--------

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

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

DER WorkSheet: New dwelling as built

Water storage loss:

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

0	(48)
---	------

Temperature factor from Table 2b

0	(49)
---	------

Energy lost from water storage, kWh/year

(48) x (49) =

0	(50)
---	------

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

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

0	(51)
---	------

If community heating see section 4.3

Volume factor from Table 2a

0	(52)
---	------

Temperature factor from Table 2b

0	(53)
---	------

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0	(54)
---	------

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

0	(55)
---	------

Water storage loss calculated for each month

((56)m = (55) x (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 x (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 x (41)m

(61)m=

11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82	(61)
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(62)m=

170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82	(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=

170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82	(64)
--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	------

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

1672.39

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=

55.83	48.91	50.67	44.45	42.86	37.28	34.85	39.56	39.91	46.14	50.01	54.16	(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	
133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	(66)

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

(67)m=

22.35	19.85	16.14	12.22	9.14	7.71	8.33	10.83	14.54	18.46	21.55	22.97	(67)
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=

244.47	247.01	240.62	227.01	209.83	193.68	182.89	180.36	186.75	200.36	217.54	233.69	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=

36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	(69)
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3	(70)
---	---	---	---	---	---	---	---	---	---	---	---	------

DER WorkSheet: New dwelling as built

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

(71)m=

-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

75.04	72.79	68.1	61.74	57.6	51.78	46.84	53.18	55.43	62.02	69.46	72.79
-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

407.83	405.61	390.83	366.93	342.53	319.14	304.03	310.33	322.69	346.81	374.51	395.42
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>8</td></tr></table>	8	(75)
0.77																			
2.36																			
11.28																			
0.39																			
1.11																			
8																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>16.28</td></tr></table>	16.28	(75)
0.77																			
2.36																			
22.97																			
0.39																			
1.11																			
16.28																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>29.33</td></tr></table>	29.33	(75)
0.77																			
2.36																			
41.38																			
0.39																			
1.11																			
29.33																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>48.16</td></tr></table>	48.16	(75)
0.77																			
2.36																			
67.96																			
0.39																			
1.11																			
48.16																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>64.74</td></tr></table>	64.74	(75)
0.77																			
2.36																			
91.35																			
0.39																			
1.11																			
64.74																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>69.02</td></tr></table>	69.02	(75)
0.77																			
2.36																			
97.38																			
0.39																			
1.11																			
69.02																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>64.56</td></tr></table>	64.56	(75)
0.77																			
2.36																			
91.1																			
0.39																			
1.11																			
64.56																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>51.47</td></tr></table>	51.47	(75)
0.77																			
2.36																			
72.63																			
0.39																			
1.11																			
51.47																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>35.73</td></tr></table>	35.73	(75)
0.77																			
2.36																			
50.42																			
0.39																			
1.11																			
35.73																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>19.89</td></tr></table>	19.89	(75)
0.77																			
2.36																			
28.07																			
0.39																			
1.11																			
19.89																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>10.06</td></tr></table>	10.06	(75)
0.77																			
2.36																			
14.2																			
0.39																			
1.11																			
10.06																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>6.53</td></tr></table>	6.53	(75)
0.77																			
2.36																			
9.21																			
0.39																			
1.11																			
6.53																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>19.64</td></tr></table>	19.64	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>3.89</td></tr></table>	3.89	(76)
0.77																			
0.66																			
19.64																			
0.39																			
1.11																			
3.89																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>38.42</td></tr></table>	38.42	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>7.61</td></tr></table>	7.61	(76)
0.77																			
0.66																			
38.42																			
0.39																			
1.11																			
7.61																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>63.27</td></tr></table>	63.27	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>12.54</td></tr></table>	12.54	(76)
0.77																			
0.66																			
63.27																			
0.39																			
1.11																			
12.54																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>92.28</td></tr></table>	92.28	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>18.29</td></tr></table>	18.29	(76)
0.77																			
0.66																			
92.28																			
0.39																			
1.11																			
18.29																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>113.09</td></tr></table>	113.09	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>22.41</td></tr></table>	22.41	(76)
0.77																			
0.66																			
113.09																			
0.39																			
1.11																			
22.41																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>115.77</td></tr></table>	115.77	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>22.95</td></tr></table>	22.95	(76)
0.77																			
0.66																			
115.77																			
0.39																			
1.11																			
22.95																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>110.22</td></tr></table>	110.22	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>21.85</td></tr></table>	21.85	(76)
0.77																			
0.66																			
110.22																			
0.39																			
1.11																			
21.85																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>94.68</td></tr></table>	94.68	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>18.76</td></tr></table>	18.76	(76)
0.77																			
0.66																			
94.68																			
0.39																			
1.11																			
18.76																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>73.59</td></tr></table>	73.59	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>14.59</td></tr></table>	14.59	(76)
0.77																			
0.66																			
73.59																			
0.39																			
1.11																			
14.59																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>45.59</td></tr></table>	45.59	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>9.04</td></tr></table>	9.04	(76)
0.77																			
0.66																			
45.59																			
0.39																			
1.11																			
9.04																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>24.49</td></tr></table>	24.49	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>4.85</td></tr></table>	4.85	(76)
0.77																			
0.66																			
24.49																			
0.39																			
1.11																			
4.85																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>16.15</td></tr></table>	16.15	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>3.2</td></tr></table>	3.2	(76)
0.77																			
0.66																			
16.15																			
0.39																			
1.11																			
3.2																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>34.92</td></tr></table>	34.92	(77)
0.77																			
3.16																			
36.79																			
0.39																			
1.11																			
34.92																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>59.47</td></tr></table>	59.47	(77)
0.77																			
3.16																			
62.67																			
0.39																			
1.11																			
59.47																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>81.37</td></tr></table>	81.37	(77)
0.77																			
3.16																			
85.75																			
0.39																			
1.11																			
81.37																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>100.83</td></tr></table>	100.83	(77)
0.77																			
3.16																			
106.25																			
0.39																			
1.11																			
100.83																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>112.93</td></tr></table>	112.93	(77)
0.77																			
3.16																			
119.01																			
0.39																			
1.11																			
112.93																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>112.12</td></tr></table>	112.12	(77)
0.77																			
3.16																			
118.15																			
0.39																			
1.11																			
112.12																			

DER WorkSheet: New dwelling as built

Southeast	0.9x	0.77	x	3.16	x	113.91	x	0.39	x	1.11	=	108.09	(77)
Southeast	0.9x	0.77	x	3.16	x	104.39	x	0.39	x	1.11	=	99.06	(77)
Southeast	0.9x	0.77	x	3.16	x	92.85	x	0.39	x	1.11	=	88.11	(77)
Southeast	0.9x	0.77	x	3.16	x	69.27	x	0.39	x	1.11	=	65.73	(77)
Southeast	0.9x	0.77	x	3.16	x	44.07	x	0.39	x	1.11	=	41.82	(77)
Southeast	0.9x	0.77	x	3.16	x	31.49	x	0.39	x	1.11	=	29.88	(77)
South	0.9x	0.77	x	0.66	x	46.75	x	0.39	x	1.11	=	9.27	(78)
South	0.9x	0.77	x	0.66	x	76.57	x	0.39	x	1.11	=	15.18	(78)
South	0.9x	0.77	x	0.66	x	97.53	x	0.39	x	1.11	=	19.33	(78)
South	0.9x	0.77	x	0.66	x	110.23	x	0.39	x	1.11	=	21.85	(78)
South	0.9x	0.77	x	0.66	x	114.87	x	0.39	x	1.11	=	22.77	(78)
South	0.9x	0.77	x	0.66	x	110.55	x	0.39	x	1.11	=	21.91	(78)
South	0.9x	0.77	x	0.66	x	108.01	x	0.39	x	1.11	=	21.41	(78)
South	0.9x	0.77	x	0.66	x	104.89	x	0.39	x	1.11	=	20.79	(78)
South	0.9x	0.77	x	0.66	x	101.89	x	0.39	x	1.11	=	20.19	(78)
South	0.9x	0.77	x	0.66	x	82.59	x	0.39	x	1.11	=	16.37	(78)
South	0.9x	0.77	x	0.66	x	55.42	x	0.39	x	1.11	=	10.98	(78)
South	0.9x	0.77	x	0.66	x	40.4	x	0.39	x	1.11	=	8.01	(78)
Northwest	0.9x	0.77	x	8.39	x	11.28	x	0.39	x	1.11	=	28.43	(81)
Northwest	0.9x	0.77	x	8.39	x	22.97	x	0.39	x	1.11	=	57.87	(81)
Northwest	0.9x	0.77	x	8.39	x	41.38	x	0.39	x	1.11	=	104.25	(81)
Northwest	0.9x	0.77	x	8.39	x	67.96	x	0.39	x	1.11	=	171.22	(81)
Northwest	0.9x	0.77	x	8.39	x	91.35	x	0.39	x	1.11	=	230.15	(81)
Northwest	0.9x	0.77	x	8.39	x	97.38	x	0.39	x	1.11	=	245.36	(81)
Northwest	0.9x	0.77	x	8.39	x	91.1	x	0.39	x	1.11	=	229.53	(81)
Northwest	0.9x	0.77	x	8.39	x	72.63	x	0.39	x	1.11	=	182.98	(81)
Northwest	0.9x	0.77	x	8.39	x	50.42	x	0.39	x	1.11	=	127.04	(81)
Northwest	0.9x	0.77	x	8.39	x	28.07	x	0.39	x	1.11	=	70.72	(81)
Northwest	0.9x	0.77	x	8.39	x	14.2	x	0.39	x	1.11	=	35.77	(81)
Northwest	0.9x	0.77	x	8.39	x	9.21	x	0.39	x	1.11	=	23.22	(81)
Rooflights	0.9x	1	x	0.92	x	39.98	x	0.63	x	0.7	=	14.6	(82)
Rooflights	0.9x	1	x	0.92	x	73.48	x	0.63	x	0.7	=	26.83	(82)
Rooflights	0.9x	1	x	0.92	x	112.11	x	0.63	x	0.7	=	40.94	(82)
Rooflights	0.9x	1	x	0.92	x	153.81	x	0.63	x	0.7	=	56.16	(82)
Rooflights	0.9x	1	x	0.92	x	182.63	x	0.63	x	0.7	=	66.69	(82)
Rooflights	0.9x	1	x	0.92	x	184.99	x	0.63	x	0.7	=	67.55	(82)
Rooflights	0.9x	1	x	0.92	x	176.88	x	0.63	x	0.7	=	64.59	(82)
Rooflights	0.9x	1	x	0.92	x	155.4	x	0.63	x	0.7	=	56.74	(82)
Rooflights	0.9x	1	x	0.92	x	126.86	x	0.63	x	0.7	=	46.32	(82)
Rooflights	0.9x	1	x	0.92	x	84.6	x	0.63	x	0.7	=	30.89	(82)
Rooflights	0.9x	1	x	0.92	x	48.93	x	0.63	x	0.7	=	17.87	(82)

DER WorkSheet: New dwelling as built

Rooflights 0.9x

 x

 x

 x

 x

 =

 (82)

Solar gains in watts, calculated for each month

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

(83)m=

99.09	183.24	287.76	416.51	519.69	538.9	510.03	429.81	331.98	212.63	121.35	83.06
-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------

 (83)

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

(84)m=

506.92	588.85	678.59	783.44	862.22	858.05	814.07	740.15	654.67	559.44	495.87	478.48
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

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

 (85)

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.99	0.98	0.93	0.83	0.67	0.52	0.58	0.82	0.96	0.99	1

 (86)

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

(87)m=

19.49	19.67	19.98	20.39	20.73	20.92	20.98	20.97	20.81	20.35	19.84	19.44
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

(88)m=

20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

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

(89)m=

0.99	0.99	0.97	0.91	0.79	0.59	0.41	0.47	0.76	0.95	0.99	0.99
------	------	------	------	------	------	------	------	------	------	------	------

 (89)

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

(90)m=

18	18.27	18.72	19.29	19.75	19.97	20.02	20.01	19.86	19.26	18.51	17.93
----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

 (91)

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

(92)m=

18.24	18.49	18.92	19.47	19.91	20.13	20.18	20.17	20.01	19.43	18.72	18.17
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

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

(93)m=

18.24	18.49	18.92	19.47	19.91	20.13	20.18	20.17	20.01	19.43	18.72	18.17
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=

0.99	0.98	0.96	0.9	0.78	0.6	0.43	0.49	0.76	0.94	0.98	0.99
------	------	------	-----	------	-----	------	------	------	------	------	------

 (94)

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

(95)m=

501.86	577.94	651.46	706.72	673.21	512.42	347.19	361.44	496.07	524.25	487.15	474.64
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

1378.06	1343.58	1228.01	1044.6	811.54	546.1	353.54	372.44	584.48	873.14	1148.94	1381.15
---------	---------	---------	--------	--------	-------	--------	--------	--------	--------	---------	---------

 (97)

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

(98)m=

651.89	514.51	428.95	243.28	102.92	0	0	0	0	259.58	476.49	674.45
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

 (98)

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

 (98)

Space heating requirement in kWh/m²/year

(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

 (201)

DER WorkSheet: New dwelling as built

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		89.9	(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)												
651.89	514.51	428.95	243.28	102.92	0	0	0	0	259.58	476.49	674.45	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												
725.13	572.31	477.14	270.61	114.48	0	0	0	0	288.74	530.02	750.22	
Total (kWh/year) = Sum(211) _{1..5,10...12} =												3728.66

Space heating fuel (secondary), kWh/month												
= {[(98)m × (201)] } × 100 ÷ (208)												
(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =												0

Water heating

Output from water heater (calculated above)	170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82
Efficiency of water heater												86.7
(217)m =	89.22	89.16	89.03	88.72	88.07	86.7	86.7	86.7	86.7	88.74	89.1	89.25
Fuel for water heating, kWh/month												
(219)m = (64)m × 100 ÷ (217)m	191.49	167.96	174.46	153.86	149.65	132.58	124.24	140.6	141.69	159.67	171.99	185.79
Total = Sum(219a) _{1..12} =												1893.99

Annual totals

	kWh/year											kWh/year
Space heating fuel used, main system 1												3728.66
Water heating fuel used												1893.99
Electricity for pumps, fans and electric keep-hot												
mechanical ventilation - balanced, extract or positive input from outside												68.83
central heating pump:												30
boiler with a fan-assisted flue												45
Total electricity for the above, kWh/year	sum of (230a)...(230g) =											143.83
Electricity for lighting												394.69
Electricity generated by PVs												-481.92
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =												5679.26

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) ×	0.216	=	805.39
Space heating (secondary)	(215) ×	0.519	=	0
Water heating	(219) ×	0.216	=	409.1

DER WorkSheet: New dwelling as built

Space and water heating	$(261) + (262) + (263) + (264) =$			1214.49	(265)
Electricity for pumps, fans and electric keep-hot	$(231) \times$	0.519	=	74.65	(267)
Electricity for lighting	$(232) \times$	0.519	=	204.84	(268)
Energy saving/generation technologies Item 1		0.519	=	-250.12	(269)
Total CO2, kg/year	$\text{sum of (265)...(271) =}$			1243.87	(272)
Dwelling CO2 Emission Rate	$(272) \div (4) =$			13.38	(273)
El rating (section 14)				88	(274)

TER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 6 As Built

Address : 28 Northfield Road, READING, RG1 8AH

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.3	(1a) x	2.5	(2a) =	100.75 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.99	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	236.5 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0
Number of open flues	0	+	0	=	0
Number of intermittent fans				3	30
Number of passive vents				0	0
Number of flueless gas fires				0	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32	(21)
Infiltration rate modified for monthly wind speed				

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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TER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

	0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.3	0.32	0.34	0.36	0.38
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1	= 2.12		(26)
Windows Type 1			3.16	x 1/[1/(1.4)+ 0.04] =	4.19		(27)
Windows Type 2			0.66	x 1/[1/(1.4)+ 0.04] =	0.88		(27)
Windows Type 3			0.66	x 1/[1/(1.4)+ 0.04] =	0.88		(27)
Windows Type 4			2.36	x 1/[1/(1.4)+ 0.04] =	3.13		(27)
Windows Type 5			8.39	x 1/[1/(1.4)+ 0.04] =	11.12		(27)
Rooflights			0.92	x 1/[1/(1.7) + 0.04] =	1.564		(27b)
Floor			40.3	x 0.13	= 5.239		(28)
Walls Type1	55.26	17.35	37.91	x 0.18	= 6.82		(29)
Walls Type2	16.45	0	16.45	x 0.18	= 2.96		(29)
Roof Type1	2.81	0	2.81	x 0.13	= 0.37		(30)
Roof Type2	0.6	0	0.6	x 0.13	= 0.08		(30)
Roof Type3	4.3	0	4.3	x 0.13	= 0.56		(30)
Roof Type4	18.16	0	18.16	x 0.13	= 2.36		(30)
Roof Type5	20.46	0.92	19.54	x 0.13	= 2.54		(30)
Total area of elements, m²			158.34				(31)
Party wall			113.49	x 0	= 0		(32)

TER WorkSheet: New dwelling as built

Internal wall **	178.58		(32c)
Internal floor	52.69		(32d)
Internal ceiling	52.69		(32e)

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

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

Fabric heat loss, W/K = $S(A \times U)$	(26)...(30) + (32) =	44.7	(33)
Heat capacity $C_m = S(A \times k)$	((28)...(30) + (32) + (32a)...(32e) =	16827.99	(34)
Thermal mass parameter (TMP = $C_m \div TFA$) 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 : $S(L \times Y)$ calculated using Appendix K		15.33	(36)
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if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss	(33) + (36) =	60.03	(37)
Ventilation heat loss calculated monthly	(38)m = $0.33 \times (25)m \times (5)$		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.53	45.28	45.03	43.87	43.65	42.64	42.64	42.45	43.03	43.65	44.09	44.55	(38)

Heat transfer coefficient, W/K											(39)m = (37) + (38)m			
(39)m=	105.56	105.31	105.06	103.9	103.68	102.66	102.66	102.48	103.06	103.68	104.12	104.58		
Average = Sum(39) _{1...12} /12=												103.89	(39)	

Heat loss parameter (HLP), W/m²K											(40)m = (39)m ÷ (4)		
(40)m=	1.14	1.13	1.13	1.12	1.11	1.1	1.1	1.1	1.11	1.11	1.12	1.12	
Average = Sum(40) _{1...12} /12=												1.12	(40)

Number of days in month (Table 1a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N	2.66	(42)
if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$		
if $TFA \leq 13.9$, $N = 1$		

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$	97.48	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	107.23	103.33	99.43	95.53	91.63	87.73	87.73	91.63	95.53	99.43	103.33	107.23	
	Total = $\text{Sum}(44)_{1...12} =$											1169.78	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	159.02	139.08	143.52	125.12	120.06	103.6	96	110.16	111.48	129.92	141.81	154		
Total = Sum(45) _{1...12} =													1533.76	(45)

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

(46)m=	23.85	20.86	21.53	18.77	18.01	15.54	14.4	16.52	16.72	19.49	21.27	23.1	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
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If community heating and no tank in dwelling, enter 110 litres in (47)

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

TER WorkSheet: New dwelling as built

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0

(54)

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

0

(55)

Water storage loss calculated for each month

((56)m = (55) x (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 x (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 x (41)m

(61)m= 50.96 46.03 50.67 47.11 46.69 43.27 44.71 46.69 47.11 50.67 49.32 50.96

(61)

