Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.8
Printed on 09 October 2020 at 11:49:28

Project Information:

Assessed By: Chris Mcdonald (STRO007579) **Building Type:** Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 175.06m²

Site Reference : Broome Farm Barn **Plot Reference:** Plot 1 LPG

Address : Land West of Broome Farm Barn, Broome, Craven Arms

Client Details:

Name: Neil Homer

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: Bulk LPG
Fuel factor: 1.06 (lpg)

Target Carbon Dioxide Emission Rate (TER)	15.49 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.42 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	52.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.16 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - LPG	
	Data from manufacturer	
	Efficiency 90.0 % SEDBUK2009	
	Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.79 kWh/day	
	Permitted by DBSCG: 2.30 kWh/day	OK
Primary pipework insulated:	Yes	OK

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Regulations Compliance Report

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Midlands):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North	9.69m²
Windows facing: South	21.2m²
Windows facing: East	2.9m²
Windows facing: West	1.3m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Roofs U-value	0.1 W/m²K
Photovoltaic array	

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Thermal Bridge Report

Property Details: Plot 1 LPG

Address:	Land West of Broome Farm Barn, Broome, Craven Arms
Located in:	England
Region:	Midlands

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0895

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Steel lintel with perforated steel base plate	0.5	25.88	E1	[A]
Sill	0.04	25.88	E3	[A]
Jamb	0.05	42.3	E4	[A]
Ground floor (normal)	0.16	45	E5	[A]
Intermediate floor within a dwelling	0.07	45	E6	[A]
Eaves (insulation at ceiling level)	0.06	25.05	E10	[A]
Gable (insulation at ceiling level)	0.24	20.3	E12	[A]
Corner (normal)	0.09	37.06	E16	[A]
Corner (inverted internal area greater than external area)	-0.09	16.62	E17	[A]

Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 England

Acorn Energy and Design

Assessor and House Details

Assessor Name: Chris Mcdonald **Assessor Number:** STRO007579

Property Address: Land West of Broome Farm Barn
Broome
Craven Arms

Buiding regulation assessment

	kg/m²/year
TER	15.49
DER	15.42

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO_2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2012 DER Worksheet		15.42	(ZC1)
TER		15.49	
Residual CO2 emissions offset from biofuel CHP		0	(ZC5)
CO2 emissions offset from additional allowable electricty generation		0	(ZC7)
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		15.42	
% improvement DER/TER	0.5		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	15.42	(ZC1)
CO2 emissions from appliances, equation (L14)	11.69	(ZC2)
CO2 emissions from cooking, equation (L16)	1.09	(ZC3)
Net CO2 emissions	27.2	(ZC8)

Result:

Credits awarded for ENE 1 = 0

Code Level = 3

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 52.46
Credits awarded for ENE 2 = 4.8

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		30.21
Standard DER		17.43
Actual Case CO2 emissions		27.17
Actual DER		14.39
Reduction in CO2 emissions	10.06	

Credits awarded for ENE 7 = 1

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.
It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

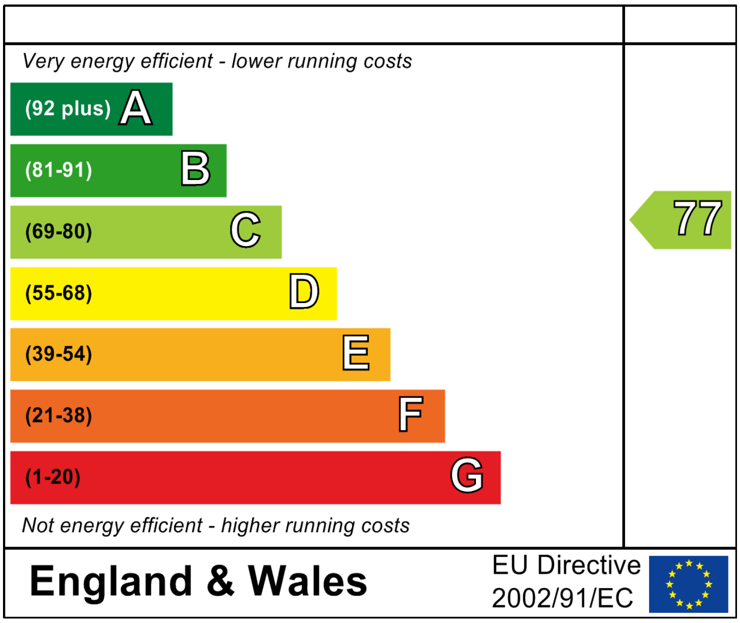
Predicted Energy Assessment

Land West of Broome Farm Barn Broome Craven Arms	Dwelling type: Date of assessment: Produced by: Total floor area:	Detached House 08 October 2020 Chris Mcdonald 175.06 m²

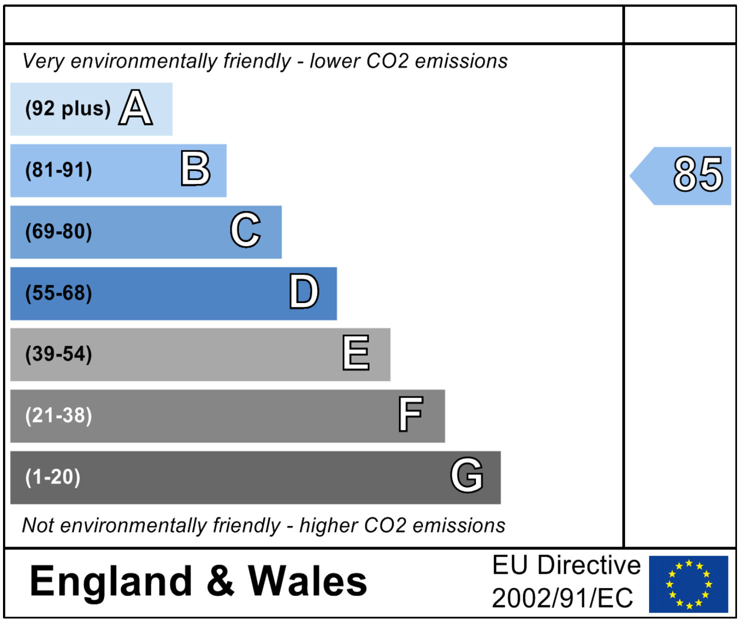
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

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

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



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

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

SAP Input

Property Details: Plot 1 LPG

Address:	Land West of Broome Farm Barn, Broome, Craven Arms
Located in:	England
Region:	Midlands
UPRN:	
Date of assessment:	08 October 2020
Date of certificate:	09 October 2020
Assessment type:	New dwelling design stage
Transaction type:	Marketed sale
Tenure type:	Owner-occupied
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	466

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2020

Floor Location:	Floor area:	Storey height:
Floor 0	92.92 m²	2.7 m
Floor 1	82.14 m²	2.41 m

Living area:	25.81 m² (fraction 0.147)
Front of dwelling faces:	South

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
North	Manufacturer	Solid			Wood
North	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	Wood
South	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	Wood
East	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	Wood
West	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	Wood

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
North	mm	0.7	0	1.6	1.9	1
North	16mm or more	0.7	0.63	1.4	9.69	1
South	16mm or more	0.7	0.63	1.4	21.2	1
East	16mm or more	0.7	0.63	1.4	2.9	1
West	16mm or more	0.7	0.63	1.4	1.3	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
North		External wall	North	0	0
North		External wall	North	0	0
South		External wall	South	0	0
East		External wall	East	0	0
West		External wall	West	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>							
External wall	201.48	36.99	164.49	0.16	0	False	N/A
Flat ceiling	92.92	0	92.92	0.1	0		N/A
Ground floor	92.92			0.14			N/A

SAP Input

Internal Elements
Party Elements

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0895

	Length	Psi-value		
[Approved]	25.88	0.5	E1	Steel lintel with perforated steel base plate
[Approved]	25.88	0.04	E3	Sill
[Approved]	42.3	0.05	E4	Jamb
[Approved]	45	0.16	E5	Ground floor (normal)
[Approved]	45	0.07	E6	Intermediate floor within a dwelling
[Approved]	25.05	0.06	E10	Eaves (insulation at ceiling level)
[Approved]	20.3	0.24	E12	Gable (insulation at ceiling level)
[Approved]	37.06	0.09	E16	Corner (normal)
[Approved]	16.62	-0.09	E17	Corner (inverted internal area greater than external area)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	1 (main: 0, secondary: 1, other: 0)
Number of fans:	5
Number of passive stacks:	0
Number of sides sheltered:	0
Pressure test:	5