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

(62)m= 209.98 185.11 194.19 172.23 166.75 146.87 140.71 156.86 158.59 180.59 191.13 204.96

(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= 209.98 185.11 194.19 172.23 166.75 146.87 140.71 156.86 158.59 180.59 191.13 204.96

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

2107.94

(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= 65.61 57.75 60.39 53.38 51.59 45.26 43.1 48.3 48.84 55.86 59.48 63.94

(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
133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22

(66)

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

(67)m= 22.35 19.85 16.14 12.22 9.14 7.71 8.33 10.83 14.54 18.46 21.55 22.97

(67)

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

(68)m= 244.47 247.01 240.62 227.01 209.83 193.68 182.89 180.36 186.75 200.36 217.54 233.69

(68)

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

(69)m= 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32

(69)

Pumps and fans gains (Table 5a)

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

(70)

TER WorkSheet: New dwelling as built

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

(71)m=

-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

88.19	85.94	81.16	74.14	69.34	62.87	57.93	64.92	67.84	75.09	82.61	85.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

420.98	418.76	403.89	379.34	354.27	330.23	315.12	322.08	335.1	359.87	387.67	408.57
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>8.14</td></tr></table>	8.14	(75)
0.77																			
2.36																			
11.28																			
0.63																			
0.7																			
8.14																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>16.56</td></tr></table>	16.56	(75)
0.77																			
2.36																			
22.97																			
0.63																			
0.7																			
16.56																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>29.84</td></tr></table>	29.84	(75)
0.77																			
2.36																			
41.38																			
0.63																			
0.7																			
29.84																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>49.01</td></tr></table>	49.01	(75)
0.77																			
2.36																			
67.96																			
0.63																			
0.7																			
49.01																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>65.88</td></tr></table>	65.88	(75)
0.77																			
2.36																			
91.35																			
0.63																			
0.7																			
65.88																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>70.24</td></tr></table>	70.24	(75)
0.77																			
2.36																			
97.38																			
0.63																			
0.7																			
70.24																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>65.71</td></tr></table>	65.71	(75)
0.77																			
2.36																			
91.1																			
0.63																			
0.7																			
65.71																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>52.38</td></tr></table>	52.38	(75)
0.77																			
2.36																			
72.63																			
0.63																			
0.7																			
52.38																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>36.37</td></tr></table>	36.37	(75)
0.77																			
2.36																			
50.42																			
0.63																			
0.7																			
36.37																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>20.24</td></tr></table>	20.24	(75)
0.77																			
2.36																			
28.07																			
0.63																			
0.7																			
20.24																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>10.24</td></tr></table>	10.24	(75)
0.77																			
2.36																			
14.2																			
0.63																			
0.7																			
10.24																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>6.65</td></tr></table>	6.65	(75)
0.77																			
2.36																			
9.21																			
0.63																			
0.7																			
6.65																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>19.64</td></tr></table>	19.64	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>3.96</td></tr></table>	3.96	(76)
0.77																			
0.66																			
19.64																			
0.63																			
0.7																			
3.96																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>38.42</td></tr></table>	38.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>7.75</td></tr></table>	7.75	(76)
0.77																			
0.66																			
38.42																			
0.63																			
0.7																			
7.75																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>63.27</td></tr></table>	63.27	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>12.76</td></tr></table>	12.76	(76)
0.77																			
0.66																			
63.27																			
0.63																			
0.7																			
12.76																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>92.28</td></tr></table>	92.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>18.61</td></tr></table>	18.61	(76)
0.77																			
0.66																			
92.28																			
0.63																			
0.7																			
18.61																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>113.09</td></tr></table>	113.09	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>22.81</td></tr></table>	22.81	(76)
0.77																			
0.66																			
113.09																			
0.63																			
0.7																			
22.81																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>115.77</td></tr></table>	115.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>23.35</td></tr></table>	23.35	(76)
0.77																			
0.66																			
115.77																			
0.63																			
0.7																			
23.35																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>110.22</td></tr></table>	110.22	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>22.23</td></tr></table>	22.23	(76)
0.77																			
0.66																			
110.22																			
0.63																			
0.7																			
22.23																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>94.68</td></tr></table>	94.68	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>19.1</td></tr></table>	19.1	(76)
0.77																			
0.66																			
94.68																			
0.63																			
0.7																			
19.1																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>73.59</td></tr></table>	73.59	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>14.84</td></tr></table>	14.84	(76)
0.77																			
0.66																			
73.59																			
0.63																			
0.7																			
14.84																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>45.59</td></tr></table>	45.59	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>9.2</td></tr></table>	9.2	(76)
0.77																			
0.66																			
45.59																			
0.63																			
0.7																			
9.2																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>24.49</td></tr></table>	24.49	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.94</td></tr></table>	4.94	(76)
0.77																			
0.66																			
24.49																			
0.63																			
0.7																			
4.94																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>16.15</td></tr></table>	16.15	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>3.26</td></tr></table>	3.26	(76)
0.77																			
0.66																			
16.15																			
0.63																			
0.7																			
3.26																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>35.53</td></tr></table>	35.53	(77)
0.77																			
3.16																			
36.79																			
0.63																			
0.7																			
35.53																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>60.53</td></tr></table>	60.53	(77)
0.77																			
3.16																			
62.67																			
0.63																			
0.7																			
60.53																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>82.81</td></tr></table>	82.81	(77)
0.77																			
3.16																			
85.75																			
0.63																			
0.7																			
82.81																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>102.61</td></tr></table>	102.61	(77)
0.77																			
3.16																			
106.25																			
0.63																			
0.7																			
102.61																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>114.93</td></tr></table>	114.93	(77)
0.77																			
3.16																			
119.01																			
0.63																			
0.7																			
114.93																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>114.1</td></tr></table>	114.1	(77)
0.77																			
3.16																			
118.15																			
0.63																			
0.7																			
114.1																			

TER WorkSheet: New dwelling as built

Southeast	0.9x	0.77	x	3.16	x	113.91	x	0.63	x	0.7	=	110.01	(77)
Southeast	0.9x	0.77	x	3.16	x	104.39	x	0.63	x	0.7	=	100.81	(77)
Southeast	0.9x	0.77	x	3.16	x	92.85	x	0.63	x	0.7	=	89.67	(77)
Southeast	0.9x	0.77	x	3.16	x	69.27	x	0.63	x	0.7	=	66.89	(77)
Southeast	0.9x	0.77	x	3.16	x	44.07	x	0.63	x	0.7	=	42.56	(77)
Southeast	0.9x	0.77	x	3.16	x	31.49	x	0.63	x	0.7	=	30.41	(77)
South	0.9x	0.77	x	0.66	x	46.75	x	0.63	x	0.7	=	9.43	(78)
South	0.9x	0.77	x	0.66	x	76.57	x	0.63	x	0.7	=	15.44	(78)
South	0.9x	0.77	x	0.66	x	97.53	x	0.63	x	0.7	=	19.67	(78)
South	0.9x	0.77	x	0.66	x	110.23	x	0.63	x	0.7	=	22.23	(78)
South	0.9x	0.77	x	0.66	x	114.87	x	0.63	x	0.7	=	23.17	(78)
South	0.9x	0.77	x	0.66	x	110.55	x	0.63	x	0.7	=	22.3	(78)
South	0.9x	0.77	x	0.66	x	108.01	x	0.63	x	0.7	=	21.79	(78)
South	0.9x	0.77	x	0.66	x	104.89	x	0.63	x	0.7	=	21.16	(78)
South	0.9x	0.77	x	0.66	x	101.89	x	0.63	x	0.7	=	20.55	(78)
South	0.9x	0.77	x	0.66	x	82.59	x	0.63	x	0.7	=	16.66	(78)
South	0.9x	0.77	x	0.66	x	55.42	x	0.63	x	0.7	=	11.18	(78)
South	0.9x	0.77	x	0.66	x	40.4	x	0.63	x	0.7	=	8.15	(78)
Northwest	0.9x	0.77	x	8.39	x	11.28	x	0.63	x	0.7	=	28.93	(81)
Northwest	0.9x	0.77	x	8.39	x	22.97	x	0.63	x	0.7	=	58.89	(81)
Northwest	0.9x	0.77	x	8.39	x	41.38	x	0.63	x	0.7	=	106.1	(81)
Northwest	0.9x	0.77	x	8.39	x	67.96	x	0.63	x	0.7	=	174.25	(81)
Northwest	0.9x	0.77	x	8.39	x	91.35	x	0.63	x	0.7	=	234.22	(81)
Northwest	0.9x	0.77	x	8.39	x	97.38	x	0.63	x	0.7	=	249.7	(81)
Northwest	0.9x	0.77	x	8.39	x	91.1	x	0.63	x	0.7	=	233.59	(81)
Northwest	0.9x	0.77	x	8.39	x	72.63	x	0.63	x	0.7	=	186.22	(81)
Northwest	0.9x	0.77	x	8.39	x	50.42	x	0.63	x	0.7	=	129.28	(81)
Northwest	0.9x	0.77	x	8.39	x	28.07	x	0.63	x	0.7	=	71.97	(81)
Northwest	0.9x	0.77	x	8.39	x	14.2	x	0.63	x	0.7	=	36.4	(81)
Northwest	0.9x	0.77	x	8.39	x	9.21	x	0.63	x	0.7	=	23.63	(81)
Rooflights	0.9x	1	x	0.92	x	39.98	x	0.63	x	0.7	=	14.6	(82)
Rooflights	0.9x	1	x	0.92	x	73.48	x	0.63	x	0.7	=	26.83	(82)
Rooflights	0.9x	1	x	0.92	x	112.11	x	0.63	x	0.7	=	40.94	(82)
Rooflights	0.9x	1	x	0.92	x	153.81	x	0.63	x	0.7	=	56.16	(82)
Rooflights	0.9x	1	x	0.92	x	182.63	x	0.63	x	0.7	=	66.69	(82)
Rooflights	0.9x	1	x	0.92	x	184.99	x	0.63	x	0.7	=	67.55	(82)
Rooflights	0.9x	1	x	0.92	x	176.88	x	0.63	x	0.7	=	64.59	(82)
Rooflights	0.9x	1	x	0.92	x	155.4	x	0.63	x	0.7	=	56.74	(82)
Rooflights	0.9x	1	x	0.92	x	126.86	x	0.63	x	0.7	=	46.32	(82)
Rooflights	0.9x	1	x	0.92	x	84.6	x	0.63	x	0.7	=	30.89	(82)
Rooflights	0.9x	1	x	0.92	x	48.93	x	0.63	x	0.7	=	17.87	(82)

TER WorkSheet: New dwelling as built

Rooflights $0.9x$

1

 $\times$

0.92

 $\times$

33.5

 $\times$

0.63

 $\times$

0.7

 =

12.23

 (82)

Solar gains in watts, calculated for each month

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

(83)m=

100.59	186.01	292.13	422.88	527.7	547.24	517.91	436.41	337.04	215.85	123.19	84.32
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	-------

 (83)

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

(84)m=

521.57	604.77	696.02	802.22	881.98	877.47	833.03	758.49	672.13	575.72	510.85	492.89
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	0.99	0.96	0.87	0.7	0.53	0.6	0.86	0.98	1	1

 (86)

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

(87)m=

19.74	19.89	20.15	20.51	20.8	20.96	20.99	20.98	20.87	20.48	20.05	19.72
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (87)

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

(88)m=

19.97	19.97	19.98	19.99	19.99	20	20	20	19.99	19.99	19.98	19.98
-------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------

 (88)

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

(89)m=

1	1	0.99	0.95	0.83	0.61	0.42	0.48	0.79	0.97	1	1
---	---	------	------	------	------	------	------	------	------	---	---

 (89)

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

(90)m=

18.29	18.51	18.89	19.4	19.79	19.97	19.99	19.99	19.88	19.37	18.75	18.26
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

0.16

 (91)

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

(92)m=

18.53	18.74	19.1	19.58	19.96	20.13	20.16	20.15	20.04	19.55	18.96	18.5
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (92)

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

(93)m=

18.53	18.74	19.1	19.58	19.96	20.13	20.16	20.15	20.04	19.55	18.96	18.5
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=

1	0.99	0.98	0.94	0.82	0.62	0.43	0.5	0.8	0.97	0.99	1
---	------	------	------	------	------	------	-----	-----	------	------	---

 (94)

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

(95)m=

519.98	600.72	683.31	753.75	727.45	545.21	362.27	379.04	535.55	556.01	507.61	491.76
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

1501.77	1457.11	1323.61	1109.89	856.21	567.58	365.12	384.67	612.44	928.15	1234.6	1495.14
---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------

 (97)

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

(98)m=

730.45	575.49	476.39	256.42	95.8	0	0	0	0	276.87	523.43	746.52
--------	--------	--------	--------	------	---	---	---	---	--------	--------	--------

 (98)

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

3681.36

 (98)

Space heating requirement in kWh/m²/year

39.59

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

TER WorkSheet: New dwelling as built

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		93.4	(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)												
730.45	575.49	476.39	256.42	95.8	0	0	0	0	276.87	523.43	746.52	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												
782.07	616.16	510.05	274.54	102.56	0	0	0	0	296.43	560.42	799.27	
Total (kWh/year) = Sum(211) _{1..5,10...12} =												3941.5

Space heating fuel (secondary), kWh/month												
= {[(98)m × (201)] } × 100 ÷ (208)												
(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =												0

Water heating

Output from water heater (calculated above)	209.98	185.11	194.19	172.23	166.75	146.87	140.71	156.86	158.59	180.59	191.13	204.96
Efficiency of water heater												80.3
(217)m =	87.93	87.72	87.22	86.05	83.71	80.3	80.3	80.3	80.3	86.12	87.46	88.02
Fuel for water heating, kWh/month												
(219)m = (64)m × 100 ÷ (217)m												
(219)m =	238.8	211.03	222.63	200.15	199.2	182.9	175.23	195.34	197.5	209.68	218.54	232.87
Total = Sum(219a) _{1..12} =												2483.85

Annual totals

	kWh/year											kWh/year
Space heating fuel used, main system 1												3941.5
Water heating fuel used												2483.85
Electricity for pumps, fans and electric keep-hot												
central heating pump:												30
boiler with a fan-assisted flue												45
Total electricity for the above, kWh/year	sum of (230a)...(230g) =											75
Electricity for lighting												394.69
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =												6895.04

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) ×	0.216	= 851.36
Space heating (secondary)	(215) ×	0.519	= 0
Water heating	(219) ×	0.216	= 536.51
Space and water heating	(261) + (262) + (263) + (264) =		1387.88
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	= 38.93

TER WorkSheet: New dwelling as built

Electricity for lighting	(232)	x	0.519	=	204.84	(268)
Total CO2, kg/year			sum of (265)...(271)	=	1631.65	(272)
TER	=				17.55	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 02 March 2023 at 13:02:32

Project Information:

Assessed By: Matt Fitzpatrick (STRO003572)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 92.39m²

Site Reference : Swansea Road

Plot Reference: 7 As Built

Address : 30 Northfield Road, READING, RG1 8AH

Client Details:

Name: Helix

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.04 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.79 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 48.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 41.3 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.65	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 512, product index 018738): Boiler systems with radiators or underfloor heating - mains gas Brand name: Baxi Model: ASSURE Model qualifier: 36 COMBI (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: South West 4.61m²
 Windows facing: North East 6.85m²
 Windows facing: North East 1.44m²
 Roof windows facing: South West 0.92m²
 Ventilation rate: 4.00
 Blinds/curtains: None
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K
 Photovoltaic array

SAP Input

Property Details: 7 As Built

Address: 30 Northfield Road, READING, RG1 8AH
 Located in: England
 Region: Thames valley
 UPRN: UPRN-510123256415
 Date of assessment: 02 March 2023
 Date of certificate: 02 March 2023
 Assessment type: New dwelling as built
 Transaction type: New dwelling
 Tenure type: Unknown
 Related party disclosure: No related party
 Thermal Mass Parameter: Calculated 151.53
 Water use <= 125 litres/person/day: True
 PCDF Version: 512

Property description:

Dwelling type: House
 Detachment: Mid-terrace
 Year Completed: 2023
 Floor Location: Floor area: Storey height:
 Floor 0 39.7 m² 2.5 m
 Floor 1 35.42 m² 2.7 m
 Floor 2 17.27 m² 2.323 m
 Living area: 15.13 m² (fraction 0.163)
 Front of dwelling faces: South West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:	
Front	Manufacturer	Solid			Wood	
1	BFRC	Windows	low-E, En = 0.1, soft coat	No		
2	BFRC	Windows	low-E, En = 0.1, soft coat	No		
2	BFRC	Windows	low-E, En = 0.1, soft coat	No		
1	Manufacturer	Roof Windows	low-E, En = 0.1, soft coat	No	Wood	
Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front	mm	0.7	0.63	1.5	2.12	1
1	12mm	0	0.39	1.3	4.61	1
2	12mm	0	0.39	1.3	6.85	1
2	12mm	0	0.39	1.3	1.44	1
1	12mm	0.7	0.63	1.2	0.92	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front		Brick	South West	0	0
1		Brick	South West	0	0
2		Brick	North East	0	0
2		Timber stud	North East	0	0
1		Sloping roof	South West	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Brick	47.24	13.58	33.66	0.25	0	False	60
Timber stud	16.45	1.44	15.01	0.25	0	False	9

SAP Input

Cold roof	2.81	0	2.81	0.11	0	9
Bay roof	0.6	0	0.6	0.11	0	9
Kitchen roof	4.3	0	4.3	0.11	0	9
Loft roof	18.16	0	18.16	0.11	0	9
Sloping roof	20.46	0.92	19.54	0.15	0	9
Suspended floor	39.7			0.11		75
<u>Internal Elements</u>						
Metal stud	178.58					9
Int ceiling	52.69					9
Int Floor	52.69					18
<u>Party Elements</u>						
Party wall	120.65					45

Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.0779				
	Length	Psi-value			
	9.83	0.05	E2	Other lintels (including other steel lintels)	
	6.42	0.034	E3	Sill	
	22.8	0.04	E4	Jamb	
	7.6	0.06	E5	Ground floor (normal)	
	0	0.32	E20	Exposed floor (normal)	
	0	0.32	E21	Exposed floor (inverted)	
	6.09	0	E6	Intermediate floor within a dwelling	
	11.96	0.123	E10	Eaves (insulation at ceiling level)	
	13.5	0.24	E24	Eaves (insulation at ceiling level - inverted)	
	0	0.033	E11	Eaves (insulation at rafter level)	
	0	0.063	E12	Gable (insulation at ceiling level)	
	0	0.08	E13	Gable (insulation at rafter level)	
	7.35	0.05	E16	Corner (normal)	
	7.35	-0.069	E17	Corner (inverted internal area greater than external area)	
	20.09	0.072	E18	Party wall between dwellings	
	0	0.12	E25	Staggered party wall between dwellings	
	20.91	0.043	P1	Ground floor	
	34.11	0	P2	Intermediate floor within a dwelling	
	0	0.16	P7	Exposed floor (normal)	
	8.46	0.055	P4	Roof (insulation at ceiling level)	
	9.88	0.069	P5	Roof (insulation at rafter level)	
	0.98	0.08	R1	Head	
	0.98	0.06	R2	Sill	
	1.96	0.08	R3	Jamb	
	7.64	0.06	R6	Flat ceiling	
	12.92	0.06	R8	Roof wall (rafter)	

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Decentralised whole house extract
	Number of fans in Wetroom: Kitchen 1 Other 3
	Ductwork: ,
	Approved Installation Scheme: True
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.65 (Assessed dwelling is tested)

Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database

SAP Input

Database: (rev 512, product index 018738) Efficiency: Winter 86.7 % Summer: 89.9
Brand name: Baxi
Model: ASSURE
Model qualifier: 36 COMBI
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes

Main heating Control:

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

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Low rise urban / suburban
EPC language: English
Wind turbine: No
Photovoltaics: Photovoltaic 1
Installed Peak power: 0.6
Tilt of collector: 45°
Overshading: None or very little
Collector Orientation: South West
Assess Zero Carbon Home: No

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 7 As Built

Address : 30 Northfield Road, READING, RG1 8AH

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	39.7	(1a) x	2.5	(2a) =	99.25 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.39	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	235 (5)

2. Ventilation rate:

	main heating	+	secondary heating	+	other	=	total		m ³ per hour
Number of chimneys	0		0		0	=	0	x 40 =	0 (6a)
Number of open flues	0		0		0	=	0	x 20 =	0 (6b)
Number of intermittent fans							0	x 10 =	0 (7a)
Number of passive vents							0	x 10 =	0 (7b)
Number of flueless gas fires							0	x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<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			4.65000009536743 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.23 (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) =		0.2 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

DER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23
--	------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

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

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

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-------

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

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

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

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1.5	= 3.18		(26)
Windows Type 1			4.61	x 1/[1/(1.3)+ 0.04]	= 5.7		(27)
Windows Type 2			6.85	x 1/[1/(1.3)+ 0.04]	= 8.46		(27)
Windows Type 3			1.44	x 1/[1/(1.3)+ 0.04]	= 1.78		(27)
Rooflights			0.92	x 1/[1/(1.2) + 0.04]	= 1.104		(27b)
Floor			39.7	x 0.11	= 4.367	75	2977.5 (28)
Walls Type1	47.24	13.58	33.66	x 0.25	= 8.42	60	2019.6 (29)
Walls Type2	16.45	1.44	15.01	x 0.25	= 3.75	9	135.09 (29)
Roof Type1	2.81	0	2.81	x 0.11	= 0.31	9	25.29 (30)
Roof Type2	0.6	0	0.6	x 0.11	= 0.07	9	5.4 (30)
Roof Type3	4.3	0	4.3	x 0.11	= 0.47	9	38.7 (30)
Roof Type4	18.16	0	18.16	x 0.11	= 2	9	163.44 (30)
Roof Type5	20.46	0.92	19.54	x 0.15	= 2.93	9	175.86 (30)
Total area of elements, m²			149.72				(31)
Party wall			120.65	x 0	= 0	45	5429.25 (32)
Internal wall **			178.58			9	1607.22 (32c)
Internal floor			52.69			18	948.42 (32d)

DER WorkSheet: New dwelling as built

Internal ceiling

52.69

9

474.21

(32e)

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

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

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) =

42.49

(33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

13999.98

(34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

= (34) ÷ (4) =

151.53

(35)

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

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

11.67

(36)

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

Total fabric heat loss

(33) + (36) =

54.16

(37)

Ventilation heat loss calculated monthly

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

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
38.93	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

93.08	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

92.94

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
------	------	------	------	------	------	------	------	------	------	------	------

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

1.01

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.3

(43)

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

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

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

(44)m=

107.04	103.14	99.25	95.36	91.47	87.57	87.57	91.47	95.36	99.25	103.14	107.04
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1167.66

(44)

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

(45)m=

158.73	138.83	143.26	124.89	119.84	103.41	95.83	109.96	111.28	129.68	141.56	153.72
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1530.98

(45)

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

(46)m=

23.81	20.82	21.49	18.73	17.98	15.51	14.37	16.49	16.69	19.45	21.23	23.06
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

DER WorkSheet: New dwelling as built

Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)												
b) If manufacturer's declared cylinder loss factor is not known:															
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)												
If community heating see section 4.3															
Volume factor from Table 2a		0	(52)												
Temperature factor from Table 2b		0	(53)												
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)												
Enter (50) or (54) in (55)		0	(55)												
Water storage loss calculated for each month	((56)m = (55) x (41)m														
(56)m=		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(56)
0	0	0	0	0	0	0	0	0	0	0	0				
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=		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(57)
0	0	0	0	0	0	0	0	0	0	0	0				
Primary circuit loss (annual) from Table 3		0	(58)												
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m															
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)															
(59)m=		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(59)
0	0	0	0	0	0	0	0	0	0	0	0				
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m															
(61)m=		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25px; text-align: center; border: 1px solid black;">11.82</td> <td style="width: 25px; text-align: center; border: 1px solid black;">10.67</td> <td style="width: 25px; text-align: center; border: 1px solid black;">11.8</td> <td style="width: 25px; text-align: center; border: 1px solid black;">11.39</td> <td style="width: 25px; text-align: center; border: 1px solid black;">11.75</td> <td style="width: 25px; text-align: center; border: 1px solid black;">11.35</td> <td style="width: 25px; text-align: center; border: 1px solid black;">11.71</td> <td style="width: 25px; text-align: center; border: 1px solid black;">11.74</td> <td style="width: 25px; text-align: center; border: 1px solid black;">11.37</td> <td style="width: 25px; text-align: center; border: 1px solid black;">11.78</td> <td style="width: 25px; text-align: center; border: 1px solid black;">11.42</td> <td style="width: 25px; text-align: center; border: 1px solid black;">11.82</td> </tr> </table>	11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82	(61)
11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82				
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m															
(62)m=		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25px; text-align: center; border: 1px solid black;">170.55</td> <td style="width: 25px; text-align: center; border: 1px solid black;">149.5</td> <td style="width: 25px; text-align: center; border: 1px solid black;">155.06</td> <td style="width: 25px; text-align: center; border: 1px solid black;">136.29</td> <td style="width: 25px; text-align: center; border: 1px solid black;">131.59</td> <td style="width: 25px; text-align: center; border: 1px solid black;">114.76</td> <td style="width: 25px; text-align: center; border: 1px solid black;">107.54</td> <td style="width: 25px; text-align: center; border: 1px solid black;">121.7</td> <td style="width: 25px; text-align: center; border: 1px solid black;">122.65</td> <td style="width: 25px; text-align: center; border: 1px solid black;">141.46</td> <td style="width: 25px; text-align: center; border: 1px solid black;">152.98</td> <td style="width: 25px; text-align: center; border: 1px solid black;">165.54</td> </tr> </table>	170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54	(62)
170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54				
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=		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> <td style="width: 25px; text-align: center; border: 1px solid black;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(63)
0	0	0	0	0	0	0	0	0	0	0	0				
Output from water heater															
(64)m=		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25px; text-align: center; border: 1px solid black;">170.55</td> <td style="width: 25px; text-align: center; border: 1px solid black;">149.5</td> <td style="width: 25px; text-align: center; border: 1px solid black;">155.06</td> <td style="width: 25px; text-align: center; border: 1px solid black;">136.29</td> <td style="width: 25px; text-align: center; border: 1px solid black;">131.59</td> <td style="width: 25px; text-align: center; border: 1px solid black;">114.76</td> <td style="width: 25px; text-align: center; border: 1px solid black;">107.54</td> <td style="width: 25px; text-align: center; border: 1px solid black;">121.7</td> <td style="width: 25px; text-align: center; border: 1px solid black;">122.65</td> <td style="width: 25px; text-align: center; border: 1px solid black;">141.46</td> <td style="width: 25px; text-align: center; border: 1px solid black;">152.98</td> <td style="width: 25px; text-align: center; border: 1px solid black;">165.54</td> </tr> </table>	170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54	
170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54				
Output from water heater (annual) _{1...12}											1669.61	(64)			
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]															
(65)m=		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25px; text-align: center; border: 1px solid black;">55.73</td> <td style="width: 25px; text-align: center; border: 1px solid black;">48.83</td> <td style="width: 25px; text-align: center; border: 1px solid black;">50.58</td> <td style="width: 25px; text-align: center; border: 1px solid black;">44.38</td> <td style="width: 25px; text-align: center; border: 1px solid black;">42.78</td> <td style="width: 25px; text-align: center; border: 1px solid black;">37.22</td> <td style="width: 25px; text-align: center; border: 1px solid black;">34.79</td> <td style="width: 25px; text-align: center; border: 1px solid black;">39.5</td> <td style="width: 25px; text-align: center; border: 1px solid black;">39.84</td> <td style="width: 25px; text-align: center; border: 1px solid black;">46.06</td> <td style="width: 25px; text-align: center; border: 1px solid black;">49.92</td> <td style="width: 25px; text-align: center; border: 1px solid black;">54.07</td> </tr> </table>	55.73	48.83	50.58	44.38	42.78	37.22	34.79	39.5	39.84	46.06	49.92	54.07	(65)
55.73	48.83	50.58	44.38	42.78	37.22	34.79	39.5	39.84	46.06	49.92	54.07				
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=	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
(67)m=	22.89	20.33	16.53	12.52	9.36	7.9	8.53	11.09	14.89	18.91	22.07	23.52
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
(68)m=	243.41	245.93	239.57	226.02	208.91	192.84	182.1	179.57	185.94	199.49	216.59	232.67
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29
Pumps and fans gains (Table 5a)												
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3
Losses e.g. evaporation (negative values) (Table 5)												
(71)m=	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28

DER WorkSheet: New dwelling as built

Water heating gains (Table 5)

(72)m=

74.91	72.66	67.99	61.63	57.51	51.7	46.76	53.09	55.34	61.91	69.34	72.67
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

407.06	404.78	389.94	366.02	341.63	318.29	303.25	309.61	322.02	346.16	373.85	394.72
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>23.21</td></tr></table>	23.21	(75)
0.77																			
6.85																			
11.28																			
0.39																			
1.11																			
23.21																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>4.88</td></tr></table>	4.88	(75)
0.77																			
1.44																			
11.28																			
0.39																			
1.11																			
4.88																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>47.24</td></tr></table>	47.24	(75)
0.77																			
6.85																			
22.97																			
0.39																			
1.11																			
47.24																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>9.93</td></tr></table>	9.93	(75)
0.77																			
1.44																			
22.97																			
0.39																			
1.11																			
9.93																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>85.12</td></tr></table>	85.12	(75)
0.77																			
6.85																			
41.38																			
0.39																			
1.11																			
85.12																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>17.89</td></tr></table>	17.89	(75)
0.77																			
1.44																			
41.38																			
0.39																			
1.11																			
17.89																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>139.79</td></tr></table>	139.79	(75)
0.77																			
6.85																			
67.96																			
0.39																			
1.11																			
139.79																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>29.39</td></tr></table>	29.39	(75)
0.77																			
1.44																			
67.96																			
0.39																			
1.11																			
29.39																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>187.9</td></tr></table>	187.9	(75)
0.77																			
6.85																			
91.35																			
0.39																			
1.11																			
187.9																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>39.5</td></tr></table>	39.5	(75)
0.77																			
1.44																			
91.35																			
0.39																			
1.11																			
39.5																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>200.33</td></tr></table>	200.33	(75)
0.77																			
6.85																			
97.38																			
0.39																			
1.11																			
200.33																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>42.11</td></tr></table>	42.11	(75)
0.77																			
1.44																			
97.38																			
0.39																			
1.11																			
42.11																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>187.4</td></tr></table>	187.4	(75)
0.77																			
6.85																			
91.1																			
0.39																			
1.11																			
187.4																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>39.4</td></tr></table>	39.4	(75)
0.77																			
1.44																			
91.1																			
0.39																			
1.11																			
39.4																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>149.4</td></tr></table>	149.4	(75)
0.77																			
6.85																			
72.63																			
0.39																			
1.11																			
149.4																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>31.41</td></tr></table>	31.41	(75)
0.77																			
1.44																			
72.63																			
0.39																			
1.11																			
31.41																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>103.72</td></tr></table>	103.72	(75)
0.77																			
6.85																			
50.42																			
0.39																			
1.11																			
103.72																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>21.8</td></tr></table>	21.8	(75)
0.77																			
1.44																			
50.42																			
0.39																			
1.11																			
21.8																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>57.74</td></tr></table>	57.74	(75)
0.77																			
6.85																			
28.07																			
0.39																			
1.11																			
57.74																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>12.14</td></tr></table>	12.14	(75)
0.77																			
1.44																			
28.07																			
0.39																			
1.11																			
12.14																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>29.2</td></tr></table>	29.2	(75)
0.77																			
6.85																			
14.2																			
0.39																			
1.11																			
29.2																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>6.14</td></tr></table>	6.14	(75)
0.77																			
1.44																			
14.2																			
0.39																			
1.11																			
6.14																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>18.95</td></tr></table>	18.95	(75)
0.77																			
6.85																			
9.21																			
0.39																			
1.11																			
18.95																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>3.98</td></tr></table>	3.98	(75)
0.77																			
1.44																			
9.21																			
0.39																			
1.11																			
3.98																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>50.94</td></tr></table>	50.94	(79)
0.77																			
4.61																			
36.79																			
0.39																			
1.11																			
50.94																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>62.67</td></tr></table>	62.67		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>86.76</td></tr></table>	86.76	(79)
0.77																			
4.61																			
62.67																			
0.39																			
1.11																			
86.76																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>85.75</td></tr></table>	85.75		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>118.71</td></tr></table>	118.71	(79)
0.77																			
4.61																			
85.75																			
0.39																			
1.11																			
118.71																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>106.25</td></tr></table>	106.25		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>147.09</td></tr></table>	147.09	(79)
0.77																			
4.61																			
106.25																			
0.39																			
1.11																			
147.09																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>119.01</td></tr></table>	119.01		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>164.76</td></tr></table>	164.76	(79)
0.77																			
4.61																			
119.01																			
0.39																			
1.11																			
164.76																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>118.15</td></tr></table>	118.15		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>163.56</td></tr></table>	163.56	(79)
0.77																			
4.61																			
118.15																			
0.39																			
1.11																			
163.56																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>113.91</td></tr></table>	113.91		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>157.69</td></tr></table>	157.69	(79)
0.77																			
4.61																			
113.91																			
0.39																			
1.11																			
157.69																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>104.39</td></tr></table>	104.39		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>144.52</td></tr></table>	144.52	(79)
0.77																			
4.61																			
104.39																			
0.39																			
1.11																			
144.52																			

DER WorkSheet: New dwelling as built

Southwest0.9x	0.77	x	4.61	x	92.85		0.39	x	1.11	=	128.54	(79)
Southwest0.9x	0.77	x	4.61	x	69.27		0.39	x	1.11	=	95.89	(79)
Southwest0.9x	0.77	x	4.61	x	44.07		0.39	x	1.11	=	61.01	(79)
Southwest0.9x	0.77	x	4.61	x	31.49		0.39	x	1.11	=	43.59	(79)
Rooflights 0.9x	1	x	0.92	x	39.98	x	0.63	x	0.7	=	14.6	(82)
Rooflights 0.9x	1	x	0.92	x	73.48	x	0.63	x	0.7	=	26.83	(82)
Rooflights 0.9x	1	x	0.92	x	112.11	x	0.63	x	0.7	=	40.94	(82)
Rooflights 0.9x	1	x	0.92	x	153.81	x	0.63	x	0.7	=	56.16	(82)
Rooflights 0.9x	1	x	0.92	x	182.63	x	0.63	x	0.7	=	66.69	(82)
Rooflights 0.9x	1	x	0.92	x	184.99	x	0.63	x	0.7	=	67.55	(82)
Rooflights 0.9x	1	x	0.92	x	176.88	x	0.63	x	0.7	=	64.59	(82)
Rooflights 0.9x	1	x	0.92	x	155.4	x	0.63	x	0.7	=	56.74	(82)
Rooflights 0.9x	1	x	0.92	x	126.86	x	0.63	x	0.7	=	46.32	(82)
Rooflights 0.9x	1	x	0.92	x	84.6	x	0.63	x	0.7	=	30.89	(82)
Rooflights 0.9x	1	x	0.92	x	48.93	x	0.63	x	0.7	=	17.87	(82)
Rooflights 0.9x	1	x	0.92	x	33.5	x	0.63	x	0.7	=	12.23	(82)

Solar gains in watts, calculated for each month

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

(83)m=	93.62	170.77	262.66	372.43	458.85	473.55	449.08	382.06	300.39	196.66	114.22	78.76	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(84)m=	500.68	575.55	652.61	738.45	800.48	791.84	752.33	691.67	622.4	542.82	488.07	473.48	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.92	0.82	0.67	0.52	0.58	0.8	0.95	0.98	0.99	(86)

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

(87)m=	19.38	19.57	19.9	20.32	20.68	20.9	20.97	20.96	20.78	20.31	19.75	19.33	(87)
--------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.96	0.9	0.78	0.59	0.42	0.48	0.74	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=	17.89	18.18	18.65	19.24	19.73	19.99	20.06	20.05	19.87	19.24	18.44	17.82	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.16

(91)

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

(92)m=	18.13	18.4	18.85	19.42	19.89	20.14	20.21	20.2	20.02	19.41	18.66	18.06	(92)
--------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(93)m=	18.13	18.4	18.85	19.42	19.89	20.14	20.21	20.2	20.02	19.41	18.66	18.06	(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 as built

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.95	0.89	0.77	0.6	0.43	0.49	0.74	0.92	0.97	0.99	(94)
--------	------	------	------	------	------	-----	------	------	------	------	------	------	------

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

(95)m=	492.02	558.91	617.12	653.98	616.92	474.45	326.59	338.95	460.49	498.04	474.36	466.68	(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=	1287.64	1254.97	1147.98	977.26	760.87	514.8	335.49	353.02	550.15	818.81	1074.08	1288.32	(97)
--------	---------	---------	---------	--------	--------	-------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	591.94	467.75	394.97	232.76	107.1	0	0	0	0	238.66	431.8	611.3	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	-------	-------	------

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

3076.28

Space heating requirement in kWh/m²/year

33.3

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

89.9

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)

591.94	467.75	394.97	232.76	107.1	0	0	0	0	238.66	431.8	611.3
--------	--------	--------	--------	-------	---	---	---	---	--------	-------	-------

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

658.45	520.3	439.34	258.91	119.13	0	0	0	0	265.47	480.31	679.98
--------	-------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

3421.89

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)
---------	---	---	---	---	---	---	---	---	---	---	---	-------

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

0

Water heating

Output from water heater (calculated above)

170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Efficiency of water heater

86.7

(217)m=	89.16	89.1	88.97	88.69	88.11	86.7	86.7	86.7	86.7	88.68	89.04	89.2	(217)
---------	-------	------	-------	-------	-------	------	------	------	------	-------	-------	------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.28	167.78	174.27	153.66	149.35	132.36	124.03	140.37	141.46	159.51	171.81	185.58	(219)
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

1891.49

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3421.89

Water heating fuel used

1891.49

Electricity for pumps, fans and electric keep-hot

DER WorkSheet: New dwelling as built

mechanical ventilation - balanced, extract or positive input from outside	68.4	(230a)
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	143.4 (231)
Electricity for lighting		404.2 (232)
Electricity generated by PVs		-481.92 (233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5379.06 (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	=	739.13 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	408.56 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1147.69 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	74.42 (267)
Electricity for lighting	(232) x	0.519	=	209.78 (268)
Energy saving/generation technologies Item 1		0.519	=	-250.12 (269)
Total CO2, kg/year		sum of (265)...(271) =		1181.78 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		12.79 (273)
El rating (section 14)				88 (274)