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: bulk LPG
Info Source: Manufacturer Declaration
Manufacturer's data
Efficiency: 90.0% (SEDBUK2009)
Regular condensing with automatic ignition
Fuel Burning Type:
Underfloor heating, pipes in screed above insulation
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature<=35°C
Room-sealed
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 :bulk LPG
Hot water cylinder
Cylinder volume: 210 litres
Cylinder insulation: Factory 100 mm
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: True

SAP Input

Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	No
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Rural
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 1.5 Tilt of collector: 45° Overshading: Modest Collector Orientation: South
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Chris Mcdonald	**Stroma Number:**	STRO007579
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.8

Property Address: Plot 1 LPG

Address : Land West of Broome Farm Barn, Broome, Craven Arms

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	92.92	(1a)	x	2.7	(2a)	=	250.88	(3a)
First floor	82.14	(1b)	x	2.41	(2b)	=	197.96	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	175.06	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	448.84	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	1	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							5	x 10 =	50	(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) =	70	÷ (5) =	0.16	(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)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.41	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.52	0.51	0.5	0.45	0.44	0.39	0.39	0.38	0.41	0.44	0.46	0.48

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

(25)m=	0.63	0.63	0.62	0.6	0.6	0.57	0.57	0.57	0.58	0.6	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.9	x	1.6	=	3.04			(26)
Windows Type 1			9.69	x1/[1/(1.4)+ 0.04]		=	12.85			(27)
Windows Type 2			21.2	x1/[1/(1.4)+ 0.04]		=	28.11			(27)
Windows Type 3			2.9	x1/[1/(1.4)+ 0.04]		=	3.84			(27)
Windows Type 4			1.3	x1/[1/(1.4)+ 0.04]		=	1.72			(27)
Floor			92.92	x	0.14	=	13.0088			(28)
Walls	201.48	36.99	164.49	x	0.16	=	26.32			(29)
Roof	92.92	0	92.92	x	0.1	=	9.29			(30)
Total area of elements, m²			387.32							(31)

** 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) = 98.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12537.89 (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 34.65 (36)

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

Total fabric heat loss (33) + (36) = 132.83 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	93.9	93.13	92.37	88.83	88.16	85.07	85.07	84.5	86.26	88.16	89.51	90.91	(38)

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

(39)m=	226.73	225.96	225.21	221.66	221	217.91	217.91	217.34	219.1	221	222.34	223.74	

Average = Sum(39)$_{1…12}$ /12= 221.66 (39)

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

(40)m=	1.3	1.29	1.29	1.27	1.26	1.24	1.24	1.24	1.25	1.26	1.27	1.28	

Average = Sum(40)$_{1…12}$ /12= 1.27 (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 2.97 (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) + 36 104.72 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	115.19	111	106.82	102.63	98.44	94.25	94.25	98.44	102.63	106.82	111	115.19	

Total = Sum(44)$_{1…12}$ = 1256.65 (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=	170.83	149.41	154.17	134.41	128.97	111.29	103.13	118.34	119.76	139.56	152.35	165.44	

Total = Sum(45)$_{1…12}$ = 1647.67 (45)

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

(46)m=	25.62	22.41	23.13	20.16	19.35	16.69	15.47	17.75	17.96	20.93	22.85	24.82	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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) x (49) = 210 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.83 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0.97 (54)

Enter (50) or (54) in (55) 0.97 (55)

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

(56)m=	30.01	27.11	30.01	29.05	30.01	29.05	30.01	30.01	29.05	30.01	29.05	30.01	(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=	30.01	27.11	30.01	29.05	30.01	29.05	30.01	30.01	29.05	30.01	29.05	30.01	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	224.1	197.53	207.45	185.97	182.25	162.85	156.41	171.62	171.31	192.84	203.9	218.71	(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=	224.1	197.53	207.45	185.97	182.25	162.85	156.41	171.62	171.31	192.84	203.9	218.71

Output from water heater (annual)$_{1...12}$ — 2274.95 — (64)

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

(65)m=	99.42	88.17	93.88	85.94	85.5	78.25	76.91	81.97	81.06	89.03	91.9	97.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	178.16	178.16	178.16	178.16	178.16	178.16	178.16	178.16	178.16	178.16	178.16	178.16	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	77.79	69.09	56.19	42.54	31.8	26.85	29.01	37.71	50.61	64.26	75	79.95	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	517.43	522.8	509.27	480.46	444.1	409.93	387.1	381.73	395.26	424.06	460.42	494.6	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	55.79	55.79	55.79	55.79	55.79	55.79	55.79	55.79	55.79	55.79	55.79	55.79	(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=	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	(71)
Water heating gains (Table 5)													
(72)m=	133.63	131.21	126.19	119.36	114.92	108.68	103.38	110.17	112.59	119.66	127.64	131.22	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	847.02	841.27	809.82	760.53	709	663.63	637.65	647.78	676.63	726.15	781.23	823.94	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	9.69	x	10.63	x	0.63	x	0.7	=	31.49	(74)
North	0.9x	0.77	x	9.69	x	20.32	x	0.63	x	0.7	=	60.18	(74)
North	0.9x	0.77	x	9.69	x	34.53	x	0.63	x	0.7	=	102.26	(74)
North	0.9x	0.77	x	9.69	x	55.46	x	0.63	x	0.7	=	164.25	(74)
North	0.9x	0.77	x	9.69	x	74.72	x	0.63	x	0.7	=	221.26	(74)
North	0.9x	0.77	x	9.69	x	79.99	x	0.63	x	0.7	=	236.87	(74)
North	0.9x	0.77	x	9.69	x	74.68	x	0.63	x	0.7	=	221.15	(74)
North	0.9x	0.77	x	9.69	x	59.25	x	0.63	x	0.7	=	175.45	(74)
North	0.9x	0.77	x	9.69	x	41.52	x	0.63	x	0.7	=	122.95	(74)
North	0.9x	0.77	x	9.69	x	24.19	x	0.63	x	0.7	=	71.63	(74)
North	0.9x	0.77	x	9.69	x	13.12	x	0.63	x	0.7	=	38.85	(74)
North	0.9x	0.77	x	9.69	x	8.86	x	0.63	x	0.7	=	26.25	(74)
East	0.9x	0.77	x	2.9	x	19.64	x	0.63	x	0.7	=	17.41	(76)
East	0.9x	0.77	x	2.9	x	38.42	x	0.63	x	0.7	=	34.05	(76)
East	0.9x	0.77	x	2.9	x	63.27	x	0.63	x	0.7	=	56.08	(76)
East	0.9x	0.77	x	2.9	x	92.28	x	0.63	x	0.7	=	81.79	(76)
East	0.9x	0.77	x	2.9	x	113.09	x	0.63	x	0.7	=	100.23	(76)
East	0.9x	0.77	x	2.9	x	115.77	x	0.63	x	0.7	=	102.6	(76)
East	0.9x	0.77	x	2.9	x	110.22	x	0.63	x	0.7	=	97.68	(76)
East	0.9x	0.77	x	2.9	x	94.68	x	0.63	x	0.7	=	83.91	(76)
East	0.9x	0.77	x	2.9	x	73.59	x	0.63	x	0.7	=	65.22	(76)
East	0.9x	0.77	x	2.9	x	45.59	x	0.63	x	0.7	=	40.4	(76)
East	0.9x	0.77	x	2.9	x	24.49	x	0.63	x	0.7	=	21.7	(76)
East	0.9x	0.77	x	2.9	x	16.15	x	0.63	x	0.7	=	14.31	(76)
South	0.9x	0.77	x	21.2	x	46.75	x	0.63	x	0.7	=	302.91	(78)
South	0.9x	0.77	x	21.2	x	76.57	x	0.63	x	0.7	=	496.08	(78)
South	0.9x	0.77	x	21.2	x	97.53	x	0.63	x	0.7	=	631.92	(78)
South	0.9x	0.77	x	21.2	x	110.23	x	0.63	x	0.7	=	714.21	(78)
South	0.9x	0.77	x	21.2	x	114.87	x	0.63	x	0.7	=	744.25	(78)
South	0.9x	0.77	x	21.2	x	110.55	x	0.63	x	0.7	=	716.24	(78)
South	0.9x	0.77	x	21.2	x	108.01	x	0.63	x	0.7	=	699.81	(78)
South	0.9x	0.77	x	21.2	x	104.89	x	0.63	x	0.7	=	679.61	(78)
South	0.9x	0.77	x	21.2	x	101.89	x	0.63	x	0.7	=	660.12	(78)
South	0.9x	0.77	x	21.2	x	82.59	x	0.63	x	0.7	=	535.07	(78)
South	0.9x	0.77	x	21.2	x	55.42	x	0.63	x	0.7	=	359.05	(78)
South	0.9x	0.77	x	21.2	x	40.4	x	0.63	x	0.7	=	261.74	(78)
West	0.9x	0.77	x	1.3	x	19.64	x	0.63	x	0.7	=	7.8	(80)
West	0.9x	0.77	x	1.3	x	38.42	x	0.63	x	0.7	=	15.26	(80)
West	0.9x	0.77	x	1.3	x	63.27	x	0.63	x	0.7	=	25.14	(80)
West	0.9x	0.77	x	1.3	x	92.28	x	0.63	x	0.7	=	36.66	(80)
West	0.9x	0.77	x	1.3	x	113.09	x	0.63	x	0.7	=	44.93	(80)