TER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 7 As Built

Address : 30 Northfield Road, READING, RG1 8AH

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	39.7	(1a) x	2.5	(2a) =	99.25 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.39	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	235 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0
Number of open flues	0	+	0	=	0
Number of intermittent fans				3	30
Number of passive vents				0	0
Number of flueless gas fires				0	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (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) =		0.32 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

TER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1	= 2.12		(26)
Windows Type 1			4.61	x1/[1/(1.4)+ 0.04]	= 6.11		(27)
Windows Type 2			6.85	x1/[1/(1.4)+ 0.04]	= 9.08		(27)
Windows Type 3			1.44	x1/[1/(1.4)+ 0.04]	= 1.91		(27)
Rooflights			0.92	x1/[1/(1.7) + 0.04]	= 1.564		(27b)
Floor			39.7	x 0.13	= 5.161		(28)
Walls Type1	47.24	13.58	33.66	x 0.18	= 6.06		(29)
Walls Type2	16.45	1.44	15.01	x 0.18	= 2.7		(29)
Roof Type1	2.81	0	2.81	x 0.13	= 0.37		(30)
Roof Type2	0.6	0	0.6	x 0.13	= 0.08		(30)
Roof Type3	4.3	0	4.3	x 0.13	= 0.56		(30)
Roof Type4	18.16	0	18.16	x 0.13	= 2.36		(30)
Roof Type5	20.46	0.92	19.54	x 0.13	= 2.54		(30)
Total area of elements, m²			149.72				(31)
Party wall			120.65	x 0	= 0		(32)
Internal wall **			178.58				(32c)
Internal floor			52.69				(32d)

TER WorkSheet: New dwelling as built

Internal ceiling

52.69

(32e)

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

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

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) =

40.51

(33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

13999.98

(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

13.34

(36)

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

Total fabric heat loss

(33) + (36) =

53.85

(37)

Ventilation heat loss calculated monthly

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

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
45.27	45.02	44.77	43.61	43.39	42.38	42.38	42.19	42.77	43.39	43.83	44.29

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

99.12	98.87	98.62	97.46	97.24	96.23	96.23	96.04	96.62	97.24	97.68	98.14
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

97.46

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.07	1.07	1.07	1.05	1.05	1.04	1.04	1.04	1.05	1.05	1.06	1.06
------	------	------	------	------	------	------	------	------	------	------	------

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

1.05

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.3

(43)

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

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

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

(44)m=

107.04	103.14	99.25	95.36	91.47	87.57	87.57	91.47	95.36	99.25	103.14	107.04
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1167.66

(44)

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

(45)m=

158.73	138.83	143.26	124.89	119.84	103.41	95.83	109.96	111.28	129.68	141.56	153.72
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1530.98

(45)

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

(46)m=

23.81	20.82	21.49	18.73	17.98	15.51	14.37	16.49	16.69	19.45	21.23	23.06
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

TER WorkSheet: New dwelling as built

Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)												
b) If manufacturer's declared cylinder loss factor is not known:															
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)												
If community heating see section 4.3															
Volume factor from Table 2a		0	(52)												
Temperature factor from Table 2b		0	(53)												
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)												
Enter (50) or (54) in (55)		0	(55)												
Water storage loss calculated for each month	((56)m = (55) x (41)m														
(56)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(56)
0	0	0	0	0	0	0	0	0	0	0	0				
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=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(57)
0	0	0	0	0	0	0	0	0	0	0	0				
Primary circuit loss (annual) from Table 3		0	(58)												
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m															
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)															
(59)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(59)
0	0	0	0	0	0	0	0	0	0	0	0				
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m															
(61)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>50.96</td><td>46.03</td><td>50.58</td><td>47.03</td><td>46.61</td><td>43.19</td><td>44.63</td><td>46.61</td><td>47.03</td><td>50.58</td><td>49.32</td><td>50.96</td> </tr> </table>	50.96	46.03	50.58	47.03	46.61	43.19	44.63	46.61	47.03	50.58	49.32	50.96		(61)
50.96	46.03	50.58	47.03	46.61	43.19	44.63	46.61	47.03	50.58	49.32	50.96				
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m															
(62)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>209.69</td><td>184.85</td><td>193.83</td><td>171.92</td><td>166.45</td><td>146.6</td><td>140.45</td><td>156.57</td><td>158.3</td><td>180.26</td><td>190.87</td><td>204.68</td> </tr> </table>	209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68		(62)
209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68				
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=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(63)
0	0	0	0	0	0	0	0	0	0	0	0				
Output from water heater															
(64)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>209.69</td><td>184.85</td><td>193.83</td><td>171.92</td><td>166.45</td><td>146.6</td><td>140.45</td><td>156.57</td><td>158.3</td><td>180.26</td><td>190.87</td><td>204.68</td> </tr> </table>	209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68		
209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68				
											Output from water heater (annual) ^{1...12}	2104.48	(64)		
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]															
(65)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>65.52</td><td>57.67</td><td>60.28</td><td>53.28</td><td>51.5</td><td>45.18</td><td>43.02</td><td>48.22</td><td>48.76</td><td>55.76</td><td>59.4</td><td>63.85</td> </tr> </table>	65.52	57.67	60.28	53.28	51.5	45.18	43.02	48.22	48.76	55.76	59.4	63.85		(65)
65.52	57.67	60.28	53.28	51.5	45.18	43.02	48.22	48.76	55.76	59.4	63.85				
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=	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	22.89	20.33	16.53	12.52	9.36	7.9	8.53	11.09	14.89	18.91	22.07	23.52	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	243.41	245.93	239.57	226.02	208.91	192.84	182.1	179.57	185.94	199.49	216.59	232.67	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	(71)

TER WorkSheet: New dwelling as built

Water heating gains (Table 5)

(72)m=

88.06	85.81	81.02	74.01	69.22	62.75	57.82	64.81	67.72	74.95	82.5	85.82
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 (72)

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

(73)m=

420.21	417.93	402.97	378.39	353.34	329.34	314.31	321.33	334.4	359.2	387.01	407.87
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 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>23.62</td></tr></table>	23.62	(75)
0.77																			
6.85																			
11.28																			
0.63																			
0.7																			
23.62																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.97</td></tr></table>	4.97	(75)
0.77																			
1.44																			
11.28																			
0.63																			
0.7																			
4.97																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>48.08</td></tr></table>	48.08	(75)
0.77																			
6.85																			
22.97																			
0.63																			
0.7																			
48.08																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>10.11</td></tr></table>	10.11	(75)
0.77																			
1.44																			
22.97																			
0.63																			
0.7																			
10.11																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>86.62</td></tr></table>	86.62	(75)
0.77																			
6.85																			
41.38																			
0.63																			
0.7																			
86.62																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>18.21</td></tr></table>	18.21	(75)
0.77																			
1.44																			
41.38																			
0.63																			
0.7																			
18.21																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>142.26</td></tr></table>	142.26	(75)
0.77																			
6.85																			
67.96																			
0.63																			
0.7																			
142.26																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>29.91</td></tr></table>	29.91	(75)
0.77																			
1.44																			
67.96																			
0.63																			
0.7																			
29.91																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>191.23</td></tr></table>	191.23	(75)
0.77																			
6.85																			
91.35																			
0.63																			
0.7																			
191.23																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>40.2</td></tr></table>	40.2	(75)
0.77																			
1.44																			
91.35																			
0.63																			
0.7																			
40.2																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>203.87</td></tr></table>	203.87	(75)
0.77																			
6.85																			
97.38																			
0.63																			
0.7																			
203.87																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>42.86</td></tr></table>	42.86	(75)
0.77																			
1.44																			
97.38																			
0.63																			
0.7																			
42.86																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>190.72</td></tr></table>	190.72	(75)
0.77																			
6.85																			
91.1																			
0.63																			
0.7																			
190.72																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>40.09</td></tr></table>	40.09	(75)
0.77																			
1.44																			
91.1																			
0.63																			
0.7																			
40.09																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>152.04</td></tr></table>	152.04	(75)
0.77																			
6.85																			
72.63																			
0.63																			
0.7																			
152.04																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>31.96</td></tr></table>	31.96	(75)
0.77																			
1.44																			
72.63																			
0.63																			
0.7																			
31.96																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>105.55</td></tr></table>	105.55	(75)
0.77																			
6.85																			
50.42																			
0.63																			
0.7																			
105.55																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>22.19</td></tr></table>	22.19	(75)
0.77																			
1.44																			
50.42																			
0.63																			
0.7																			
22.19																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>58.76</td></tr></table>	58.76	(75)
0.77																			
6.85																			
28.07																			
0.63																			
0.7																			
58.76																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>12.35</td></tr></table>	12.35	(75)
0.77																			
1.44																			
28.07																			
0.63																			
0.7																			
12.35																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>29.72</td></tr></table>	29.72	(75)
0.77																			
6.85																			
14.2																			
0.63																			
0.7																			
29.72																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>6.25</td></tr></table>	6.25	(75)
0.77																			
1.44																			
14.2																			
0.63																			
0.7																			
6.25																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>19.29</td></tr></table>	19.29	(75)
0.77																			
6.85																			
9.21																			
0.63																			
0.7																			
19.29																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.06</td></tr></table>	4.06	(75)
0.77																			
1.44																			
9.21																			
0.63																			
0.7																			
4.06																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>51.84</td></tr></table>	51.84	(79)
0.77																			
4.61																			
36.79																			
0.63																			
0.7																			
51.84																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>62.67</td></tr></table>	62.67		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>88.3</td></tr></table>	88.3	(79)
0.77																			
4.61																			
62.67																			
0.63																			
0.7																			
88.3																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>85.75</td></tr></table>	85.75		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>120.81</td></tr></table>	120.81	(79)
0.77																			
4.61																			
85.75																			
0.63																			
0.7																			
120.81																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>106.25</td></tr></table>	106.25		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>149.7</td></tr></table>	149.7	(79)
0.77																			
4.61																			
106.25																			
0.63																			
0.7																			
149.7																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>119.01</td></tr></table>	119.01		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>167.67</td></tr></table>	167.67	(79)
0.77																			
4.61																			
119.01																			
0.63																			
0.7																			
167.67																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>118.15</td></tr></table>	118.15		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>166.46</td></tr></table>	166.46	(79)
0.77																			
4.61																			
118.15																			
0.63																			
0.7																			
166.46																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>113.91</td></tr></table>	113.91		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>160.48</td></tr></table>	160.48	(79)
0.77																			
4.61																			
113.91																			
0.63																			
0.7																			
160.48																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>104.39</td></tr></table>	104.39		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>147.07</td></tr></table>	147.07	(79)
0.77																			
4.61																			
104.39																			
0.63																			
0.7																			
147.07																			

TER WorkSheet: New dwelling as built

Southwest0.9x	0.77	x	4.61	x	92.85	0.63	x	0.7	=	130.82	(79)
Southwest0.9x	0.77	x	4.61	x	69.27	0.63	x	0.7	=	97.59	(79)
Southwest0.9x	0.77	x	4.61	x	44.07	0.63	x	0.7	=	62.09	(79)
Southwest0.9x	0.77	x	4.61	x	31.49	0.63	x	0.7	=	44.36	(79)
Rooflights 0.9x	1	x	0.92	x	39.98	0.63	x	0.7	=	14.6	(82)
Rooflights 0.9x	1	x	0.92	x	73.48	0.63	x	0.7	=	26.83	(82)
Rooflights 0.9x	1	x	0.92	x	112.11	0.63	x	0.7	=	40.94	(82)
Rooflights 0.9x	1	x	0.92	x	153.81	0.63	x	0.7	=	56.16	(82)
Rooflights 0.9x	1	x	0.92	x	182.63	0.63	x	0.7	=	66.69	(82)
Rooflights 0.9x	1	x	0.92	x	184.99	0.63	x	0.7	=	67.55	(82)
Rooflights 0.9x	1	x	0.92	x	176.88	0.63	x	0.7	=	64.59	(82)
Rooflights 0.9x	1	x	0.92	x	155.4	0.63	x	0.7	=	56.74	(82)
Rooflights 0.9x	1	x	0.92	x	126.86	0.63	x	0.7	=	46.32	(82)
Rooflights 0.9x	1	x	0.92	x	84.6	0.63	x	0.7	=	30.89	(82)
Rooflights 0.9x	1	x	0.92	x	48.93	0.63	x	0.7	=	17.87	(82)
Rooflights 0.9x	1	x	0.92	x	33.5	0.63	x	0.7	=	12.23	(82)

Solar gains in watts, calculated for each month

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

(83)m=	95.02	173.32	266.59	378.03	465.79	480.74	455.88	387.82	304.88	199.59	115.92	79.94	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	515.23	591.25	669.56	756.42	819.13	810.08	770.19	709.14	639.28	558.79	502.93	487.81	(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=	1	1	0.99	0.97	0.88	0.71	0.54	0.6	0.86	0.98	1	1	(86)

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

(87)m=	19.82	19.97	20.21	20.54	20.81	20.96	20.99	20.99	20.88	20.52	20.11	19.8	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(88)m=	20.02	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.03	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.95	0.84	0.62	0.43	0.49	0.8	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	-----	------	---	---	------

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

(90)m=	18.45	18.66	19.01	19.48	19.85	20.02	20.05	20.04	19.95	19.47	18.88	18.42	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.16 (91)

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

(92)m=	18.67	18.87	19.21	19.66	20.01	20.17	20.2	20.2	20.1	19.64	19.08	18.64	(92)
--------	-------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	------

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

(93)m=	18.67	18.87	19.21	19.66	20.01	20.17	20.2	20.2	20.1	19.64	19.08	18.64	(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
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

TER WorkSheet: New dwelling as built

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.84	0.64	0.45	0.51	0.8	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	-----	------	------	---	------

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

(95)m=	513.75	587.55	658.36	714.98	686.37	515.77	344.04	360.07	511.58	540.15	499.87	486.75	(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=	1424.54	1381.19	1253.11	1048.31	808.07	536.43	346.51	364.86	579.6	879.41	1170.49	1417.58	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	-------	--------	---------	---------	------

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

(98)m=	677.63	533.33	442.5	239.99	90.55	0	0	0	0	252.41	482.85	692.54	(98)
--------	--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------	------

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

3411.78

Space heating requirement in kWh/m²/year

36.93

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

93.4

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)

677.63	533.33	442.5	239.99	90.55	0	0	0	0	252.41	482.85	692.54
--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------

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

725.51	571.01	473.77	256.95	96.94	0	0	0	0	270.24	516.97	741.47
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

3652.87

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)

209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68
--------	--------	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------

Efficiency of water heater

80.3

(217)m=

87.79	87.57	87.06	85.89	83.59	80.3	80.3	80.3	80.3	85.9	87.29	87.88
-------	-------	-------	-------	-------	------	------	------	------	------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	238.85	211.1	222.63	200.16	199.12	182.56	174.91	194.98	197.14	209.85	218.67	232.91	(219)
---------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

2482.9

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3652.87

Water heating fuel used

2482.9

Electricity for pumps, fans and electric keep-hot

TER WorkSheet: New dwelling as built

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		404.2	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6614.97	(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	=	789.02	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	536.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1325.33	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	209.78	(268)
Total CO2, kg/year		sum of (265)...(271) =			1574.03	(272)
 TER =					 17.04	 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 02 March 2023 at 13:02:31

Project Information:

Assessed By: Matt Fitzpatrick (STRO003572)

Building Type: Mid-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 92.39m²

Site Reference : Swansea Road

Plot Reference: 8 As Built

Address : 32 Northfield Road, READING, RG1 8AH

Client Details:

Name: Helix

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.04 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.79 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 48.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 41.0 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.32	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 512, product index 018738): Boiler systems with radiators or underfloor heating - mains gas Brand name: Baxi Model: ASSURE Model qualifier: 36 COMBI (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: South West 4.61m²
 Windows facing: North East 6.85m²
 Windows facing: North East 1.44m²
 Roof windows facing: South West 0.92m²
 Ventilation rate: 4.00
 Blinds/curtains: None
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K
 Photovoltaic array

SAP Input

Property Details: 8 As Built

Address: 32 Northfield Road, READING, RG1 8AH
 Located in: England
 Region: Thames valley
 UPRN: UPRN-557155256416
 Date of assessment: 02 March 2023
 Date of certificate: 02 March 2023
 Assessment type: New dwelling as built
 Transaction type: New dwelling
 Tenure type: Unknown
 Related party disclosure: No related party
 Thermal Mass Parameter: Calculated 151.53
 Water use <= 125 litres/person/day: True
 PCDF Version: 512

Property description:

Dwelling type: House
 Detachment: Mid-terrace
 Year Completed: 2023
 Floor Location: Floor area: Storey height:
 Floor 0 39.7 m² 2.5 m
 Floor 1 35.42 m² 2.7 m
 Floor 2 17.27 m² 2.323 m
 Living area: 15.13 m² (fraction 0.163)
 Front of dwelling faces: South West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:	
Front	Manufacturer	Solid			Wood	
1	BFRC	Windows	low-E, En = 0.1, soft coat	No		
2	BFRC	Windows	low-E, En = 0.1, soft coat	No		
2	BFRC	Windows	low-E, En = 0.1, soft coat	No		
1	Manufacturer	Roof Windows	low-E, En = 0.1, soft coat	No	Wood	
Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front	mm	0.7	0.63	1.5	2.12	1
1	12mm	0	0.39	1.3	4.61	1
2	12mm	0	0.39	1.3	6.85	1
2	12mm	0	0.39	1.3	1.44	1
1	12mm	0.7	0.63	1.2	0.92	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front		Brick	South West	0	0
1		Brick	South West	0	0
2		Brick	North East	0	0
2		Timber stud	North East	0	0
1		Sloping roof	South West	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Brick	47.24	13.58	33.66	0.25	0	False	60
Timber stud	16.45	1.44	15.01	0.25	0	False	9

SAP Input

Cold roof	2.81	0	2.81	0.11	0	9
Bay roof	0.6	0	0.6	0.11	0	9
Kitchen roof	4.3	0	4.3	0.11	0	9
Loft roof	18.16	0	18.16	0.11	0	9
Sloping roof	20.46	0.92	19.54	0.15	0	9
Suspended floor	39.7			0.11		75
<u>Internal Elements</u>						
Metal stud	178.58					9
Int ceiling	52.69					9
Int Floor	52.69					18
<u>Party Elements</u>						
Party wall	120.65					45

Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.0779				
	Length	Psi-value			
	9.83	0.05	E2	Other lintels (including other steel lintels)	
	6.42	0.034	E3	Sill	
	22.8	0.04	E4	Jamb	
	7.6	0.06	E5	Ground floor (normal)	
	0	0.32	E20	Exposed floor (normal)	
	0	0.32	E21	Exposed floor (inverted)	
	6.09	0	E6	Intermediate floor within a dwelling	
	11.96	0.123	E10	Eaves (insulation at ceiling level)	
	13.5	0.24	E24	Eaves (insulation at ceiling level - inverted)	
	0	0.033	E11	Eaves (insulation at rafter level)	
	0	0.063	E12	Gable (insulation at ceiling level)	
	0	0.08	E13	Gable (insulation at rafter level)	
	7.35	0.05	E16	Corner (normal)	
	7.35	-0.069	E17	Corner (inverted internal area greater than external area)	
	20.09	0.072	E18	Party wall between dwellings	
	0	0.12	E25	Staggered party wall between dwellings	
	20.91	0.043	P1	Ground floor	
	34.11	0	P2	Intermediate floor within a dwelling	
	0	0.16	P7	Exposed floor (normal)	
	8.46	0.055	P4	Roof (insulation at ceiling level)	
	9.88	0.069	P5	Roof (insulation at rafter level)	
	0.98	0.08	R1	Head	
	0.98	0.06	R2	Sill	
	1.96	0.08	R3	Jamb	
	7.64	0.06	R6	Flat ceiling	
	12.92	0.06	R8	Roof wall (rafter)	

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Decentralised whole house extract
	Number of fans in Wetroom: Kitchen 1 Other 3
	Ductwork: ,
	Approved Installation Scheme: True
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.32 (Assessed dwelling is tested)

Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database

SAP Input

Database: (rev 512, product index 018738) Efficiency: Winter 86.7 % Summer: 89.9
Brand name: Baxi
Model: ASSURE
Model qualifier: 36 COMBI
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes

Main heating Control:

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

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Low rise urban / suburban
EPC language: English
Wind turbine: No
Photovoltaics: Photovoltaic 1
Installed Peak power: 0.6
Tilt of collector: 45°
Overshading: None or very little
Collector Orientation: South West
Assess Zero Carbon Home: No

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 8 As Built

Address : 32 Northfield Road, READING, RG1 8AH

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	39.7	(1a) x	2.5	(2a) =	99.25 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.39	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	235 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.32000017166138 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.22 (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) =		0.18 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

DER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

	0.23	0.23	0.22	0.2	0.2	0.17	0.17	0.17	0.18	0.2	0.21	0.22
--	------	------	------	-----	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

0 (23c)

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

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

(24a)

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

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

(24b)

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

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

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(24c)

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

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

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

(24d)

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

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1.5	= 3.18		(26)
Windows Type 1			4.61	x 1/[1/(1.3) + 0.04]	= 5.7		(27)
Windows Type 2			6.85	x 1/[1/(1.3) + 0.04]	= 8.46		(27)
Windows Type 3			1.44	x 1/[1/(1.3) + 0.04]	= 1.78		(27)
Rooflights			0.92	x 1/[1/(1.2) + 0.04]	= 1.104		(27b)
Floor			39.7	x 0.11	= 4.367	75	2977.5 (28)
Walls Type1	47.24	13.58	33.66	x 0.25	= 8.42	60	2019.6 (29)
Walls Type2	16.45	1.44	15.01	x 0.25	= 3.75	9	135.09 (29)
Roof Type1	2.81	0	2.81	x 0.11	= 0.31	9	25.29 (30)
Roof Type2	0.6	0	0.6	x 0.11	= 0.07	9	5.4 (30)
Roof Type3	4.3	0	4.3	x 0.11	= 0.47	9	38.7 (30)
Roof Type4	18.16	0	18.16	x 0.11	= 2	9	163.44 (30)
Roof Type5	20.46	0.92	19.54	x 0.15	= 2.93	9	175.86 (30)
Total area of elements, m²			149.72				(31)
Party wall			120.65	x 0	= 0	45	5429.25 (32)
Internal wall **			178.58			9	1607.22 (32c)
Internal floor			52.69			18	948.42 (32d)

DER WorkSheet: New dwelling as built

Internal ceiling

52.69

9

474.21

(32e)

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

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

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) =

42.49

(33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

13999.98

(34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K

= (34) ÷ (4) =

151.53

(35)

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

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

11.67

(36)

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

Total fabric heat loss

(33) + (36) =

54.16

(37)

Ventilation heat loss calculated monthly

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

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78	38.78

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93	92.93
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

92.93

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
------	------	------	------	------	------	------	------	------	------	------	------

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

1.01

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.3

(43)

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

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

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

(44)m=

107.04	103.14	99.25	95.36	91.47	87.57	87.57	91.47	95.36	99.25	103.14	107.04
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

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

1167.66

(44)

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

(45)m=

158.73	138.83	143.26	124.89	119.84	103.41	95.83	109.96	111.28	129.68	141.56	153.72
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1530.98

(45)

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

(46)m=

23.81	20.82	21.49	18.73	17.98	15.51	14.37	16.49	16.69	19.45	21.23	23.06
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

DER WorkSheet: New dwelling as built

Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)												
b) If manufacturer's declared cylinder loss factor is not known:															
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)												
If community heating see section 4.3															
Volume factor from Table 2a		0	(52)												
Temperature factor from Table 2b		0	(53)												
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)												
Enter (50) or (54) in (55)		0	(55)												
Water storage loss calculated for each month	((56)m = (55) x (41)m														
(56)m=		<table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(56)
0	0	0	0	0	0	0	0	0	0	0	0				
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=		<table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(57)
0	0	0	0	0	0	0	0	0	0	0	0				
Primary circuit loss (annual) from Table 3		0	(58)												
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m															
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)															
(59)m=		<table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(59)
0	0	0	0	0	0	0	0	0	0	0	0				
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m															
(61)m=		<table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 25px;">11.82</td> <td style="border: 1px solid black; width: 25px;">10.67</td> <td style="border: 1px solid black; width: 25px;">11.8</td> <td style="border: 1px solid black; width: 25px;">11.39</td> <td style="border: 1px solid black; width: 25px;">11.75</td> <td style="border: 1px solid black; width: 25px;">11.35</td> <td style="border: 1px solid black; width: 25px;">11.71</td> <td style="border: 1px solid black; width: 25px;">11.74</td> <td style="border: 1px solid black; width: 25px;">11.37</td> <td style="border: 1px solid black; width: 25px;">11.78</td> <td style="border: 1px solid black; width: 25px;">11.42</td> <td style="border: 1px solid black; width: 25px;">11.82</td> </tr> </table>	11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82	(61)
11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82				
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m															
(62)m=		<table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 25px;">170.55</td> <td style="border: 1px solid black; width: 25px;">149.5</td> <td style="border: 1px solid black; width: 25px;">155.06</td> <td style="border: 1px solid black; width: 25px;">136.29</td> <td style="border: 1px solid black; width: 25px;">131.59</td> <td style="border: 1px solid black; width: 25px;">114.76</td> <td style="border: 1px solid black; width: 25px;">107.54</td> <td style="border: 1px solid black; width: 25px;">121.7</td> <td style="border: 1px solid black; width: 25px;">122.65</td> <td style="border: 1px solid black; width: 25px;">141.46</td> <td style="border: 1px solid black; width: 25px;">152.98</td> <td style="border: 1px solid black; width: 25px;">165.54</td> </tr> </table>	170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54	(62)
170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54				
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=		<table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> <td style="border: 1px solid black; width: 25px;">0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0	(63)
0	0	0	0	0	0	0	0	0	0	0	0				
Output from water heater															
(64)m=		<table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 25px;">170.55</td> <td style="border: 1px solid black; width: 25px;">149.5</td> <td style="border: 1px solid black; width: 25px;">155.06</td> <td style="border: 1px solid black; width: 25px;">136.29</td> <td style="border: 1px solid black; width: 25px;">131.59</td> <td style="border: 1px solid black; width: 25px;">114.76</td> <td style="border: 1px solid black; width: 25px;">107.54</td> <td style="border: 1px solid black; width: 25px;">121.7</td> <td style="border: 1px solid black; width: 25px;">122.65</td> <td style="border: 1px solid black; width: 25px;">141.46</td> <td style="border: 1px solid black; width: 25px;">152.98</td> <td style="border: 1px solid black; width: 25px;">165.54</td> </tr> </table>	170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54	
170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54				
Output from water heater (annual) _{1...12}											1669.61	(64)			
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]															
(65)m=		<table style="width: 100%; text-align: center; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 25px;">55.73</td> <td style="border: 1px solid black; width: 25px;">48.83</td> <td style="border: 1px solid black; width: 25px;">50.58</td> <td style="border: 1px solid black; width: 25px;">44.38</td> <td style="border: 1px solid black; width: 25px;">42.78</td> <td style="border: 1px solid black; width: 25px;">37.22</td> <td style="border: 1px solid black; width: 25px;">34.79</td> <td style="border: 1px solid black; width: 25px;">39.5</td> <td style="border: 1px solid black; width: 25px;">39.84</td> <td style="border: 1px solid black; width: 25px;">46.06</td> <td style="border: 1px solid black; width: 25px;">49.92</td> <td style="border: 1px solid black; width: 25px;">54.07</td> </tr> </table>	55.73	48.83	50.58	44.38	42.78	37.22	34.79	39.5	39.84	46.06	49.92	54.07	(65)
55.73	48.83	50.58	44.38	42.78	37.22	34.79	39.5	39.84	46.06	49.92	54.07				
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=	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
(67)m=	22.89	20.33	16.53	12.52	9.36	7.9	8.53	11.09	14.89	18.91	22.07	23.52
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
(68)m=	243.41	245.93	239.57	226.02	208.91	192.84	182.1	179.57	185.94	199.49	216.59	232.67
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29
Pumps and fans gains (Table 5a)												
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3
Losses e.g. evaporation (negative values) (Table 5)												
(71)m=	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28

DER WorkSheet: New dwelling as built

Water heating gains (Table 5)

(72)m=

74.91	72.66	67.99	61.63	57.51	51.7	46.76	53.09	55.34	61.91	69.34	72.67
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

407.06	404.78	389.94	366.02	341.63	318.29	303.25	309.61	322.02	346.16	373.85	394.72
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>23.21</td></tr></table>	23.21	(75)
0.77																			
6.85																			
11.28																			
0.39																			
1.11																			
23.21																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>4.88</td></tr></table>	4.88	(75)
0.77																			
1.44																			
11.28																			
0.39																			
1.11																			
4.88																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>47.24</td></tr></table>	47.24	(75)
0.77																			
6.85																			
22.97																			
0.39																			
1.11																			
47.24																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>9.93</td></tr></table>	9.93	(75)
0.77																			
1.44																			
22.97																			
0.39																			
1.11																			
9.93																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>85.12</td></tr></table>	85.12	(75)
0.77																			
6.85																			
41.38																			
0.39																			
1.11																			
85.12																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>17.89</td></tr></table>	17.89	(75)
0.77																			
1.44																			
41.38																			
0.39																			
1.11																			
17.89																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>139.79</td></tr></table>	139.79	(75)
0.77																			
6.85																			
67.96																			
0.39																			
1.11																			
139.79																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>29.39</td></tr></table>	29.39	(75)
0.77																			
1.44																			
67.96																			
0.39																			
1.11																			
29.39																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>187.9</td></tr></table>	187.9	(75)
0.77																			
6.85																			
91.35																			
0.39																			
1.11																			
187.9																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>39.5</td></tr></table>	39.5	(75)
0.77																			
1.44																			
91.35																			
0.39																			
1.11																			
39.5																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>200.33</td></tr></table>	200.33	(75)
0.77																			
6.85																			
97.38																			
0.39																			
1.11																			
200.33																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>42.11</td></tr></table>	42.11	(75)
0.77																			
1.44																			
97.38																			
0.39																			
1.11																			
42.11																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>187.4</td></tr></table>	187.4	(75)
0.77																			
6.85																			
91.1																			
0.39																			
1.11																			
187.4																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>39.4</td></tr></table>	39.4	(75)
0.77																			
1.44																			
91.1																			
0.39																			
1.11																			
39.4																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>149.4</td></tr></table>	149.4	(75)
0.77																			
6.85																			
72.63																			
0.39																			
1.11																			
149.4																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>31.41</td></tr></table>	31.41	(75)
0.77																			
1.44																			
72.63																			
0.39																			
1.11																			
31.41																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>103.72</td></tr></table>	103.72	(75)
0.77																			
6.85																			
50.42																			
0.39																			
1.11																			
103.72																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>21.8</td></tr></table>	21.8	(75)
0.77																			
1.44																			
50.42																			
0.39																			
1.11																			
21.8																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>57.74</td></tr></table>	57.74	(75)
0.77																			
6.85																			
28.07																			
0.39																			
1.11																			
57.74																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>12.14</td></tr></table>	12.14	(75)
0.77																			
1.44																			
28.07																			
0.39																			
1.11																			
12.14																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>29.2</td></tr></table>	29.2	(75)
0.77																			
6.85																			
14.2																			
0.39																			
1.11																			
29.2																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>6.14</td></tr></table>	6.14	(75)
0.77																			
1.44																			
14.2																			
0.39																			
1.11																			
6.14																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>18.95</td></tr></table>	18.95	(75)
0.77																			
6.85																			
9.21																			
0.39																			
1.11																			
18.95																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>3.98</td></tr></table>	3.98	(75)
0.77																			
1.44																			
9.21																			
0.39																			
1.11																			
3.98																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>50.94</td></tr></table>	50.94	(79)
0.77																			
4.61																			
36.79																			
0.39																			
1.11																			
50.94																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>62.67</td></tr></table>	62.67		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>86.76</td></tr></table>	86.76	(79)
0.77																			
4.61																			
62.67																			
0.39																			
1.11																			
86.76																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>85.75</td></tr></table>	85.75		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>118.71</td></tr></table>	118.71	(79)
0.77																			
4.61																			
85.75																			
0.39																			
1.11																			
118.71																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>106.25</td></tr></table>	106.25		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>147.09</td></tr></table>	147.09	(79)
0.77																			
4.61																			
106.25																			
0.39																			
1.11																			
147.09																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>119.01</td></tr></table>	119.01		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>164.76</td></tr></table>	164.76	(79)
0.77																			
4.61																			
119.01																			
0.39																			
1.11																			
164.76																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>118.15</td></tr></table>	118.15		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>163.56</td></tr></table>	163.56	(79)
0.77																			
4.61																			
118.15																			
0.39																			
1.11																			
163.56																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>113.91</td></tr></table>	113.91		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>157.69</td></tr></table>	157.69	(79)
0.77																			
4.61																			
113.91																			
0.39																			
1.11																			
157.69																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>104.39</td></tr></table>	104.39		<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>144.52</td></tr></table>	144.52	(79)
0.77																			
4.61																			
104.39																			
0.39																			
1.11																			
144.52																			

DER WorkSheet: New dwelling as built

Southwest0.9x	0.77	x	4.61	x	92.85		0.39	x	1.11	=	128.54	(79)
Southwest0.9x	0.77	x	4.61	x	69.27		0.39	x	1.11	=	95.89	(79)
Southwest0.9x	0.77	x	4.61	x	44.07		0.39	x	1.11	=	61.01	(79)
Southwest0.9x	0.77	x	4.61	x	31.49		0.39	x	1.11	=	43.59	(79)
Rooflights 0.9x	1	x	0.92	x	39.98	x	0.63	x	0.7	=	14.6	(82)
Rooflights 0.9x	1	x	0.92	x	73.48	x	0.63	x	0.7	=	26.83	(82)
Rooflights 0.9x	1	x	0.92	x	112.11	x	0.63	x	0.7	=	40.94	(82)
Rooflights 0.9x	1	x	0.92	x	153.81	x	0.63	x	0.7	=	56.16	(82)
Rooflights 0.9x	1	x	0.92	x	182.63	x	0.63	x	0.7	=	66.69	(82)
Rooflights 0.9x	1	x	0.92	x	184.99	x	0.63	x	0.7	=	67.55	(82)
Rooflights 0.9x	1	x	0.92	x	176.88	x	0.63	x	0.7	=	64.59	(82)
Rooflights 0.9x	1	x	0.92	x	155.4	x	0.63	x	0.7	=	56.74	(82)
Rooflights 0.9x	1	x	0.92	x	126.86	x	0.63	x	0.7	=	46.32	(82)
Rooflights 0.9x	1	x	0.92	x	84.6	x	0.63	x	0.7	=	30.89	(82)
Rooflights 0.9x	1	x	0.92	x	48.93	x	0.63	x	0.7	=	17.87	(82)
Rooflights 0.9x	1	x	0.92	x	33.5	x	0.63	x	0.7	=	12.23	(82)

Solar gains in watts, calculated for each month

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

(83)m=	93.62	170.77	262.66	372.43	458.85	473.55	449.08	382.06	300.39	196.66	114.22	78.76	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(84)m=	500.68	575.55	652.61	738.45	800.48	791.84	752.33	691.67	622.4	542.82	488.07	473.48	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.92	0.82	0.67	0.52	0.58	0.8	0.95	0.98	0.99	(86)

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

(87)m=	19.38	19.57	19.9	20.32	20.68	20.9	20.97	20.96	20.78	20.31	19.75	19.33	(87)
--------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.96	0.9	0.78	0.59	0.42	0.48	0.74	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=	17.9	18.18	18.65	19.24	19.73	19.99	20.06	20.05	19.87	19.24	18.44	17.82	(90)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.16 (91)

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

(92)m=	18.14	18.4	18.85	19.42	19.89	20.14	20.21	20.2	20.02	19.41	18.66	18.06	(92)
--------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(93)m=	18.14	18.4	18.85	19.42	19.89	20.14	20.21	20.2	20.02	19.41	18.66	18.06	(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 as built

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.95	0.89	0.77	0.6	0.43	0.49	0.74	0.92	0.97	0.99	(94)
--------	------	------	------	------	------	-----	------	------	------	------	------	------	------

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

(95)m=	492.02	558.91	617.12	653.98	616.92	474.45	326.59	338.95	460.49	498.04	474.36	466.68	(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=	1286.01	1254.97	1147.98	977.26	760.87	514.8	335.49	353.02	550.15	818.81	1074.08	1288.32	(97)
--------	---------	---------	---------	--------	--------	-------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	590.72	467.75	394.97	232.76	107.1	0	0	0	0	238.66	431.8	611.3	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	-------	-------	------

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

3075.06

Space heating requirement in kWh/m²/year

33.28

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) x [1 – (203)] =

1

Efficiency of main space heating system 1

89.9

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)

590.72	467.75	394.97	232.76	107.1	0	0	0	0	238.66	431.8	611.3
--------	--------	--------	--------	-------	---	---	---	---	--------	-------	-------

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

657.09	520.3	439.34	258.91	119.13	0	0	0	0	265.47	480.31	679.98
--------	-------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

3420.53

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)
---------	---	---	---	---	---	---	---	---	---	---	---	-------

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

0

Water heating

Output from water heater (calculated above)

170.55	149.5	155.06	136.29	131.59	114.76	107.54	121.7	122.65	141.46	152.98	165.54
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Efficiency of water heater

86.7

(217)m=	89.16	89.1	88.97	88.69	88.11	86.7	86.7	86.7	86.7	88.68	89.04	89.2	(217)
---------	-------	------	-------	-------	-------	------	------	------	------	-------	-------	------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	191.28	167.78	174.27	153.66	149.35	132.36	124.03	140.37	141.46	159.51	171.81	185.58	(219)
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

1891.49

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3420.53

Water heating fuel used

1891.49

Electricity for pumps, fans and electric keep-hot

DER WorkSheet: New dwelling as built

mechanical ventilation - balanced, extract or positive input from outside	68.4	(230a)
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	143.4 (231)
Electricity for lighting		404.2 (232)
Electricity generated by PVs		-481.92 (233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5377.7 (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	=	738.84 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	408.56 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1147.4 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	74.42 (267)
Electricity for lighting	(232) x	0.519	=	209.78 (268)
Energy saving/generation technologies Item 1		0.519	=	-250.12 (269)
Total CO2, kg/year		sum of (265)...(271) =		1181.48 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		12.79 (273)
El rating (section 14)				88 (274)

TER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 8 As Built

Address : 32 Northfield Road, READING, RG1 8AH

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	39.7	(1a) x	2.5	(2a) =	99.25 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.39	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	235 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	0 (6b)
Number of intermittent fans				3	x 10 = 30 (7a)
Number of passive vents				0	x 10 = 0 (7b)
Number of flueless gas fires				0	x 40 = 0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)					
Number of storeys in the dwelling (ns)				0	(9)
Additional infiltration			[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35					
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0	(12)
If no draught lobby, enter 0.05, else enter 0				0	(13)
Percentage of windows and doors draught stripped				0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)				0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used					
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.32	(21)
Infiltration rate modified for monthly wind speed					