West	0.9x	0.77	x	1.3	x	115.77	x	0.63	x	0.7	=	46	(80)
West	0.9x	0.77	x	1.3	x	110.22	x	0.63	x	0.7	=	43.79	(80)
West	0.9x	0.77	x	1.3	x	94.68	x	0.63	x	0.7	=	37.61	(80)
West	0.9x	0.77	x	1.3	x	73.59	x	0.63	x	0.7	=	29.24	(80)
West	0.9x	0.77	x	1.3	x	45.59	x	0.63	x	0.7	=	18.11	(80)
West	0.9x	0.77	x	1.3	x	24.49	x	0.63	x	0.7	=	9.73	(80)
West	0.9x	0.77	x	1.3	x	16.15	x	0.63	x	0.7	=	6.42	(80)

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

(83)m=	359.61	605.58	815.39	996.91	1110.67	1101.71	1062.43	976.59	877.52	665.22	429.33	308.72	(83)

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

(84)m=	1206.63	1446.85	1625.21	1757.44	1819.67	1765.33	1700.08	1624.36	1554.15	1391.37	1210.56	1132.66	(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	0.99	0.98	0.95	0.87	0.72	0.55	0.59	0.81	0.96	0.99	1	(86)

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

(87)m=	19.93	20.08	20.28	20.54	20.76	20.89	20.93	20.93	20.84	20.56	20.2	19.91	(87)

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

(88)m=	19.84	19.85	19.85	19.87	19.87	19.88	19.88	19.89	19.88	19.87	19.86	19.86	(88)

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

(89)m=	1	0.99	0.97	0.93	0.82	0.62	0.42	0.46	0.73	0.94	0.99	1	(89)

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

(90)m=	18.42	18.64	18.94	19.32	19.6	19.77	19.8	19.8	19.72	19.36	18.83	18.4	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.65	18.85	19.14	19.5	19.77	19.93	19.96	19.96	19.89	19.54	19.03	18.63	(92)

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

(93)m=	18.65	18.85	19.14	19.5	19.77	19.93	19.96	19.96	19.89	19.54	19.03	18.63	(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	0.97	0.92	0.82	0.62	0.43	0.47	0.73	0.93	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1198.46	1424.58	1569.87	1615.36	1483.75	1101.21	725	762.01	1136.98	1298.4	1193.16	1126.84	(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=	3252.6	3153.03	2847.07	2349.53	1784.41	1161.93	732.92	774.39	1267.51	1974.74	2653.38	3227.75	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1528.28	1161.52	950.24	528.6	223.69	0	0	0	0	503.2	1051.35	1563.08	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	7509.95	(98)
Space heating requirement in kWh/m²/year	42.9	(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		90.9	(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)	1528.28	1161.52	950.24	528.6	223.69	0	0	0	0	503.2	1051.35	1563.08		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1681.28	1277.79	1045.37	581.52	246.08	0	0	0	0	553.57	1156.6	1719.56		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													8261.77	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	224.1	197.53	207.45	185.97	182.25	162.85	156.41	171.62	171.31	192.84	203.9	218.71		
Efficiency of water heater													80.8	(216)
(217)m=	89.47	89.28	88.91	88.04	86.07	80.8	80.8	80.8	80.8	87.86	89.09	89.53		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	250.48	221.25	233.33	211.24	211.75	201.55	193.57	212.4	212.02	219.49	228.87	244.3		
Total = Sum(219a)$_{1...12}$ =													2640.25	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			8261.77	
Water heating fuel used			2640.25	
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			549.53	(232)
Electricity generated by PVs			-1025.35	(233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year

Space heating - main system 1	(211) x	7.6	x 0.01 =	627.89	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	7.6	x 0.01 =	200.66	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	13.19	x 0.01 =	72.48	(250)
Additional standing charges (Table 12)				70	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	-135.24	(252)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)…(254) =			845.69	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.61	(257)
SAP rating (Section 12)		77.48	(258)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.241	=	1991.09	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.241	=	636.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2627.39	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	285.21	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-532.16	(269)
Total CO2, kg/year		sum of (265)…(271) =		2419.37	(272)
CO2 emissions per m²		(272) ÷ (4) =		13.82	(273)
EI rating (section 14)				85	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.09	=	9005.33	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.09	=	2877.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =			11883.21	(265)

SAP WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1687.07	(268)
Energy saving/generation technologies					
Item 1		3.07	=	-3147.82	(269)
'Total Primary Energy	sum of (265)…(271) =			10652.71	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			60.85	(273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Chris Mcdonald	**Stroma Number:**	STRO007579
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.8

Property Address: Plot 1 LPG

Address : Land West of Broome Farm Barn, Broome, Craven Arms

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.92	(1a) x	2.7	(2a) =	250.88	(3a)
First floor	82.14	(1b) x	2.41	(2b) =	197.96	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	175.06	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	448.84	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	1	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(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) =	40	÷ (5) =	0.09	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.34	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.43	0.42	0.42	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.9	x	1	=	1.9			(26)
Windows Type 1			9.69	x1/[1/(1.4)+ 0.04]		=	12.85			(27)
Windows Type 2			21.2	x1/[1/(1.4)+ 0.04]		=	28.11			(27)
Windows Type 3			2.9	x1/[1/(1.4)+ 0.04]		=	3.84			(27)
Windows Type 4			1.3	x1/[1/(1.4)+ 0.04]		=	1.72			(27)
Floor			92.92	x	0.13	=	12.0796			(28)
Walls	201.48	36.99	164.49	x	0.18	=	29.61			(29)
Roof	92.92	0	92.92	x	0.13	=	12.08			(30)
Total area of elements, m²			387.32							(31)

** 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) = 102.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12537.89 (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 16.46 (36)

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

Total fabric heat loss (33) + (36) = 118.65 (37)

TFEE WorkSheet: New dwelling design stage

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	87.9	87.37	86.84	84.36	83.9	81.75	81.75	81.35	82.58	83.9	84.84	85.82	(38)

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

(39)m=	206.56	206.02	205.49	203.02	202.55	200.4	200.4	200	201.23	202.55	203.49	204.47	

Average = Sum(39)1...12 /12= 203.01 (39)

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

(40)m=	1.18	1.18	1.17	1.16	1.16	1.14	1.14	1.14	1.15	1.16	1.16	1.17	

Average = Sum(40)1...12 /12= 1.16 (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 2.97 (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) + 36 104.72 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	115.19	111	106.82	102.63	98.44	94.25	94.25	98.44	102.63	106.82	111	115.19	

Total = Sum(44)1...12 = 1256.65 (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=	170.83	149.41	154.17	134.41	128.97	111.29	103.13	118.34	119.76	139.56	152.35	165.44	

Total = Sum(45)1...12 = 1647.67 (45)

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

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

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) 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) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

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

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

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

(62)m=	145.2	127	131.05	114.25	109.63	94.6	87.66	100.59	101.79	118.63	129.49	140.62	(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=	145.2	127	131.05	114.25	109.63	94.6	87.66	100.59	101.79	118.63	129.49	140.62

Output from water heater (annual)$_{1...12}$ — 1400.52 (64)

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

(65)m=	36.3	31.75	32.76	28.56	27.41	23.65	21.92	25.15	25.45	29.66	32.37	35.16	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	(66)

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

(67)m=	31.12	27.64	22.48	17.02	12.72	10.74	11.6	15.08	20.24	25.7	30	31.98	(67)