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

TER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1	= 2.12		(26)
Windows Type 1			4.61	x 1/[1/(1.4)+ 0.04]	= 6.11		(27)
Windows Type 2			6.85	x 1/[1/(1.4)+ 0.04]	= 9.08		(27)
Windows Type 3			1.44	x 1/[1/(1.4)+ 0.04]	= 1.91		(27)
Rooflights			0.92	x 1/[1/(1.7) + 0.04]	= 1.564		(27b)
Floor			39.7	x 0.13	= 5.161		(28)
Walls Type1	47.24	13.58	33.66	x 0.18	= 6.06		(29)
Walls Type2	16.45	1.44	15.01	x 0.18	= 2.7		(29)
Roof Type1	2.81	0	2.81	x 0.13	= 0.37		(30)
Roof Type2	0.6	0	0.6	x 0.13	= 0.08		(30)
Roof Type3	4.3	0	4.3	x 0.13	= 0.56		(30)
Roof Type4	18.16	0	18.16	x 0.13	= 2.36		(30)
Roof Type5	20.46	0.92	19.54	x 0.13	= 2.54		(30)
Total area of elements, m²			149.72				(31)
Party wall			120.65	x 0	= 0		(32)
Internal wall **			178.58				(32c)
Internal floor			52.69				(32d)

TER WorkSheet: New dwelling as built

Internal ceiling

52.69

(32e)

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

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

Fabric heat loss, W/K = S (A x U)

(26)...(30) + (32) =

40.51

(33)

Heat capacity Cm = S(A x k)

((28)...(30) + (32) + (32a)...(32e) =

13999.98

(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

13.34

(36)

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

Total fabric heat loss

(33) + (36) =

53.85

(37)

Ventilation heat loss calculated monthly

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

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
45.27	45.02	44.77	43.61	43.39	42.38	42.38	42.19	42.77	43.39	43.83	44.29

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

99.12	98.87	98.62	97.46	97.24	96.23	96.23	96.04	96.62	97.24	97.68	98.14
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

97.46

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.07	1.07	1.07	1.05	1.05	1.04	1.04	1.04	1.05	1.05	1.06	1.06
------	------	------	------	------	------	------	------	------	------	------	------

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

1.05

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.66

(42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

97.3

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

107.04	103.14	99.25	95.36	91.47	87.57	87.57	91.47	95.36	99.25	103.14	107.04
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------

Total = Sum(44)_{1...12} =

1167.66

(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

158.73	138.83	143.26	124.89	119.84	103.41	95.83	109.96	111.28	129.68	141.56	153.72
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

Total = Sum(45)_{1...12} =

1530.98

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

23.81	20.82	21.49	18.73	17.98	15.51	14.37	16.49	16.69	19.45	21.23	23.06
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

TER WorkSheet: New dwelling as built

Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)												
b) If manufacturer's declared cylinder loss factor is not known:															
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)												
If community heating see section 4.3															
Volume factor from Table 2a		0	(52)												
Temperature factor from Table 2b		0	(53)												
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)												
Enter (50) or (54) in (55)		0	(55)												
Water storage loss calculated for each month	((56)m = (55) x (41)m														
(56)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(56)
0	0	0	0	0	0	0	0	0	0	0	0				
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=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(57)
0	0	0	0	0	0	0	0	0	0	0	0				
Primary circuit loss (annual) from Table 3		0	(58)												
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m															
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)															
(59)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(59)
0	0	0	0	0	0	0	0	0	0	0	0				
Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m															
(61)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>50.96</td><td>46.03</td><td>50.58</td><td>47.03</td><td>46.61</td><td>43.19</td><td>44.63</td><td>46.61</td><td>47.03</td><td>50.58</td><td>49.32</td><td>50.96</td> </tr> </table>	50.96	46.03	50.58	47.03	46.61	43.19	44.63	46.61	47.03	50.58	49.32	50.96		(61)
50.96	46.03	50.58	47.03	46.61	43.19	44.63	46.61	47.03	50.58	49.32	50.96				
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m															
(62)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>209.69</td><td>184.85</td><td>193.83</td><td>171.92</td><td>166.45</td><td>146.6</td><td>140.45</td><td>156.57</td><td>158.3</td><td>180.26</td><td>190.87</td><td>204.68</td> </tr> </table>	209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68		(62)
209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68				
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=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	0	0	0	0	0	0	0	0		(63)
0	0	0	0	0	0	0	0	0	0	0	0				
Output from water heater															
(64)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>209.69</td><td>184.85</td><td>193.83</td><td>171.92</td><td>166.45</td><td>146.6</td><td>140.45</td><td>156.57</td><td>158.3</td><td>180.26</td><td>190.87</td><td>204.68</td> </tr> </table>	209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68		
209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68				
											Output from water heater (annual) ^{1...12}	2104.48	(64)		
Heat gains from water heating, kWh/month 0.25 ´ [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]															
(65)m=	<table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td>65.52</td><td>57.67</td><td>60.28</td><td>53.28</td><td>51.5</td><td>45.18</td><td>43.02</td><td>48.22</td><td>48.76</td><td>55.76</td><td>59.4</td><td>63.85</td> </tr> </table>	65.52	57.67	60.28	53.28	51.5	45.18	43.02	48.22	48.76	55.76	59.4	63.85		(65)
65.52	57.67	60.28	53.28	51.5	45.18	43.02	48.22	48.76	55.76	59.4	63.85				
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=	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	132.85	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	22.89	20.33	16.53	12.52	9.36	7.9	8.53	11.09	14.89	18.91	22.07	23.52	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	243.41	245.93	239.57	226.02	208.91	192.84	182.1	179.57	185.94	199.49	216.59	232.67	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	36.29	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	-106.28	(71)

TER WorkSheet: New dwelling as built

Water heating gains (Table 5)

(72)m=

88.06	85.81	81.02	74.01	69.22	62.75	57.82	64.81	67.72	74.95	82.5	85.82
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

420.21	417.93	402.97	378.39	353.34	329.34	314.31	321.33	334.4	359.2	387.01	407.87
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 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>23.62</td></tr></table>	23.62	(75)
0.77																			
6.85																			
11.28																			
0.63																			
0.7																			
23.62																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.97</td></tr></table>	4.97	(75)
0.77																			
1.44																			
11.28																			
0.63																			
0.7																			
4.97																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>48.08</td></tr></table>	48.08	(75)
0.77																			
6.85																			
22.97																			
0.63																			
0.7																			
48.08																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>10.11</td></tr></table>	10.11	(75)
0.77																			
1.44																			
22.97																			
0.63																			
0.7																			
10.11																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>86.62</td></tr></table>	86.62	(75)
0.77																			
6.85																			
41.38																			
0.63																			
0.7																			
86.62																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>18.21</td></tr></table>	18.21	(75)
0.77																			
1.44																			
41.38																			
0.63																			
0.7																			
18.21																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>142.26</td></tr></table>	142.26	(75)
0.77																			
6.85																			
67.96																			
0.63																			
0.7																			
142.26																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>29.91</td></tr></table>	29.91	(75)
0.77																			
1.44																			
67.96																			
0.63																			
0.7																			
29.91																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>191.23</td></tr></table>	191.23	(75)
0.77																			
6.85																			
91.35																			
0.63																			
0.7																			
191.23																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>40.2</td></tr></table>	40.2	(75)
0.77																			
1.44																			
91.35																			
0.63																			
0.7																			
40.2																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>203.87</td></tr></table>	203.87	(75)
0.77																			
6.85																			
97.38																			
0.63																			
0.7																			
203.87																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>42.86</td></tr></table>	42.86	(75)
0.77																			
1.44																			
97.38																			
0.63																			
0.7																			
42.86																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>190.72</td></tr></table>	190.72	(75)
0.77																			
6.85																			
91.1																			
0.63																			
0.7																			
190.72																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>40.09</td></tr></table>	40.09	(75)
0.77																			
1.44																			
91.1																			
0.63																			
0.7																			
40.09																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>152.04</td></tr></table>	152.04	(75)
0.77																			
6.85																			
72.63																			
0.63																			
0.7																			
152.04																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>31.96</td></tr></table>	31.96	(75)
0.77																			
1.44																			
72.63																			
0.63																			
0.7																			
31.96																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>105.55</td></tr></table>	105.55	(75)
0.77																			
6.85																			
50.42																			
0.63																			
0.7																			
105.55																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>22.19</td></tr></table>	22.19	(75)
0.77																			
1.44																			
50.42																			
0.63																			
0.7																			
22.19																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>58.76</td></tr></table>	58.76	(75)
0.77																			
6.85																			
28.07																			
0.63																			
0.7																			
58.76																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>12.35</td></tr></table>	12.35	(75)
0.77																			
1.44																			
28.07																			
0.63																			
0.7																			
12.35																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>29.72</td></tr></table>	29.72	(75)
0.77																			
6.85																			
14.2																			
0.63																			
0.7																			
29.72																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>6.25</td></tr></table>	6.25	(75)
0.77																			
1.44																			
14.2																			
0.63																			
0.7																			
6.25																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.85</td></tr></table>	6.85	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>19.29</td></tr></table>	19.29	(75)
0.77																			
6.85																			
9.21																			
0.63																			
0.7																			
19.29																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>1.44</td></tr></table>	1.44	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>4.06</td></tr></table>	4.06	(75)
0.77																			
1.44																			
9.21																			
0.63																			
0.7																			
4.06																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>51.84</td></tr></table>	51.84	(79)
0.77																			
4.61																			
36.79																			
0.63																			
0.7																			
51.84																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>62.67</td></tr></table>	62.67		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>88.3</td></tr></table>	88.3	(79)
0.77																			
4.61																			
62.67																			
0.63																			
0.7																			
88.3																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>85.75</td></tr></table>	85.75		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>120.81</td></tr></table>	120.81	(79)
0.77																			
4.61																			
85.75																			
0.63																			
0.7																			
120.81																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>106.25</td></tr></table>	106.25		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>149.7</td></tr></table>	149.7	(79)
0.77																			
4.61																			
106.25																			
0.63																			
0.7																			
149.7																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>119.01</td></tr></table>	119.01		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>167.67</td></tr></table>	167.67	(79)
0.77																			
4.61																			
119.01																			
0.63																			
0.7																			
167.67																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>118.15</td></tr></table>	118.15		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>166.46</td></tr></table>	166.46	(79)
0.77																			
4.61																			
118.15																			
0.63																			
0.7																			
166.46																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>113.91</td></tr></table>	113.91		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>160.48</td></tr></table>	160.48	(79)
0.77																			
4.61																			
113.91																			
0.63																			
0.7																			
160.48																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.61</td></tr></table>	4.61	x	<table><tr><td>104.39</td></tr></table>	104.39		<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>147.07</td></tr></table>	147.07	(79)
0.77																			
4.61																			
104.39																			
0.63																			
0.7																			
147.07																			

TER WorkSheet: New dwelling as built

Southwest0.9x	0.77	x	4.61	x	92.85		0.63	x	0.7	=	130.82	(79)
Southwest0.9x	0.77	x	4.61	x	69.27		0.63	x	0.7	=	97.59	(79)
Southwest0.9x	0.77	x	4.61	x	44.07		0.63	x	0.7	=	62.09	(79)
Southwest0.9x	0.77	x	4.61	x	31.49		0.63	x	0.7	=	44.36	(79)
Rooflights 0.9x	1	x	0.92	x	39.98	x	0.63	x	0.7	=	14.6	(82)
Rooflights 0.9x	1	x	0.92	x	73.48	x	0.63	x	0.7	=	26.83	(82)
Rooflights 0.9x	1	x	0.92	x	112.11	x	0.63	x	0.7	=	40.94	(82)
Rooflights 0.9x	1	x	0.92	x	153.81	x	0.63	x	0.7	=	56.16	(82)
Rooflights 0.9x	1	x	0.92	x	182.63	x	0.63	x	0.7	=	66.69	(82)
Rooflights 0.9x	1	x	0.92	x	184.99	x	0.63	x	0.7	=	67.55	(82)
Rooflights 0.9x	1	x	0.92	x	176.88	x	0.63	x	0.7	=	64.59	(82)
Rooflights 0.9x	1	x	0.92	x	155.4	x	0.63	x	0.7	=	56.74	(82)
Rooflights 0.9x	1	x	0.92	x	126.86	x	0.63	x	0.7	=	46.32	(82)
Rooflights 0.9x	1	x	0.92	x	84.6	x	0.63	x	0.7	=	30.89	(82)
Rooflights 0.9x	1	x	0.92	x	48.93	x	0.63	x	0.7	=	17.87	(82)
Rooflights 0.9x	1	x	0.92	x	33.5	x	0.63	x	0.7	=	12.23	(82)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	95.02	173.32	266.59	378.03	465.79	480.74	455.88	387.82	304.88	199.59	115.92	79.94	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	515.23	591.25	669.56	756.42	819.13	810.08	770.19	709.14	639.28	558.79	502.93	487.81	(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=	1	1	0.99	0.97	0.88	0.71	0.54	0.6	0.86	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	19.97	20.21	20.54	20.81	20.96	20.99	20.99	20.88	20.52	20.11	19.8	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.03	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.95	0.84	0.62	0.43	0.49	0.8	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	-----	------	---	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.45	18.66	19.01	19.48	19.85	20.02	20.05	20.04	19.95	19.47	18.88	18.42	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.16

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.67	18.87	19.21	19.66	20.01	20.17	20.2	20.2	20.1	19.64	19.08	18.64	(92)
--------	-------	-------	-------	-------	-------	-------	------	------	------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.67	18.87	19.21	19.66	20.01	20.17	20.2	20.2	20.1	19.64	19.08	18.64	(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 as built

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.84	0.64	0.45	0.51	0.8	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	-----	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	513.75	587.55	658.36	714.98	686.37	515.77	344.04	360.07	511.58	540.15	499.87	486.75	(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=	1424.54	1381.19	1253.11	1048.31	808.07	536.43	346.51	364.86	579.6	879.41	1170.49	1417.58	(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=	677.63	533.33	442.5	239.99	90.55	0	0	0	0	252.41	482.85	692.54	(98)
--------	--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3411.78

Space heating requirement in kWh/m²/year

36.93

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

93.4

Efficiency of secondary/supplementary heating system, %

0

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

677.63	533.33	442.5	239.99	90.55	0	0	0	0	252.41	482.85	692.54
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(211)m = {[(98)m x (204)] } x 100 ÷ (206)

725.51	571.01	473.77	256.95	96.94	0	0	0	0	270.24	516.97	741.47
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} =

3652.87

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)
---------	---	---	---	---	---	---	---	---	---	---	---	-------

Total (kWh/year) =Sum(215)_{1...5,10...12} =

0

Water heating

Output from water heater (calculated above)

209.69	184.85	193.83	171.92	166.45	146.6	140.45	156.57	158.3	180.26	190.87	204.68
--------	--------	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------

Efficiency of water heater

80.3

(217)m=

87.79	87.57	87.06	85.89	83.59	80.3	80.3	80.3	80.3	85.9	87.29	87.88
-------	-------	-------	-------	-------	------	------	------	------	------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	238.85	211.1	222.63	200.16	199.12	182.56	174.91	194.98	197.14	209.85	218.67	232.91	(219)
---------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Total = Sum(219a)_{1...12} =

2482.9

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

3652.87

Water heating fuel used

2482.9

Electricity for pumps, fans and electric keep-hot

TER WorkSheet: New dwelling as built

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		404.2	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6614.97	(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	=	789.02	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	536.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1325.33	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	209.78	(268)
Total CO2, kg/year		sum of (265)...(271) =			1574.03	(272)
 TER =					 17.04	 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 02 March 2023 at 13:02:31

Project Information:

Assessed By: Matt Fitzpatrick (STRO003572)

Building Type: End-terrace House

Dwelling Details:

NEW DWELLING AS BUILT

Total Floor Area: 92.99m²

Site Reference : Swansea Road

Plot Reference: 9 As Built

Address : 34 Northfield Road, READING, RG1 8AH

Client Details:

Name: Helix

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 18.78 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.87 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 58.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 50.8 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.44	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 512, product index 018738): Boiler systems with radiators or underfloor heating - mains gas Brand name: Baxi Model: ASSURE Model qualifier: 36 COMBI (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%
 Minimum 75.0% **OK**

8 Mechanical ventilation

Continuous extract system (decentralised)
 Specific fan power: 0.19 0.18
 Maximum 0.7 **OK**

9 Summertime temperature

Overheating risk (Thames valley): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: South East 3.16m²
 Windows facing: East 0.66m²
 Windows facing: South 0.66m²
 Windows facing: North East 2.36m²
 Windows facing: North West 8.39m²
 Roof windows facing: South East 0.92m²
 Ventilation rate: 4.00

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K
 Photovoltaic array

SAP Input

Property Details: 9 As Built

Address: 34 Northfield Road, READING, RG1 8AH
Located in: England
Region: Thames valley
UPRN: UPRN-531151256417
Date of assessment: 02 March 2023
Date of certificate: 02 March 2023
Assessment type: New dwelling as built
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Calculated 158.11
Water use <= 125 litres/person/day: True
PCDF Version: 512

Property description:

Dwelling type: House
Detachment: End-terrace
Year Completed: 2023
Floor Location: Floor area: Storey height:
 Floor 0 40.3 m² 2.5 m
 Floor 1 35.42 m² 2.7 m
 Floor 2 17.27 m² 2.323 m
Living area: 15.13 m² (fraction 0.163)
Front of dwelling faces: South East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front	Manufacturer	Solid			Wood
1	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
2	BFRC	Windows	low-E, En = 0.1, soft coat	No	
3	BFRC	Windows	low-E, En = 0.1, soft coat	No	
4	BFRC	Windows	low-E, En = 0.1, soft coat	No	
1	Manufacturer	Roof Windows	low-E, En = 0.1, soft coat	No	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front	mm	0.7	0.63	1.5	2.12	1
1	12mm	0	0.39	1.3	3.16	1
2	12mm	0	0.39	1.3	0.66	1
2	12mm	0	0.39	1.3	0.66	1
3	12mm	0	0.39	1.3	2.36	1
4	12mm	0	0.39	1.3	8.39	1
1	12mm	0.7	0.63	1.2	0.92	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front		Brick	South East	0	0
1		Brick	South East	0	0
2		Brick	East	0	0
2		Brick	South	0	0
3		Brick	North East	0	0
4		Brick	North West	0	0
1		Sloping roof	South East	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type: Gross area: Openings: Net area: U-value: Ru value: Curtain wall: Kappa:

SAP Input

External Elements

Brick	102.78	17.35	85.43	0.25	0	False	60
Timber stud	16.45	0	16.45	0.25	0	False	9
Cold roof	2.81	0	2.81	0.11	0		9
Bay roof	0.6	0	0.6	0.11	0		9
Kitchen roof	4.3	0	4.3	0.11	0		9
Loft roof	18.16	0	18.16	0.11	0		9
Sloping roof	20.46	0.92	19.54	0.15	0		9
Suspended floor	40.3			0.11			75

Internal Elements

Metal stud	178.58						9
Int ceiling	52.69						9
Int Floor	52.69						18

Party Elements

Party wall	65.95						45
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Thermal bridges:

Thermal bridges:

User-defined (individual PSI-values) Y-Value = 0.0673

Length	Psi-value		
12.25	0.05	E2	Other lintels (including other steel lintels)
8.85	0.034	E3	Sill
33.6	0.04	E4	Jamb
18.4	0.06	E5	Ground floor (normal)
0	0.32	E20	Exposed floor (normal)
0	0.32	E21	Exposed floor (inverted)
15.33	0	E6	Intermediate floor within a dwelling
21.12	0.123	E10	Eaves (insulation at ceiling level)
15.32	0.24	E24	Eaves (insulation at ceiling level - inverted)
0	0.033	E11	Eaves (insulation at rafter level)
0.74	0.063	E12	Gable (insulation at ceiling level)
3.87	0.08	E13	Gable (insulation at rafter level)
27.39	0.05	E16	Corner (normal)
12.35	-0.069	E17	Corner (inverted internal area greater than external area)
15.05	0.072	E18	Party wall between dwellings
0	0.12	E25	Staggered party wall between dwellings
10.45	0.043	P1	Ground floor
15.45	0	P2	Intermediate floor within a dwelling
0	0.16	P7	Exposed floor (normal)
5	0.055	P4	Roof (insulation at ceiling level)
6.03	0.069	P5	Roof (insulation at rafter level)
0.98	0.08	R1	Head
0.98	0.06	R2	Sill
1.92	0.08	R3	Jamb
7.64	0.06	R6	Flat ceiling
6.33	0.06	R8	Roof wall (rafter)

Ventilation:

Pressure test:	Yes (As built)
Ventilation:	Decentralised whole house extract
	Number of fans in Wetroom: Kitchen 1 Other 3
	Ductwork: ,
	Approved Installation Scheme: True
Number of chimneys:	0
Number of open flues:	0
Number of fans:	0
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	4.44 (Assessed dwelling is tested)

SAP Input

Main heating system:

Main heating system: Boiler systems with radiators or underfloor heating
 Gas boilers and oil boilers
 Fuel: mains gas
 Info Source: Boiler Database
 Database: (rev 512, product index 018738) Efficiency: Winter 86.7 % Summer: 89.9
 Brand name: Baxi
 Model: ASSURE
 Model qualifier: 36 COMBI
 (Combi boiler)
 Systems with radiators
 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature >45°C
 Open
 Boiler interlock: Yes

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical services
 Control code: 2110

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
 Water code: 901
 Fuel :mains gas
 No hot water cylinder
 Solar panel: False

Others:

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 100%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: Photovoltaic 1
 Installed Peak power: 0.6
 Tilt of collector: 45°
 Overshading: None or very little
 Collector Orientation: South East
 Assess Zero Carbon Home: No

DER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 9 As Built

Address : 34 Northfield Road, READING, RG1 8AH

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.3	(1a) x	2.5	(2a) =	100.75 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.99	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	236.5 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 (6a)
Number of open flues	0	+	0	=	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.44000005722046	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.22	(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) =		0.19	(21)
Infiltration rate modified for monthly wind speed				

DER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.24	0.24	0.23	0.21	0.2	0.18	0.18	0.17	0.19	0.2	0.21	0.22
--	------	------	------	------	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)
---------	---	---	---	---	---	---	---	---	---	---	---	---	-------

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
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c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)
---------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-------

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)
---------	---	---	---	---	---	---	---	---	---	---	---	---	-------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)
--------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1.5	= 3.18		(26)
Windows Type 1			3.16	x 1/[1/(1.3)+ 0.04]	= 3.9		(27)
Windows Type 2			0.66	x 1/[1/(1.3)+ 0.04]	= 0.82		(27)
Windows Type 3			0.66	x 1/[1/(1.3)+ 0.04]	= 0.82		(27)
Windows Type 4			2.36	x 1/[1/(1.3)+ 0.04]	= 2.92		(27)
Windows Type 5			8.39	x 1/[1/(1.3)+ 0.04]	= 10.37		(27)
Rooflights			0.92	x 1/[1/(1.2) + 0.04]	= 1.104		(27b)
Floor			40.3	x 0.11	= 4.433	75	3022.5 (28)
Walls Type1	102.78	17.35	85.43	x 0.25	= 21.36	60	5125.8 (29)
Walls Type2	16.45	0	16.45	x 0.25	= 4.11	9	148.05 (29)
Roof Type1	2.81	0	2.81	x 0.11	= 0.31	9	25.29 (30)
Roof Type2	0.6	0	0.6	x 0.11	= 0.07	9	5.4 (30)
Roof Type3	4.3	0	4.3	x 0.11	= 0.47	9	38.7 (30)
Roof Type4	18.16	0	18.16	x 0.11	= 2	9	163.44 (30)
Roof Type5	20.46	0.92	19.54	x 0.15	= 2.93	9	175.86 (30)
Total area of elements, m²			205.86				(31)
Party wall			65.95	x 0	= 0	45	2967.75 (32)

DER WorkSheet: New dwelling as built

Internal wall **	178.58	9	1607.22 (32c)
Internal floor	52.69	18	948.42 (32d)
Internal ceiling	52.69	9	474.21 (32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = $S(A \times U)$ (26)...(30) + (32) = 58.73 (33)

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = 14702.64 (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in kJ/m²K = (34) $\div$ (4) = 158.11 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : $S(L \times Y)$ calculated using Appendix K 13.86 (36)

if details of thermal bridging are not known (36) = $0.05 \times (31)$

Total fabric heat loss (33) + (36) = 72.6 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	39.02	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	111.62	
Average = Sum(39) _{1...12} /12=												111.62	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m $\div$ (4)

(40)m=	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
Average = Sum(40) _{1...12} /12=												1.2	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if $TFA > 13.9$, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if $TFA \leq 13.9$, $N = 1$

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 97.48 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	107.23	103.33	99.43	95.53	91.63	87.73	87.73	91.63	95.53	99.43	103.33	107.23	
Total = Sum(44) _{1...12} =												1169.78	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times nm \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.02	139.08	143.52	125.12	120.06	103.6	96	110.16	111.48	129.92	141.81	154	
Total = Sum(45) _{1...12} =												1533.76	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.85	20.86	21.53	18.77	18.01	15.54	14.4	16.52	16.72	19.49	21.27	23.1	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

DER WorkSheet: New dwelling as built

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0	(48)
---	------

Temperature factor from Table 2b

0	(49)
---	------

Energy lost from water storage, kWh/year

(48) x (49) =

0	(50)
---	------

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0	(51)
---	------

If community heating see section 4.3

Volume factor from Table 2a

0	(52)
---	------

Temperature factor from Table 2b

0	(53)
---	------

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0	(54)
---	------

Enter (50) or (54) in (55)

0	(55)
---	------

Water storage loss calculated for each month

((56)m = (55) x (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 x (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 x (41)m

(61)m=

11.82	10.67	11.8	11.39	11.75	11.35	11.71	11.74	11.37	11.78	11.42	11.82
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82
--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------

(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=

170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82
--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------

Output from water heater (annual)_{1...12} 1672.39 (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=

55.83	48.91	50.67	44.45	42.86	37.28	34.85	39.56	39.91	46.14	50.01	54.16
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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
133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22	133.22

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

22.35	19.85	16.14	12.22	9.14	7.71	8.33	10.83	14.54	18.46	21.55	22.97
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

244.47	247.01	240.62	227.01	209.83	193.68	182.89	180.36	186.75	200.36	217.54	233.69
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32	36.32
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

DER WorkSheet: New dwelling as built

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

75.04	72.79	68.1	61.74	57.6	51.78	46.84	53.18	55.43	62.02	69.46	72.79
-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

407.83	405.61	390.83	366.93	342.53	319.14	304.03	310.33	322.69	346.81	374.51	395.42
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>11.28</td></tr></table>	11.28	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>8</td></tr></table>	8	(75)
0.77																			
2.36																			
11.28																			
0.39																			
1.11																			
8																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>22.97</td></tr></table>	22.97	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>16.28</td></tr></table>	16.28	(75)
0.77																			
2.36																			
22.97																			
0.39																			
1.11																			
16.28																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>41.38</td></tr></table>	41.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>29.33</td></tr></table>	29.33	(75)
0.77																			
2.36																			
41.38																			
0.39																			
1.11																			
29.33																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>67.96</td></tr></table>	67.96	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>48.16</td></tr></table>	48.16	(75)
0.77																			
2.36																			
67.96																			
0.39																			
1.11																			
48.16																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.35</td></tr></table>	91.35	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>64.74</td></tr></table>	64.74	(75)
0.77																			
2.36																			
91.35																			
0.39																			
1.11																			
64.74																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>97.38</td></tr></table>	97.38	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>69.02</td></tr></table>	69.02	(75)
0.77																			
2.36																			
97.38																			
0.39																			
1.11																			
69.02																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>91.1</td></tr></table>	91.1	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>64.56</td></tr></table>	64.56	(75)
0.77																			
2.36																			
91.1																			
0.39																			
1.11																			
64.56																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>72.63</td></tr></table>	72.63	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>51.47</td></tr></table>	51.47	(75)
0.77																			
2.36																			
72.63																			
0.39																			
1.11																			
51.47																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>50.42</td></tr></table>	50.42	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>35.73</td></tr></table>	35.73	(75)
0.77																			
2.36																			
50.42																			
0.39																			
1.11																			
35.73																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>28.07</td></tr></table>	28.07	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>19.89</td></tr></table>	19.89	(75)
0.77																			
2.36																			
28.07																			
0.39																			
1.11																			
19.89																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>14.2</td></tr></table>	14.2	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>10.06</td></tr></table>	10.06	(75)
0.77																			
2.36																			
14.2																			
0.39																			
1.11																			
10.06																			
Northeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.36</td></tr></table>	2.36	x	<table><tr><td>9.21</td></tr></table>	9.21	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>6.53</td></tr></table>	6.53	(75)
0.77																			
2.36																			
9.21																			
0.39																			
1.11																			
6.53																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>19.64</td></tr></table>	19.64	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>3.89</td></tr></table>	3.89	(76)
0.77																			
0.66																			
19.64																			
0.39																			
1.11																			
3.89																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>38.42</td></tr></table>	38.42	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>7.61</td></tr></table>	7.61	(76)
0.77																			
0.66																			
38.42																			
0.39																			
1.11																			
7.61																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>63.27</td></tr></table>	63.27	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>12.54</td></tr></table>	12.54	(76)
0.77																			
0.66																			
63.27																			
0.39																			
1.11																			
12.54																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>92.28</td></tr></table>	92.28	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>18.29</td></tr></table>	18.29	(76)
0.77																			
0.66																			
92.28																			
0.39																			
1.11																			
18.29																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>113.09</td></tr></table>	113.09	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>22.41</td></tr></table>	22.41	(76)
0.77																			
0.66																			
113.09																			
0.39																			
1.11																			
22.41																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>115.77</td></tr></table>	115.77	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>22.95</td></tr></table>	22.95	(76)
0.77																			
0.66																			
115.77																			
0.39																			
1.11																			
22.95																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>110.22</td></tr></table>	110.22	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>21.85</td></tr></table>	21.85	(76)
0.77																			
0.66																			
110.22																			
0.39																			
1.11																			
21.85																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>94.68</td></tr></table>	94.68	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>18.76</td></tr></table>	18.76	(76)
0.77																			
0.66																			
94.68																			
0.39																			
1.11																			
18.76																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>73.59</td></tr></table>	73.59	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>14.59</td></tr></table>	14.59	(76)
0.77																			
0.66																			
73.59																			
0.39																			
1.11																			
14.59																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>45.59</td></tr></table>	45.59	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>9.04</td></tr></table>	9.04	(76)
0.77																			
0.66																			
45.59																			
0.39																			
1.11																			
9.04																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>24.49</td></tr></table>	24.49	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>4.85</td></tr></table>	4.85	(76)
0.77																			
0.66																			
24.49																			
0.39																			
1.11																			
4.85																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>0.66</td></tr></table>	0.66	x	<table><tr><td>16.15</td></tr></table>	16.15	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>3.2</td></tr></table>	3.2	(76)
0.77																			
0.66																			
16.15																			
0.39																			
1.11																			
3.2																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>34.92</td></tr></table>	34.92	(77)
0.77																			
3.16																			
36.79																			
0.39																			
1.11																			
34.92																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>59.47</td></tr></table>	59.47	(77)
0.77																			
3.16																			
62.67																			
0.39																			
1.11																			
59.47																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>81.37</td></tr></table>	81.37	(77)
0.77																			
3.16																			
85.75																			
0.39																			
1.11																			
81.37																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>100.83</td></tr></table>	100.83	(77)
0.77																			
3.16																			
106.25																			
0.39																			
1.11																			
100.83																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>112.93</td></tr></table>	112.93	(77)
0.77																			
3.16																			
119.01																			
0.39																			
1.11																			
112.93																			
Southeast	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>3.16</td></tr></table>	3.16	x	<table><tr><td>118.15</td></tr></table>	118.15	x	<table><tr><td>0.39</td></tr></table>	0.39	x	<table><tr><td>1.11</td></tr></table>	1.11	=	<table><tr><td>112.12</td></tr></table>	112.12	(77)
0.77																			
3.16																			
118.15																			
0.39																			
1.11																			
112.12																			

DER WorkSheet: New dwelling as built

Southeast	0.9x	0.77	x	3.16	x	113.91	x	0.39	x	1.11	=	108.09	(77)
Southeast	0.9x	0.77	x	3.16	x	104.39	x	0.39	x	1.11	=	99.06	(77)
Southeast	0.9x	0.77	x	3.16	x	92.85	x	0.39	x	1.11	=	88.11	(77)
Southeast	0.9x	0.77	x	3.16	x	69.27	x	0.39	x	1.11	=	65.73	(77)
Southeast	0.9x	0.77	x	3.16	x	44.07	x	0.39	x	1.11	=	41.82	(77)
Southeast	0.9x	0.77	x	3.16	x	31.49	x	0.39	x	1.11	=	29.88	(77)
South	0.9x	0.77	x	0.66	x	46.75	x	0.39	x	1.11	=	9.27	(78)
South	0.9x	0.77	x	0.66	x	76.57	x	0.39	x	1.11	=	15.18	(78)
South	0.9x	0.77	x	0.66	x	97.53	x	0.39	x	1.11	=	19.33	(78)
South	0.9x	0.77	x	0.66	x	110.23	x	0.39	x	1.11	=	21.85	(78)
South	0.9x	0.77	x	0.66	x	114.87	x	0.39	x	1.11	=	22.77	(78)
South	0.9x	0.77	x	0.66	x	110.55	x	0.39	x	1.11	=	21.91	(78)
South	0.9x	0.77	x	0.66	x	108.01	x	0.39	x	1.11	=	21.41	(78)
South	0.9x	0.77	x	0.66	x	104.89	x	0.39	x	1.11	=	20.79	(78)
South	0.9x	0.77	x	0.66	x	101.89	x	0.39	x	1.11	=	20.19	(78)
South	0.9x	0.77	x	0.66	x	82.59	x	0.39	x	1.11	=	16.37	(78)
South	0.9x	0.77	x	0.66	x	55.42	x	0.39	x	1.11	=	10.98	(78)
South	0.9x	0.77	x	0.66	x	40.4	x	0.39	x	1.11	=	8.01	(78)
Northwest	0.9x	0.77	x	8.39	x	11.28	x	0.39	x	1.11	=	28.43	(81)
Northwest	0.9x	0.77	x	8.39	x	22.97	x	0.39	x	1.11	=	57.87	(81)
Northwest	0.9x	0.77	x	8.39	x	41.38	x	0.39	x	1.11	=	104.25	(81)
Northwest	0.9x	0.77	x	8.39	x	67.96	x	0.39	x	1.11	=	171.22	(81)
Northwest	0.9x	0.77	x	8.39	x	91.35	x	0.39	x	1.11	=	230.15	(81)
Northwest	0.9x	0.77	x	8.39	x	97.38	x	0.39	x	1.11	=	245.36	(81)
Northwest	0.9x	0.77	x	8.39	x	91.1	x	0.39	x	1.11	=	229.53	(81)
Northwest	0.9x	0.77	x	8.39	x	72.63	x	0.39	x	1.11	=	182.98	(81)
Northwest	0.9x	0.77	x	8.39	x	50.42	x	0.39	x	1.11	=	127.04	(81)
Northwest	0.9x	0.77	x	8.39	x	28.07	x	0.39	x	1.11	=	70.72	(81)
Northwest	0.9x	0.77	x	8.39	x	14.2	x	0.39	x	1.11	=	35.77	(81)
Northwest	0.9x	0.77	x	8.39	x	9.21	x	0.39	x	1.11	=	23.22	(81)
Rooflights	0.9x	1	x	0.92	x	39.98	x	0.63	x	0.7	=	14.6	(82)
Rooflights	0.9x	1	x	0.92	x	73.48	x	0.63	x	0.7	=	26.83	(82)
Rooflights	0.9x	1	x	0.92	x	112.11	x	0.63	x	0.7	=	40.94	(82)
Rooflights	0.9x	1	x	0.92	x	153.81	x	0.63	x	0.7	=	56.16	(82)
Rooflights	0.9x	1	x	0.92	x	182.63	x	0.63	x	0.7	=	66.69	(82)
Rooflights	0.9x	1	x	0.92	x	184.99	x	0.63	x	0.7	=	67.55	(82)
Rooflights	0.9x	1	x	0.92	x	176.88	x	0.63	x	0.7	=	64.59	(82)
Rooflights	0.9x	1	x	0.92	x	155.4	x	0.63	x	0.7	=	56.74	(82)
Rooflights	0.9x	1	x	0.92	x	126.86	x	0.63	x	0.7	=	46.32	(82)
Rooflights	0.9x	1	x	0.92	x	84.6	x	0.63	x	0.7	=	30.89	(82)
Rooflights	0.9x	1	x	0.92	x	48.93	x	0.63	x	0.7	=	17.87	(82)

DER WorkSheet: New dwelling as built

Rooflights $0.9x$

1

 $\times$

0.92

 $\times$

33.5

 $\times$

0.63

 $\times$

0.7

 =

12.23

 (82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ... (82)m

(83)m=

99.09	183.24	287.76	416.51	519.69	538.9	510.03	429.81	331.98	212.63	121.35	83.06
-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

506.92	588.85	678.59	783.44	862.22	858.05	814.07	740.15	654.67	559.44	495.87	478.48
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.99	0.97	0.93	0.84	0.7	0.56	0.62	0.83	0.96	0.99	0.99

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

19.09	19.29	19.65	20.12	20.56	20.84	20.95	20.92	20.68	20.12	19.51	19.03
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92	19.92
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

0.99	0.98	0.96	0.91	0.8	0.62	0.44	0.5	0.77	0.94	0.98	0.99
------	------	------	------	-----	------	------	-----	------	------	------	------

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

17.36	17.66	18.18	18.86	19.45	19.79	19.89	19.87	19.62	18.86	17.98	17.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) =

0.16

 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

17.64	17.92	18.42	19.06	19.63	19.96	20.06	20.04	19.8	19.07	18.23	17.57
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

17.64	17.92	18.42	19.06	19.63	19.96	20.06	20.04	19.8	19.07	18.23	17.57
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=

0.98	0.97	0.95	0.89	0.78	0.62	0.45	0.52	0.76	0.93	0.97	0.99
------	------	------	------	------	------	------	------	------	------	------	------

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

498.64	572.91	644.04	699.32	676.61	532.56	370.25	381.64	499.65	517.77	482.98	471.94
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