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

(68)m=	346.68	350.27	341.21	321.91	297.55	274.65	259.35	255.76	264.82	284.12	308.48	331.38	(68)

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

(69)m=	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	(71)

Water heating gains (Table 5)

(72)m=	48.79	47.25	44.04	39.67	36.84	32.85	29.46	33.8	35.34	39.86	44.96	47.25	(72)

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

(73)m=	494.12	492.7	475.26	446.13	414.64	385.78	367.95	372.18	387.95	417.23	450.99	478.15	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

TFEE WorkSheet: New dwelling design stage

North	0.9x	0.77	x	9.69	x	10.63	x	0.63	x	0.7	=	31.49	(74)
North	0.9x	0.77	x	9.69	x	20.32	x	0.63	x	0.7	=	60.18	(74)
North	0.9x	0.77	x	9.69	x	34.53	x	0.63	x	0.7	=	102.26	(74)
North	0.9x	0.77	x	9.69	x	55.46	x	0.63	x	0.7	=	164.25	(74)
North	0.9x	0.77	x	9.69	x	74.72	x	0.63	x	0.7	=	221.26	(74)
North	0.9x	0.77	x	9.69	x	79.99	x	0.63	x	0.7	=	236.87	(74)
North	0.9x	0.77	x	9.69	x	74.68	x	0.63	x	0.7	=	221.15	(74)
North	0.9x	0.77	x	9.69	x	59.25	x	0.63	x	0.7	=	175.45	(74)
North	0.9x	0.77	x	9.69	x	41.52	x	0.63	x	0.7	=	122.95	(74)
North	0.9x	0.77	x	9.69	x	24.19	x	0.63	x	0.7	=	71.63	(74)
North	0.9x	0.77	x	9.69	x	13.12	x	0.63	x	0.7	=	38.85	(74)
North	0.9x	0.77	x	9.69	x	8.86	x	0.63	x	0.7	=	26.25	(74)
East	0.9x	0.77	x	2.9	x	19.64	x	0.63	x	0.7	=	17.41	(76)
East	0.9x	0.77	x	2.9	x	38.42	x	0.63	x	0.7	=	34.05	(76)
East	0.9x	0.77	x	2.9	x	63.27	x	0.63	x	0.7	=	56.08	(76)
East	0.9x	0.77	x	2.9	x	92.28	x	0.63	x	0.7	=	81.79	(76)
East	0.9x	0.77	x	2.9	x	113.09	x	0.63	x	0.7	=	100.23	(76)
East	0.9x	0.77	x	2.9	x	115.77	x	0.63	x	0.7	=	102.6	(76)
East	0.9x	0.77	x	2.9	x	110.22	x	0.63	x	0.7	=	97.68	(76)
East	0.9x	0.77	x	2.9	x	94.68	x	0.63	x	0.7	=	83.91	(76)
East	0.9x	0.77	x	2.9	x	73.59	x	0.63	x	0.7	=	65.22	(76)
East	0.9x	0.77	x	2.9	x	45.59	x	0.63	x	0.7	=	40.4	(76)
East	0.9x	0.77	x	2.9	x	24.49	x	0.63	x	0.7	=	21.7	(76)
East	0.9x	0.77	x	2.9	x	16.15	x	0.63	x	0.7	=	14.31	(76)
South	0.9x	0.77	x	21.2	x	46.75	x	0.63	x	0.7	=	302.91	(78)
South	0.9x	0.77	x	21.2	x	76.57	x	0.63	x	0.7	=	496.08	(78)
South	0.9x	0.77	x	21.2	x	97.53	x	0.63	x	0.7	=	631.92	(78)
South	0.9x	0.77	x	21.2	x	110.23	x	0.63	x	0.7	=	714.21	(78)
South	0.9x	0.77	x	21.2	x	114.87	x	0.63	x	0.7	=	744.25	(78)
South	0.9x	0.77	x	21.2	x	110.55	x	0.63	x	0.7	=	716.24	(78)
South	0.9x	0.77	x	21.2	x	108.01	x	0.63	x	0.7	=	699.81	(78)
South	0.9x	0.77	x	21.2	x	104.89	x	0.63	x	0.7	=	679.61	(78)
South	0.9x	0.77	x	21.2	x	101.89	x	0.63	x	0.7	=	660.12	(78)
South	0.9x	0.77	x	21.2	x	82.59	x	0.63	x	0.7	=	535.07	(78)
South	0.9x	0.77	x	21.2	x	55.42	x	0.63	x	0.7	=	359.05	(78)
South	0.9x	0.77	x	21.2	x	40.4	x	0.63	x	0.7	=	261.74	(78)
West	0.9x	0.77	x	1.3	x	19.64	x	0.63	x	0.7	=	7.8	(80)
West	0.9x	0.77	x	1.3	x	38.42	x	0.63	x	0.7	=	15.26	(80)
West	0.9x	0.77	x	1.3	x	63.27	x	0.63	x	0.7	=	25.14	(80)
West	0.9x	0.77	x	1.3	x	92.28	x	0.63	x	0.7	=	36.66	(80)
West	0.9x	0.77	x	1.3	x	113.09	x	0.63	x	0.7	=	44.93	(80)

West	0.9x	0.77	x	1.3	x	115.77	x	0.63	x	0.7	=	46	(80)
West	0.9x	0.77	x	1.3	x	110.22	x	0.63	x	0.7	=	43.79	(80)
West	0.9x	0.77	x	1.3	x	94.68	x	0.63	x	0.7	=	37.61	(80)
West	0.9x	0.77	x	1.3	x	73.59	x	0.63	x	0.7	=	29.24	(80)
West	0.9x	0.77	x	1.3	x	45.59	x	0.63	x	0.7	=	18.11	(80)
West	0.9x	0.77	x	1.3	x	24.49	x	0.63	x	0.7	=	9.73	(80)
West	0.9x	0.77	x	1.3	x	16.15	x	0.63	x	0.7	=	6.42	(80)

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

(83)m=	359.61	605.58	815.39	996.91	1110.67	1101.71	1062.43	976.59	877.52	665.22	429.33	308.72	(83)

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

(84)m=	853.73	1098.27	1290.65	1443.04	1525.32	1487.48	1430.38	1348.77	1265.47	1082.45	880.31	786.87	(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	0.91	0.77	0.59	0.65	0.87	0.98	1	1	(86)

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

(87)m=	19.61	19.81	20.09	20.43	20.73	20.92	20.98	20.97	20.85	20.44	19.96	19.58	(87)

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

(88)m=	19.94	19.94	19.94	19.95	19.95	19.96	19.96	19.97	19.96	19.95	19.95	19.95	(88)

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

(89)m=	1	1	0.99	0.96	0.87	0.68	0.47	0.52	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=	18.67	18.87	19.15	19.49	19.77	19.93	19.96	19.96	19.87	19.5	19.02	18.64	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.81	19.01	19.29	19.63	19.91	20.08	20.11	20.11	20.02	19.64	19.16	18.78	(92)

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

(93)m=	18.81	19.01	19.29	19.63	19.91	20.08	20.11	20.11	20.02	19.64	19.16	18.78	(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	0.87	0.69	0.48	0.54	0.81	0.97	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	852.47	1092.64	1270.82	1374.92	1322.82	1023.46	693.47	725.01	1022.08	1049.12	876.89	786.1	(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=	2996.6	2906.5	2627.36	2178.33	1663.18	1097.19	703.59	741.73	1190.61	1831.45	2453.75	2981.79	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1595.23	1218.91	1009.27	578.45	253.23	0	0	0	0	582.05	1135.34	1633.59	

Total per year (kWh/year) = Sum(98)1...5,9...12 =	8006.07	(98)
Space heating requirement in kWh/m²/year	45.73	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1883.73	1482.94	1519.98	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.83	0.9	0.88	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1567.36	1341.1	1337.23	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1872.5	1802.53	1709.87	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	219.7	343.31	277.24	0	0	0	0	

	Total = Sum(104)6...8 =	840.25	(104)
Cooled fraction	f C = cooled area ÷ (4) =	1	(105)

Intermittency factor (Table 10b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)6...8 =	0	(106)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(107)m=	0	0	0	0	0	54.93	85.83	69.31	0	0	0	0

	Total = Sum(107)6...8 =	210.06	(107)
Space cooling requirement in kWh/m²/year	(107) ÷ (4) =	1.2	(108)

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

Fabric Energy Efficiency	(99) + (108) =	46.93	(109)
Target Fabric Energy Efficiency (TFEE)		53.97	(109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Chris Mcdonald	**Stroma Number:**	STRO007579
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.8

Property Address: Plot 1 LPG

Address : Land West of Broome Farm Barn, Broome, Craven Arms

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	92.92	(1a)	x	2.7	(2a)	=	250.88	(3a)
First floor	82.14	(1b)	x	2.41	(2b)	=	197.96	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	175.06	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	448.84	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	1	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							4	x 10 =	40	(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) =	60	÷ (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		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.38	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.49	0.48	0.47	0.42	0.41	0.36	0.36	0.35	0.38	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(24d)

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

(25)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.9	x	1.6	=	3.04			(26)
Windows Type 1			9.69	x1/[1/(1.4)+ 0.04]		=	12.85			(27)
Windows Type 2			21.2	x1/[1/(1.4)+ 0.04]		=	28.11			(27)
Windows Type 3			2.9	x1/[1/(1.4)+ 0.04]		=	3.84			(27)
Windows Type 4			1.3	x1/[1/(1.4)+ 0.04]		=	1.72			(27)
Floor			92.92	x	0.14	=	13.0088			(28)
Walls	201.48	36.99	164.49	x	0.16	=	26.32			(29)
Roof	92.92	0	92.92	x	0.1	=	9.29			(30)
Total area of elements, m²			387.32							(31)

** 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) =	98.18	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	12537.89	(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 34.65 (36)

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

Total fabric heat loss (33) + (36) = 132.83 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	91.78	91.09	90.42	87.25	86.66	83.9	83.9	83.39	84.96	86.66	87.86	89.11	(38)

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

(39)m=	224.62	223.93	223.25	220.09	219.49	216.73	216.73	216.22	217.8	219.49	220.69	221.95	

Average = Sum(39)$_{1...12}$ /12= 220.08 (39)

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

(40)m=	1.28	1.28	1.28	1.26	1.25	1.24	1.24	1.24	1.24	1.25	1.26	1.27	

Average = Sum(40)$_{1...12}$ /12= 1.26 (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 2.97 (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) + 36 104.72 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	115.19	111	106.82	102.63	98.44	94.25	94.25	98.44	102.63	106.82	111	115.19	
										Total = Sum(44)$_{1...12}$ =		1256.65	(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=	170.83	149.41	154.17	134.41	128.97	111.29	103.13	118.34	119.76	139.56	152.35	165.44	
										Total = Sum(45)$_{1...12}$ =		1647.67	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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) 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) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

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

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

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

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

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

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

(62)m=	145.2	127	131.05	114.25	109.63	94.6	87.66	100.59	101.79	118.63	129.49	140.62	(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=	145.2	127	131.05	114.25	109.63	94.6	87.66	100.59	101.79	118.63	129.49	140.62

Output from water heater (annual)$_{1...12}$ — 1400.52 (64)

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

(65)m=	36.3	31.75	32.76	28.56	27.41	23.65	21.92	25.15	25.45	29.66	32.37	35.16	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	(66)

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

(67)m=	31.12	27.64	22.48	17.02	12.72	10.74	11.6	15.08	20.24	25.7	30	31.98	(67)

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

(68)m=	346.68	350.27	341.21	321.91	297.55	274.65	259.35	255.76	264.82	284.12	308.48	331.38	(68)

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

(69)m=	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	(71)

Water heating gains (Table 5)

(72)m=	48.79	47.25	44.04	39.67	36.84	32.85	29.46	33.8	35.34	39.86	44.96	47.25	(72)

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

(73)m=	494.12	492.7	475.26	446.13	414.64	385.78	367.95	372.18	387.95	417.23	450.99	478.15	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DFEE WorkSheet: New dwelling design stage

North	0.9x	0.77	x	9.69	x	10.63	x	0.63	x	0.7	=	31.49	(74)
North	0.9x	0.77	x	9.69	x	20.32	x	0.63	x	0.7	=	60.18	(74)
North	0.9x	0.77	x	9.69	x	34.53	x	0.63	x	0.7	=	102.26	(74)
North	0.9x	0.77	x	9.69	x	55.46	x	0.63	x	0.7	=	164.25	(74)
North	0.9x	0.77	x	9.69	x	74.72	x	0.63	x	0.7	=	221.26	(74)
North	0.9x	0.77	x	9.69	x	79.99	x	0.63	x	0.7	=	236.87	(74)
North	0.9x	0.77	x	9.69	x	74.68	x	0.63	x	0.7	=	221.15	(74)
North	0.9x	0.77	x	9.69	x	59.25	x	0.63	x	0.7	=	175.45	(74)
North	0.9x	0.77	x	9.69	x	41.52	x	0.63	x	0.7	=	122.95	(74)
North	0.9x	0.77	x	9.69	x	24.19	x	0.63	x	0.7	=	71.63	(74)
North	0.9x	0.77	x	9.69	x	13.12	x	0.63	x	0.7	=	38.85	(74)
North	0.9x	0.77	x	9.69	x	8.86	x	0.63	x	0.7	=	26.25	(74)
East	0.9x	0.77	x	2.9	x	19.64	x	0.63	x	0.7	=	17.41	(76)
East	0.9x	0.77	x	2.9	x	38.42	x	0.63	x	0.7	=	34.05	(76)
East	0.9x	0.77	x	2.9	x	63.27	x	0.63	x	0.7	=	56.08	(76)
East	0.9x	0.77	x	2.9	x	92.28	x	0.63	x	0.7	=	81.79	(76)
East	0.9x	0.77	x	2.9	x	113.09	x	0.63	x	0.7	=	100.23	(76)
East	0.9x	0.77	x	2.9	x	115.77	x	0.63	x	0.7	=	102.6	(76)
East	0.9x	0.77	x	2.9	x	110.22	x	0.63	x	0.7	=	97.68	(76)
East	0.9x	0.77	x	2.9	x	94.68	x	0.63	x	0.7	=	83.91	(76)
East	0.9x	0.77	x	2.9	x	73.59	x	0.63	x	0.7	=	65.22	(76)
East	0.9x	0.77	x	2.9	x	45.59	x	0.63	x	0.7	=	40.4	(76)
East	0.9x	0.77	x	2.9	x	24.49	x	0.63	x	0.7	=	21.7	(76)
East	0.9x	0.77	x	2.9	x	16.15	x	0.63	x	0.7	=	14.31	(76)
South	0.9x	0.77	x	21.2	x	46.75	x	0.63	x	0.7	=	302.91	(78)
South	0.9x	0.77	x	21.2	x	76.57	x	0.63	x	0.7	=	496.08	(78)
South	0.9x	0.77	x	21.2	x	97.53	x	0.63	x	0.7	=	631.92	(78)
South	0.9x	0.77	x	21.2	x	110.23	x	0.63	x	0.7	=	714.21	(78)
South	0.9x	0.77	x	21.2	x	114.87	x	0.63	x	0.7	=	744.25	(78)
South	0.9x	0.77	x	21.2	x	110.55	x	0.63	x	0.7	=	716.24	(78)
South	0.9x	0.77	x	21.2	x	108.01	x	0.63	x	0.7	=	699.81	(78)
South	0.9x	0.77	x	21.2	x	104.89	x	0.63	x	0.7	=	679.61	(78)
South	0.9x	0.77	x	21.2	x	101.89	x	0.63	x	0.7	=	660.12	(78)
South	0.9x	0.77	x	21.2	x	82.59	x	0.63	x	0.7	=	535.07	(78)
South	0.9x	0.77	x	21.2	x	55.42	x	0.63	x	0.7	=	359.05	(78)
South	0.9x	0.77	x	21.2	x	40.4	x	0.63	x	0.7	=	261.74	(78)
West	0.9x	0.77	x	1.3	x	19.64	x	0.63	x	0.7	=	7.8	(80)
West	0.9x	0.77	x	1.3	x	38.42	x	0.63	x	0.7	=	15.26	(80)
West	0.9x	0.77	x	1.3	x	63.27	x	0.63	x	0.7	=	25.14	(80)
West	0.9x	0.77	x	1.3	x	92.28	x	0.63	x	0.7	=	36.66	(80)
West	0.9x	0.77	x	1.3	x	113.09	x	0.63	x	0.7	=	44.93	(80)