1489.45	1453.77	1330.56	1134.42	884.99	598.16	386.51	406.79	635.7	945.11	1241.89	1492.23
---------	---------	---------	---------	--------	--------	--------	--------	-------	--------	---------	---------

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

737.16	591.94	510.77	313.27	155.04	0	0	0	0	317.94	546.42	759.1
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	-------

 (98)

Total per year (kWh/year) = Sum(98)_{...5,9...12} =

3931.62

 (98)

Space heating requirement in kWh/m²/year

42.28

 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

DER WorkSheet: New dwelling as built

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		89.9	(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)												
737.16	591.94	510.77	313.27	155.04	0	0	0	0	317.94	546.42	759.1	
(211)m = {[[(98)m x (204)] } x 100 ÷ (206)												
819.98	658.44	568.15	348.46	172.45	0	0	0	0	353.66	607.81	844.38	
Total (kWh/year) = Sum(211) _{1..5,10...12} =												4373.33
(211)												

Space heating fuel (secondary), kWh/month												
= {[[(98)m x (201)] } x 100 ÷ (208)												
(215)m=	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =												0
(215)												

Water heating

Output from water heater (calculated above)												
170.84	149.75	155.32	136.51	131.81	114.95	107.71	121.9	122.85	141.7	153.24	165.82	
Efficiency of water heater												86.7
(217)m=	89.28	89.24	89.13	88.9	88.4	86.7	86.7	86.7	86.7	88.89	89.18	89.31
(217)												
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	191.36	167.82	174.25	153.55	149.1	132.58	124.24	140.6	141.69	159.41	171.83	185.67
Total = Sum(219a) _{1..12} =												1892.1
(219)												

Annual totals

Space heating fuel used, main system 1		4373.33	
Water heating fuel used		1892.1	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	68.83		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	143.83	(231)
Electricity for lighting		394.69	(232)
Electricity generated by PVs		-481.92	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6322.04	(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	=	944.64
Space heating (secondary)	(215) x		0.519	=	0
Water heating	(219) x		0.216	=	408.69

DER WorkSheet: New dwelling as built

Space and water heating	$(261) + (262) + (263) + (264) =$			1353.33	(265)
Electricity for pumps, fans and electric keep-hot	$(231) \times$	0.519	=	74.65	(267)
Electricity for lighting	$(232) \times$	0.519	=	204.84	(268)
Energy saving/generation technologies Item 1		0.519	=	-250.12	(269)
Total CO2, kg/year	$\text{sum of (265)...(271) =}$			1382.71	(272)
Dwelling CO2 Emission Rate	$(272) \div (4) =$			14.87	(273)
El rating (section 14)				87	(274)

TER WorkSheet: New dwelling as built

User Details:

Assessor Name: Matt Fitzpatrick **Stroma Number:** STRO003572
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: 9 As Built

Address : 34 Northfield Road, READING, RG1 8AH

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	40.3	(1a) x	2.5	(2a) =	100.75 (3a)
First floor	35.42	(1b) x	2.7	(2b) =	95.63 (3b)
Second floor	17.27	(1c) x	2.32	(2c) =	40.12 (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	92.99	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	236.5 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0
Number of open flues	0	+	0	=	0
Number of intermittent fans				3	30
Number of passive vents				0	0
Number of flueless gas fires				0	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32	(21)
Infiltration rate modified for monthly wind speed				

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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TER WorkSheet: New dwelling as built

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.3	0.32	0.34	0.36	0.38
--	------	-----	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 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 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.56 0.57 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.12	x 1	= 2.12		(26)
Windows Type 1			3.16	x1/[1/(1.4)+ 0.04] =	4.19		(27)
Windows Type 2			0.66	x1/[1/(1.4)+ 0.04] =	0.88		(27)
Windows Type 3			0.66	x1/[1/(1.4)+ 0.04] =	0.88		(27)
Windows Type 4			2.36	x1/[1/(1.4)+ 0.04] =	3.13		(27)
Windows Type 5			8.39	x1/[1/(1.4)+ 0.04] =	11.12		(27)
Rooflights			0.92	x1/[1/(1.7) + 0.04] =	1.564		(27b)
Floor			40.3	x 0.13	= 5.239		(28)
Walls Type1	102.78	17.35	85.43	x 0.18	= 15.38		(29)
Walls Type2	16.45	0	16.45	x 0.18	= 2.96		(29)
Roof Type1	2.81	0	2.81	x 0.13	= 0.37		(30)
Roof Type2	0.6	0	0.6	x 0.13	= 0.08		(30)
Roof Type3	4.3	0	4.3	x 0.13	= 0.56		(30)
Roof Type4	18.16	0	18.16	x 0.13	= 2.36		(30)
Roof Type5	20.46	0.92	19.54	x 0.13	= 2.54		(30)
Total area of elements, m²			205.86				(31)
Party wall			65.95	x 0	= 0		(32)

TER WorkSheet: New dwelling as built

Internal wall **	178.58		(32c)
Internal floor	52.69		(32d)
Internal ceiling	52.69		(32e)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 53.26 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 14702.64 (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 16.28 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 69.54 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.53	45.28	45.03	43.87	43.65	42.64	42.64	42.45	43.03	43.65	44.09	44.55	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	115.07	114.82	114.57	113.41	113.19	112.17	112.17	111.99	112.56	113.19	113.63	114.09	
Average = Sum(39) _{1...12} /12=												113.4	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.24	1.23	1.23	1.22	1.22	1.21	1.21	1.2	1.21	1.22	1.22	1.23	
Average = Sum(40) _{1...12} /12=												1.22	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.66 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.48 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.23	103.33	99.43	95.53	91.63	87.73	87.73	91.63	95.53	99.43	103.33	107.23	
Total = Sum(44) _{1...12} =												1169.78	(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.02	139.08	143.52	125.12	120.06	103.6	96	110.16	111.48	129.92	141.81	154	
Total = Sum(45) _{1...12} =												1533.76	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.85	20.86	21.53	18.77	18.01	15.54	14.4	16.52	16.72	19.49	21.27	23.1	(46)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

TER WorkSheet: New dwelling as built

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0

(54)

Enter (50) or (54) in (55)

0

(55)

Water storage loss calculated for each month

((56)m = (55) x (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 x (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 x (41)m

(61)m= 50.96 46.03 50.67 47.11 46.69 43.27 44.71 46.69 47.11 50.67 49.32 50.96

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m= 209.98 185.11 194.19 172.23 166.75 146.87 140.71 156.86 158.59 180.59 191.13 204.96

(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= 209.98 185.11 194.19 172.23 166.75 146.87 140.71 156.86 158.59 180.59 191.13 204.96

Output from water heater (annual)_{1...12}

2107.94

(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= 65.61 57.75 60.39 53.38 51.59 45.26 43.1 48.3 48.84 55.86 59.48 63.94

(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= 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22 133.22

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m= 22.35 19.85 16.14 12.22 9.14 7.71 8.33 10.83 14.54 18.46 21.55 22.97

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m= 244.47 247.01 240.62 227.01 209.83 193.68 182.89 180.36 186.75 200.36 217.54 233.69

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m= 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32 36.32

(69)

Pumps and fans gains (Table 5a)

(70)m= 3 3 3 3 3 3 3 3 3 3 3 3

(70)

TER WorkSheet: New dwelling as built

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58	-106.58
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

88.19	85.94	81.16	74.14	69.34	62.87	57.93	64.92	67.84	75.09	82.61	85.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

420.98	418.76	403.89	379.34	354.27	330.23	315.12	322.08	335.1	359.87	387.67	408.57
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	2.36	x	11.28	x	0.63	x	0.7	=	8.14	(75)
Northeast 0.9x	0.77	x	2.36	x	22.97	x	0.63	x	0.7	=	16.56	(75)
Northeast 0.9x	0.77	x	2.36	x	41.38	x	0.63	x	0.7	=	29.84	(75)
Northeast 0.9x	0.77	x	2.36	x	67.96	x	0.63	x	0.7	=	49.01	(75)
Northeast 0.9x	0.77	x	2.36	x	91.35	x	0.63	x	0.7	=	65.88	(75)
Northeast 0.9x	0.77	x	2.36	x	97.38	x	0.63	x	0.7	=	70.24	(75)
Northeast 0.9x	0.77	x	2.36	x	91.1	x	0.63	x	0.7	=	65.71	(75)
Northeast 0.9x	0.77	x	2.36	x	72.63	x	0.63	x	0.7	=	52.38	(75)
Northeast 0.9x	0.77	x	2.36	x	50.42	x	0.63	x	0.7	=	36.37	(75)
Northeast 0.9x	0.77	x	2.36	x	28.07	x	0.63	x	0.7	=	20.24	(75)
Northeast 0.9x	0.77	x	2.36	x	14.2	x	0.63	x	0.7	=	10.24	(75)
Northeast 0.9x	0.77	x	2.36	x	9.21	x	0.63	x	0.7	=	6.65	(75)
East 0.9x	0.77	x	0.66	x	19.64	x	0.63	x	0.7	=	3.96	(76)
East 0.9x	0.77	x	0.66	x	38.42	x	0.63	x	0.7	=	7.75	(76)
East 0.9x	0.77	x	0.66	x	63.27	x	0.63	x	0.7	=	12.76	(76)
East 0.9x	0.77	x	0.66	x	92.28	x	0.63	x	0.7	=	18.61	(76)
East 0.9x	0.77	x	0.66	x	113.09	x	0.63	x	0.7	=	22.81	(76)
East 0.9x	0.77	x	0.66	x	115.77	x	0.63	x	0.7	=	23.35	(76)
East 0.9x	0.77	x	0.66	x	110.22	x	0.63	x	0.7	=	22.23	(76)
East 0.9x	0.77	x	0.66	x	94.68	x	0.63	x	0.7	=	19.1	(76)
East 0.9x	0.77	x	0.66	x	73.59	x	0.63	x	0.7	=	14.84	(76)
East 0.9x	0.77	x	0.66	x	45.59	x	0.63	x	0.7	=	9.2	(76)
East 0.9x	0.77	x	0.66	x	24.49	x	0.63	x	0.7	=	4.94	(76)
East 0.9x	0.77	x	0.66	x	16.15	x	0.63	x	0.7	=	3.26	(76)
Southeast 0.9x	0.77	x	3.16	x	36.79	x	0.63	x	0.7	=	35.53	(77)
Southeast 0.9x	0.77	x	3.16	x	62.67	x	0.63	x	0.7	=	60.53	(77)
Southeast 0.9x	0.77	x	3.16	x	85.75	x	0.63	x	0.7	=	82.81	(77)
Southeast 0.9x	0.77	x	3.16	x	106.25	x	0.63	x	0.7	=	102.61	(77)
Southeast 0.9x	0.77	x	3.16	x	119.01	x	0.63	x	0.7	=	114.93	(77)
Southeast 0.9x	0.77	x	3.16	x	118.15	x	0.63	x	0.7	=	114.1	(77)

TER WorkSheet: New dwelling as built

Southeast	0.9x	0.77	x	3.16	x	113.91	x	0.63	x	0.7	=	110.01	(77)
Southeast	0.9x	0.77	x	3.16	x	104.39	x	0.63	x	0.7	=	100.81	(77)
Southeast	0.9x	0.77	x	3.16	x	92.85	x	0.63	x	0.7	=	89.67	(77)
Southeast	0.9x	0.77	x	3.16	x	69.27	x	0.63	x	0.7	=	66.89	(77)
Southeast	0.9x	0.77	x	3.16	x	44.07	x	0.63	x	0.7	=	42.56	(77)
Southeast	0.9x	0.77	x	3.16	x	31.49	x	0.63	x	0.7	=	30.41	(77)
South	0.9x	0.77	x	0.66	x	46.75	x	0.63	x	0.7	=	9.43	(78)
South	0.9x	0.77	x	0.66	x	76.57	x	0.63	x	0.7	=	15.44	(78)
South	0.9x	0.77	x	0.66	x	97.53	x	0.63	x	0.7	=	19.67	(78)
South	0.9x	0.77	x	0.66	x	110.23	x	0.63	x	0.7	=	22.23	(78)
South	0.9x	0.77	x	0.66	x	114.87	x	0.63	x	0.7	=	23.17	(78)
South	0.9x	0.77	x	0.66	x	110.55	x	0.63	x	0.7	=	22.3	(78)
South	0.9x	0.77	x	0.66	x	108.01	x	0.63	x	0.7	=	21.79	(78)
South	0.9x	0.77	x	0.66	x	104.89	x	0.63	x	0.7	=	21.16	(78)
South	0.9x	0.77	x	0.66	x	101.89	x	0.63	x	0.7	=	20.55	(78)
South	0.9x	0.77	x	0.66	x	82.59	x	0.63	x	0.7	=	16.66	(78)
South	0.9x	0.77	x	0.66	x	55.42	x	0.63	x	0.7	=	11.18	(78)
South	0.9x	0.77	x	0.66	x	40.4	x	0.63	x	0.7	=	8.15	(78)
Northwest	0.9x	0.77	x	8.39	x	11.28	x	0.63	x	0.7	=	28.93	(81)
Northwest	0.9x	0.77	x	8.39	x	22.97	x	0.63	x	0.7	=	58.89	(81)
Northwest	0.9x	0.77	x	8.39	x	41.38	x	0.63	x	0.7	=	106.1	(81)
Northwest	0.9x	0.77	x	8.39	x	67.96	x	0.63	x	0.7	=	174.25	(81)
Northwest	0.9x	0.77	x	8.39	x	91.35	x	0.63	x	0.7	=	234.22	(81)
Northwest	0.9x	0.77	x	8.39	x	97.38	x	0.63	x	0.7	=	249.7	(81)
Northwest	0.9x	0.77	x	8.39	x	91.1	x	0.63	x	0.7	=	233.59	(81)
Northwest	0.9x	0.77	x	8.39	x	72.63	x	0.63	x	0.7	=	186.22	(81)
Northwest	0.9x	0.77	x	8.39	x	50.42	x	0.63	x	0.7	=	129.28	(81)
Northwest	0.9x	0.77	x	8.39	x	28.07	x	0.63	x	0.7	=	71.97	(81)
Northwest	0.9x	0.77	x	8.39	x	14.2	x	0.63	x	0.7	=	36.4	(81)
Northwest	0.9x	0.77	x	8.39	x	9.21	x	0.63	x	0.7	=	23.63	(81)
Rooflights	0.9x	1	x	0.92	x	39.98	x	0.63	x	0.7	=	14.6	(82)
Rooflights	0.9x	1	x	0.92	x	73.48	x	0.63	x	0.7	=	26.83	(82)
Rooflights	0.9x	1	x	0.92	x	112.11	x	0.63	x	0.7	=	40.94	(82)
Rooflights	0.9x	1	x	0.92	x	153.81	x	0.63	x	0.7	=	56.16	(82)
Rooflights	0.9x	1	x	0.92	x	182.63	x	0.63	x	0.7	=	66.69	(82)
Rooflights	0.9x	1	x	0.92	x	184.99	x	0.63	x	0.7	=	67.55	(82)
Rooflights	0.9x	1	x	0.92	x	176.88	x	0.63	x	0.7	=	64.59	(82)
Rooflights	0.9x	1	x	0.92	x	155.4	x	0.63	x	0.7	=	56.74	(82)
Rooflights	0.9x	1	x	0.92	x	126.86	x	0.63	x	0.7	=	46.32	(82)
Rooflights	0.9x	1	x	0.92	x	84.6	x	0.63	x	0.7	=	30.89	(82)
Rooflights	0.9x	1	x	0.92	x	48.93	x	0.63	x	0.7	=	17.87	(82)

TER WorkSheet: New dwelling as built

Rooflights 0.9x

 x

 x

 x

 x

 =

 (82)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=

100.59	186.01	292.13	422.88	527.7	547.24	517.91	436.41	337.04	215.85	123.19	84.32
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	-------

 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=

521.57	604.77	696.02	802.22	881.98	877.47	833.03	758.49	672.13	575.72	510.85	492.89
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	0.99	0.97	0.89	0.74	0.57	0.64	0.88	0.98	1	1

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=

19.61	19.76	20.03	20.41	20.73	20.93	20.98	20.97	20.82	20.39	19.93	19.58
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=

19.89	19.89	19.89	19.9	19.91	19.91	19.91	19.92	19.91	19.91	19.9	19.9
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	------

 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=

1	1	0.99	0.95	0.85	0.64	0.44	0.51	0.82	0.97	1	1
---	---	------	------	------	------	------	------	------	------	---	---

 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=

18.04	18.26	18.66	19.2	19.64	19.87	19.91	19.9	19.76	19.19	18.52	18
-------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	----

 (90)

fLA = Living area ÷ (4) =

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=

18.29	18.51	18.88	19.4	19.82	20.04	20.08	20.08	19.93	19.38	18.75	18.26
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=

18.29	18.51	18.88	19.4	19.82	20.04	20.08	20.08	19.93	19.38	18.75	18.26
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=

1	0.99	0.98	0.95	0.84	0.65	0.46	0.53	0.82	0.97	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=

519.88	600.66	683.84	758.33	744.65	573.75	385.38	401.86	549.98	557.38	507.56	491.67
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

1610.01	1562.15	1418.68	1190.2	919.09	610.17	390.77	411.92	656.26	994.07	1323.86	1604.13
---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------

 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=

811.05	646.12	546.72	310.94	129.79	0	0	0	0	324.9	587.74	827.67
--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------

 (98)

Total per year (kWh/year) = Sum(98).....5,9...12 =

(98)

Space heating requirement in kWh/m²/year

(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

(201)

TER WorkSheet: New dwelling as built

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		93.4	(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)												
811.05	646.12	546.72	310.94	129.79	0	0	0	0	324.9	587.74	827.67	
(211)m = {[[(98)m × (204)] } × 100 ÷ (206)												
868.37	691.78	585.35	332.91	138.96	0	0	0	0	347.86	629.27	886.16	
Total (kWh/year) = Sum(211) _{1..5,10...12} =												4480.66
(211)												

Space heating fuel (secondary), kWh/month
= {[[(98)m × (201)] } × 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1..5,10...12} =													0
(215)													(215)

Water heating

Output from water heater (calculated above)													
209.98	185.11	194.19	172.23	166.75	146.87	140.71	156.86	158.59	180.59	191.13	204.96		
Efficiency of water heater												80.3	(216)
(217)m=	88.12	87.94	87.52	86.52	84.43	80.3	80.3	80.3	80.3	86.51	87.69	88.2	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	238.28	210.5	221.89	199.06	197.51	182.9	175.23	195.34	197.5	208.74	217.95	232.39	
Total = Sum(219a) _{1..12} =												2477.27	(219)

Annual totals

	kWh/year											kWh/year
Space heating fuel used, main system 1												4480.66
Water heating fuel used												2477.27
Electricity for pumps, fans and electric keep-hot												
central heating pump:												30
boiler with a fan-assisted flue												45
Total electricity for the above, kWh/year	sum of (230a)...(230g) =											75
Electricity for lighting												394.69
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =												7427.62

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) ×	0.216	= 967.82
Space heating (secondary)	(215) ×	0.519	= 0
Water heating	(219) ×	0.216	= 535.09
Space and water heating	(261) + (262) + (263) + (264) =		1502.91
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	= 38.93

TER WorkSheet: New dwelling as built

Electricity for lighting	(232)	x	0.519	=	204.84	(268)
Total CO2, kg/year			sum of (265)...(271)	=	1746.68	(272)
TER	=				18.78	(273)