West	0.9x	0.77	x	1.3	x	115.77	x	0.63	x	0.7	=	46	(80)
West	0.9x	0.77	x	1.3	x	110.22	x	0.63	x	0.7	=	43.79	(80)
West	0.9x	0.77	x	1.3	x	94.68	x	0.63	x	0.7	=	37.61	(80)
West	0.9x	0.77	x	1.3	x	73.59	x	0.63	x	0.7	=	29.24	(80)
West	0.9x	0.77	x	1.3	x	45.59	x	0.63	x	0.7	=	18.11	(80)
West	0.9x	0.77	x	1.3	x	24.49	x	0.63	x	0.7	=	9.73	(80)
West	0.9x	0.77	x	1.3	x	16.15	x	0.63	x	0.7	=	6.42	(80)

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

(83)m=	359.61	605.58	815.39	996.91	1110.67	1101.71	1062.43	976.59	877.52	665.22	429.33	308.72	(83)

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

(84)m=	853.73	1098.27	1290.65	1443.04	1525.32	1487.48	1430.38	1348.77	1265.47	1082.45	880.31	786.87	(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	0.92	0.8	0.63	0.68	0.89	0.98	1	1	(86)

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

(87)m=	19.48	19.68	19.97	20.34	20.66	20.89	20.97	20.96	20.8	20.36	19.85	19.45	(87)

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

(88)m=	19.85	19.86	19.86	19.87	19.88	19.89	19.89	19.89	19.88	19.88	19.87	19.87	(88)

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

(89)m=	1	1	0.99	0.96	0.88	0.7	0.49	0.54	0.82	0.98	1	1	(89)

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

(90)m=	18.47	18.68	18.96	19.33	19.64	19.84	19.88	19.88	19.77	19.36	18.85	18.45	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.62	18.82	19.11	19.48	19.79	19.99	20.04	20.04	19.92	19.51	19	18.6	(92)

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

(93)m=	18.62	18.82	19.11	19.48	19.79	19.99	20.04	20.04	19.92	19.51	19	18.6	(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	0.99	0.96	0.88	0.71	0.51	0.56	0.83	0.97	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	852.34	1092.52	1271.55	1380.57	1343.47	1062.27	729.53	760.39	1045.31	1051.23	876.76	786	(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=	3216.49	3117.94	2815.99	2328.92	1776.34	1168.87	746.28	786.98	1267.96	1955.23	2625.83	3196.15	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1758.93	1361.09	1149.06	682.82	322.06	0	0	0	0	672.58	1259.33	1793.15	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 8999.01 (98)

Space heating requirement in kWh/m²/year 51.41 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	2037.29	1603.82	1643.29	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.79	0.87	0.84	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1607.87	1395.75	1383.68	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1872.5	1802.53	1709.87	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	190.54	302.65	242.68	0	0	0	0	

Total = $Sum(104)_{6...8}$ = 735.86 (104)

Cooled fraction f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = $Sum(104)_{6...8}$ = 0 (106)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(107)m=	0	0	0	0	0	47.63	75.66	60.67	0	0	0	0

Total = $Sum(107)_{6...8}$ = 183.97 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 1.05 (108)

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

Fabric Energy Efficiency (99) + (108) = 52.46 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Chris Mcdonald	**Stroma Number:**	STRO007579
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.8

Property Address: Plot 1 LPG

Address : Land West of Broome Farm Barn, Broome, Craven Arms

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.92	(1a) x	2.7	(2a) =	250.88	(3a)
First floor	82.14	(1b) x	2.41	(2b) =	197.96	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	175.06	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	448.84	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	1	+	0	=	1	x 20 =	20	(6b)
Number of intermittent fans							5	x 10 =	50	(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) = 70	÷ (5) =	0.16	(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)	0.41	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.41	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(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 design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.52	0.51	0.5	0.45	0.44	0.39	0.39	0.38	0.41	0.44	0.46	0.48

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

(25)m=	0.63	0.63	0.62	0.6	0.6	0.57	0.57	0.57	0.58	0.6	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.9	x	1.6	=	3.04			(26)
Windows Type 1			9.69	x1/[1/(1.4)+ 0.04]		=	12.85			(27)
Windows Type 2			21.2	x1/[1/(1.4)+ 0.04]		=	28.11			(27)
Windows Type 3			2.9	x1/[1/(1.4)+ 0.04]		=	3.84			(27)
Windows Type 4			1.3	x1/[1/(1.4)+ 0.04]		=	1.72			(27)
Floor			92.92	x	0.14	=	13.0088			(28)
Walls	201.48	36.99	164.49	x	0.16	=	26.32			(29)
Roof	92.92	0	92.92	x	0.1	=	9.29			(30)
Total area of elements, m²			387.32							(31)

** 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) =	98.18	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	12537.89	(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 34.65 (36)

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

Total fabric heat loss (33) + (36) = 132.83 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	93.9	93.13	92.37	88.83	88.16	85.07	85.07	84.5	86.26	88.16	89.51	90.91	(38)

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

(39)m=	226.73	225.96	225.21	221.66	221	217.91	217.91	217.34	219.1	221	222.34	223.74	

Average = $Sum(39)_{1...12}$ /12= 221.66 (39)

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

(40)m=	1.3	1.29	1.29	1.27	1.26	1.24	1.24	1.24	1.25	1.26	1.27	1.28	

Average = $Sum(40)_{1...12}$ /12= 1.27 (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 2.97 (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) + 36 104.72 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	115.19	111	106.82	102.63	98.44	94.25	94.25	98.44	102.63	106.82	111	115.19	

Total = $Sum(44)_{1...12}$ = 1256.65 (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=	170.83	149.41	154.17	134.41	128.97	111.29	103.13	118.34	119.76	139.56	152.35	165.44	

Total = $Sum(45)_{1...12}$ = 1647.67 (45)

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

(46)m=	25.62	22.41	23.13	20.16	19.35	16.69	15.47	17.75	17.96	20.93	22.85	24.82	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (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) x (49) = 210 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01 (51)

If community heating see section 4.3

Volume factor from Table 2a 0.83 (52)

Temperature factor from Table 2b 0.54 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0.97 (54)

Enter (50) or (54) in (55) 0.97 (55)

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

(56)m=	30.01	27.11	30.01	29.05	30.01	29.05	30.01	30.01	29.05	30.01	29.05	30.01	(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=	30.01	27.11	30.01	29.05	30.01	29.05	30.01	30.01	29.05	30.01	29.05	30.01	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	224.1	197.53	207.45	185.97	182.25	162.85	156.41	171.62	171.31	192.84	203.9	218.71	(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=	224.1	197.53	207.45	185.97	182.25	162.85	156.41	171.62	171.31	192.84	203.9	218.71

Output from water heater (annual)$_{1...12}$ — 2274.95 (64)

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

(65)m=	99.42	88.17	93.88	85.94	85.5	78.25	76.91	81.97	81.06	89.03	91.9	97.63	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	31.12	27.64	22.48	17.02	12.72	10.74	11.6	15.08	20.24	25.7	30	31.98	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	346.68	350.27	341.21	321.91	297.55	274.65	259.35	255.76	264.82	284.12	308.48	331.38	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	(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=	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	(71)
Water heating gains (Table 5)													
(72)m=	133.63	131.21	126.19	119.36	114.92	108.68	103.38	110.17	112.59	119.66	127.64	131.22	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	581.96	579.66	560.41	528.82	495.73	464.61	444.87	451.55	468.2	500.02	536.66	565.12	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	9.69	x	10.63	x	0.63	x	0.7	=	31.49	(74)
North	0.9x	0.77	x	9.69	x	20.32	x	0.63	x	0.7	=	60.18	(74)
North	0.9x	0.77	x	9.69	x	34.53	x	0.63	x	0.7	=	102.26	(74)
North	0.9x	0.77	x	9.69	x	55.46	x	0.63	x	0.7	=	164.25	(74)
North	0.9x	0.77	x	9.69	x	74.72	x	0.63	x	0.7	=	221.26	(74)
North	0.9x	0.77	x	9.69	x	79.99	x	0.63	x	0.7	=	236.87	(74)
North	0.9x	0.77	x	9.69	x	74.68	x	0.63	x	0.7	=	221.15	(74)
North	0.9x	0.77	x	9.69	x	59.25	x	0.63	x	0.7	=	175.45	(74)
North	0.9x	0.77	x	9.69	x	41.52	x	0.63	x	0.7	=	122.95	(74)
North	0.9x	0.77	x	9.69	x	24.19	x	0.63	x	0.7	=	71.63	(74)
North	0.9x	0.77	x	9.69	x	13.12	x	0.63	x	0.7	=	38.85	(74)
North	0.9x	0.77	x	9.69	x	8.86	x	0.63	x	0.7	=	26.25	(74)
East	0.9x	0.77	x	2.9	x	19.64	x	0.63	x	0.7	=	17.41	(76)
East	0.9x	0.77	x	2.9	x	38.42	x	0.63	x	0.7	=	34.05	(76)
East	0.9x	0.77	x	2.9	x	63.27	x	0.63	x	0.7	=	56.08	(76)
East	0.9x	0.77	x	2.9	x	92.28	x	0.63	x	0.7	=	81.79	(76)
East	0.9x	0.77	x	2.9	x	113.09	x	0.63	x	0.7	=	100.23	(76)
East	0.9x	0.77	x	2.9	x	115.77	x	0.63	x	0.7	=	102.6	(76)
East	0.9x	0.77	x	2.9	x	110.22	x	0.63	x	0.7	=	97.68	(76)
East	0.9x	0.77	x	2.9	x	94.68	x	0.63	x	0.7	=	83.91	(76)
East	0.9x	0.77	x	2.9	x	73.59	x	0.63	x	0.7	=	65.22	(76)
East	0.9x	0.77	x	2.9	x	45.59	x	0.63	x	0.7	=	40.4	(76)
East	0.9x	0.77	x	2.9	x	24.49	x	0.63	x	0.7	=	21.7	(76)
East	0.9x	0.77	x	2.9	x	16.15	x	0.63	x	0.7	=	14.31	(76)
South	0.9x	0.77	x	21.2	x	46.75	x	0.63	x	0.7	=	302.91	(78)
South	0.9x	0.77	x	21.2	x	76.57	x	0.63	x	0.7	=	496.08	(78)
South	0.9x	0.77	x	21.2	x	97.53	x	0.63	x	0.7	=	631.92	(78)
South	0.9x	0.77	x	21.2	x	110.23	x	0.63	x	0.7	=	714.21	(78)
South	0.9x	0.77	x	21.2	x	114.87	x	0.63	x	0.7	=	744.25	(78)
South	0.9x	0.77	x	21.2	x	110.55	x	0.63	x	0.7	=	716.24	(78)
South	0.9x	0.77	x	21.2	x	108.01	x	0.63	x	0.7	=	699.81	(78)
South	0.9x	0.77	x	21.2	x	104.89	x	0.63	x	0.7	=	679.61	(78)
South	0.9x	0.77	x	21.2	x	101.89	x	0.63	x	0.7	=	660.12	(78)
South	0.9x	0.77	x	21.2	x	82.59	x	0.63	x	0.7	=	535.07	(78)
South	0.9x	0.77	x	21.2	x	55.42	x	0.63	x	0.7	=	359.05	(78)
South	0.9x	0.77	x	21.2	x	40.4	x	0.63	x	0.7	=	261.74	(78)
West	0.9x	0.77	x	1.3	x	19.64	x	0.63	x	0.7	=	7.8	(80)
West	0.9x	0.77	x	1.3	x	38.42	x	0.63	x	0.7	=	15.26	(80)
West	0.9x	0.77	x	1.3	x	63.27	x	0.63	x	0.7	=	25.14	(80)
West	0.9x	0.77	x	1.3	x	92.28	x	0.63	x	0.7	=	36.66	(80)
West	0.9x	0.77	x	1.3	x	113.09	x	0.63	x	0.7	=	44.93	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.3	x	115.77	x	0.63	x	0.7	=	46	(80)
West	0.9x	0.77	x	1.3	x	110.22	x	0.63	x	0.7	=	43.79	(80)
West	0.9x	0.77	x	1.3	x	94.68	x	0.63	x	0.7	=	37.61	(80)
West	0.9x	0.77	x	1.3	x	73.59	x	0.63	x	0.7	=	29.24	(80)
West	0.9x	0.77	x	1.3	x	45.59	x	0.63	x	0.7	=	18.11	(80)
West	0.9x	0.77	x	1.3	x	24.49	x	0.63	x	0.7	=	9.73	(80)
West	0.9x	0.77	x	1.3	x	16.15	x	0.63	x	0.7	=	6.42	(80)

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

(83)m=	359.61	605.58	815.39	996.91	1110.67	1101.71	1062.43	976.59	877.52	665.22	429.33	308.72	(83)

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

(84)m=	941.57	1185.24	1375.81	1525.73	1606.41	1566.32	1507.3	1428.14	1345.72	1165.25	965.99	873.84	(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	0.91	0.77	0.61	0.66	0.87	0.98	1	1	(86)

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

(87)m=	19.83	19.98	20.19	20.47	20.71	20.87	20.92	20.92	20.81	20.49	20.1	19.81	(87)

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

(88)m=	19.84	19.85	19.85	19.87	19.87	19.88	19.88	19.89	19.88	19.87	19.86	19.86	(88)

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

(89)m=	1	0.99	0.98	0.95	0.87	0.68	0.47	0.52	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=	18.27	18.5	18.82	19.22	19.55	19.75	19.79	19.79	19.68	19.25	18.7	18.26	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.5	18.72	19.02	19.4	19.72	19.92	19.96	19.96	19.85	19.44	18.9	18.49	(92)

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

(93)m=	18.5	18.72	19.02	19.4	19.72	19.92	19.96	19.96	19.85	19.44	18.9	18.49	(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	0.86	0.68	0.48	0.53	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	939.16	1176.55	1349.33	1444.82	1383.78	1069.92	719.58	753.25	1071.49	1120.62	960.09	872.26	(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=	3220.23	3121.95	2819.27	2328.16	1772.12	1158.27	732.26	773.34	1259.65	1952.52	2624.56	3196.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1697.11	1307.31	1093.63	636	288.92	0	0	0	0	618.94	1198.42	1729.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 8569.44 (98)

Space heating requirement in kWh/m²/year 48.95 (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 90.9 (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)	1697.11	1307.31	1093.63	636	288.92	0	0	0	0	618.94	1198.42	1729.11		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1867.01	1438.18	1203.12	699.67	317.84	0	0	0	0	680.9	1318.39	1902.21		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													9427.32	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	224.1	197.53	207.45	185.97	182.25	162.85	156.41	171.62	171.31	192.84	203.9	218.71		
Efficiency of water heater													80.8	(216)
(217)m=	89.59	89.43	89.12	88.4	86.71	80.8	80.8	80.8	80.8	88.28	89.28	89.64		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	250.13	220.87	232.77	210.37	210.19	201.55	193.57	212.4	212.02	218.45	228.39	243.99		
Total = Sum(219a)$_{1...12}$ =													2634.69	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		9427.32	
Water heating fuel used		2634.69	
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		549.53	(232)
Electricity generated by PVs		-1025.35	(233)

12a. CO_2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.241	=	2271.99	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.241	=	634.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2906.95	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	285.21	(268)
Energy saving/generation technologies Item 1		0.519	=	-532.16	(269)
Total CO_2, kg/year	sum of (265)…(271) =			2698.92	(272)
Dwelling CO_2 Emission Rate	(272) ÷ (4) =			15.42	(273)
EI rating (section 14)				84	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Chris Mcdonald	**Stroma Number:**	STRO007579
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.8

Property Address: Plot 1 LPG

Address : Land West of Broome Farm Barn, Broome, Craven Arms

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	92.92	(1a) x	2.7	(2a) =	250.88	(3a)
First floor	82.14	(1b) x	2.41	(2b) =	197.96	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	175.06	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		448.84	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	1	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(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) =	40	÷ (5) =	0.09	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.34	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.43	0.42	0.42	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.9	x	1	=	1.9			(26)
Windows Type 1			9.69	x1/[1/(1.4)+ 0.04]		=	12.85			(27)
Windows Type 2			21.2	x1/[1/(1.4)+ 0.04]		=	28.11			(27)
Windows Type 3			2.9	x1/[1/(1.4)+ 0.04]		=	3.84			(27)
Windows Type 4			1.3	x1/[1/(1.4)+ 0.04]		=	1.72			(27)
Floor			92.92	x	0.13	=	12.0796			(28)
Walls	201.48	36.99	164.49	x	0.18	=	29.61			(29)
Roof	92.92	0	92.92	x	0.13	=	12.08			(30)
Total area of elements, m²			387.32							(31)

** 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) = 102.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12537.89 (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 16.46 (36)

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

Total fabric heat loss (33) + (36) = 118.65 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	87.9	87.37	86.84	84.36	83.9	81.75	81.75	81.35	82.58	83.9	84.84	85.82	(38)

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

(39)m=	206.56	206.02	205.49	203.02	202.55	200.4	200.4	200	201.23	202.55	203.49	204.47	

Average = Sum(39)$_{1...12}$ /12= 203.01 (39)

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

(40)m=	1.18	1.18	1.17	1.16	1.16	1.14	1.14	1.14	1.15	1.16	1.16	1.17	

Average = Sum(40)$_{1...12}$ /12= 1.16 (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 2.97 (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) + 36 104.72 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	115.19	111	106.82	102.63	98.44	94.25	94.25	98.44	102.63	106.82	111	115.19	

Total = Sum(44)$_{1...12}$ = 1256.65 (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=	170.83	149.41	154.17	134.41	128.97	111.29	103.13	118.34	119.76	139.56	152.35	165.44	

Total = Sum(45)$_{1...12}$ = 1647.67 (45)

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

(46)m=	25.62	22.41	23.13	20.16	19.35	16.69	15.47	17.75	17.96	20.93	22.85	24.82	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.7 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.92 (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) 0.92 (55)

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

(56)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(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=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	222.57	196.15	205.92	184.49	180.72	161.37	154.88	170.09	169.83	191.31	202.42	217.18	(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=	222.57	196.15	205.92	184.49	180.72	161.37	154.88	170.09	169.83	191.31	202.42	217.18

Output from water heater (annual)$_{1…12}$ — 2256.94 (64)

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

(65)m=	98.2	87.07	92.66	84.75	84.28	77.07	75.69	80.75	79.88	87.8	90.72	96.41	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	148.47	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	31.12	27.64	22.48	17.02	12.72	10.74	11.6	15.08	20.24	25.7	30	31.98	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	346.68	350.27	341.21	321.91	297.55	274.65	259.35	255.76	264.82	284.12	308.48	331.38	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	37.85	(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=	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	-118.77	(71)
Water heating gains (Table 5)													
(72)m=	131.99	129.57	124.54	117.71	113.28	107.04	101.73	108.53	110.95	118.01	126	129.58	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	580.32	578.02	558.77	527.18	494.09	462.97	443.23	449.91	466.55	498.38	535.02	563.48	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

TER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	9.69	x	10.63	x	0.63	x	0.7	=	31.49	(74)
North	0.9x	0.77	x	9.69	x	20.32	x	0.63	x	0.7	=	60.18	(74)
North	0.9x	0.77	x	9.69	x	34.53	x	0.63	x	0.7	=	102.26	(74)
North	0.9x	0.77	x	9.69	x	55.46	x	0.63	x	0.7	=	164.25	(74)
North	0.9x	0.77	x	9.69	x	74.72	x	0.63	x	0.7	=	221.26	(74)
North	0.9x	0.77	x	9.69	x	79.99	x	0.63	x	0.7	=	236.87	(74)
North	0.9x	0.77	x	9.69	x	74.68	x	0.63	x	0.7	=	221.15	(74)
North	0.9x	0.77	x	9.69	x	59.25	x	0.63	x	0.7	=	175.45	(74)
North	0.9x	0.77	x	9.69	x	41.52	x	0.63	x	0.7	=	122.95	(74)
North	0.9x	0.77	x	9.69	x	24.19	x	0.63	x	0.7	=	71.63	(74)
North	0.9x	0.77	x	9.69	x	13.12	x	0.63	x	0.7	=	38.85	(74)
North	0.9x	0.77	x	9.69	x	8.86	x	0.63	x	0.7	=	26.25	(74)
East	0.9x	0.77	x	2.9	x	19.64	x	0.63	x	0.7	=	17.41	(76)
East	0.9x	0.77	x	2.9	x	38.42	x	0.63	x	0.7	=	34.05	(76)
East	0.9x	0.77	x	2.9	x	63.27	x	0.63	x	0.7	=	56.08	(76)
East	0.9x	0.77	x	2.9	x	92.28	x	0.63	x	0.7	=	81.79	(76)
East	0.9x	0.77	x	2.9	x	113.09	x	0.63	x	0.7	=	100.23	(76)
East	0.9x	0.77	x	2.9	x	115.77	x	0.63	x	0.7	=	102.6	(76)
East	0.9x	0.77	x	2.9	x	110.22	x	0.63	x	0.7	=	97.68	(76)
East	0.9x	0.77	x	2.9	x	94.68	x	0.63	x	0.7	=	83.91	(76)
East	0.9x	0.77	x	2.9	x	73.59	x	0.63	x	0.7	=	65.22	(76)
East	0.9x	0.77	x	2.9	x	45.59	x	0.63	x	0.7	=	40.4	(76)
East	0.9x	0.77	x	2.9	x	24.49	x	0.63	x	0.7	=	21.7	(76)
East	0.9x	0.77	x	2.9	x	16.15	x	0.63	x	0.7	=	14.31	(76)
South	0.9x	0.77	x	21.2	x	46.75	x	0.63	x	0.7	=	302.91	(78)
South	0.9x	0.77	x	21.2	x	76.57	x	0.63	x	0.7	=	496.08	(78)
South	0.9x	0.77	x	21.2	x	97.53	x	0.63	x	0.7	=	631.92	(78)
South	0.9x	0.77	x	21.2	x	110.23	x	0.63	x	0.7	=	714.21	(78)
South	0.9x	0.77	x	21.2	x	114.87	x	0.63	x	0.7	=	744.25	(78)
South	0.9x	0.77	x	21.2	x	110.55	x	0.63	x	0.7	=	716.24	(78)
South	0.9x	0.77	x	21.2	x	108.01	x	0.63	x	0.7	=	699.81	(78)
South	0.9x	0.77	x	21.2	x	104.89	x	0.63	x	0.7	=	679.61	(78)
South	0.9x	0.77	x	21.2	x	101.89	x	0.63	x	0.7	=	660.12	(78)
South	0.9x	0.77	x	21.2	x	82.59	x	0.63	x	0.7	=	535.07	(78)
South	0.9x	0.77	x	21.2	x	55.42	x	0.63	x	0.7	=	359.05	(78)
South	0.9x	0.77	x	21.2	x	40.4	x	0.63	x	0.7	=	261.74	(78)
West	0.9x	0.77	x	1.3	x	19.64	x	0.63	x	0.7	=	7.8	(80)
West	0.9x	0.77	x	1.3	x	38.42	x	0.63	x	0.7	=	15.26	(80)
West	0.9x	0.77	x	1.3	x	63.27	x	0.63	x	0.7	=	25.14	(80)
West	0.9x	0.77	x	1.3	x	92.28	x	0.63	x	0.7	=	36.66	(80)
West	0.9x	0.77	x	1.3	x	113.09	x	0.63	x	0.7	=	44.93	(80)

West	0.9x	0.77	x	1.3	x	115.77	x	0.63	x	0.7	=	46	(80)
West	0.9x	0.77	x	1.3	x	110.22	x	0.63	x	0.7	=	43.79	(80)
West	0.9x	0.77	x	1.3	x	94.68	x	0.63	x	0.7	=	37.61	(80)
West	0.9x	0.77	x	1.3	x	73.59	x	0.63	x	0.7	=	29.24	(80)
West	0.9x	0.77	x	1.3	x	45.59	x	0.63	x	0.7	=	18.11	(80)
West	0.9x	0.77	x	1.3	x	24.49	x	0.63	x	0.7	=	9.73	(80)
West	0.9x	0.77	x	1.3	x	16.15	x	0.63	x	0.7	=	6.42	(80)

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

(83)m=	359.61	605.58	815.39	996.91	1110.67	1101.71	1062.43	976.59	877.52	665.22	429.33	308.72	(83)

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

(84)m=	939.92	1183.59	1374.16	1524.09	1604.76	1564.67	1505.66	1426.5	1344.07	1163.6	964.35	872.2	(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	0.89	0.74	0.57	0.62	0.85	0.98	1	1	(86)

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

(87)m=	19.66	19.86	20.13	20.47	20.76	20.93	20.99	20.98	20.87	20.48	20	19.63	(87)

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

(88)m=	19.94	19.94	19.94	19.95	19.95	19.96	19.96	19.97	19.96	19.95	19.95	19.95	(88)

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

(89)m=	1	0.99	0.98	0.95	0.85	0.65	0.44	0.49	0.78	0.96	1	1	(89)

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

(90)m=	18.15	18.44	18.84	19.33	19.71	19.92	19.96	19.96	19.85	19.35	18.65	18.11	(90)

fLA = Living area ÷ (4) = 0.15 (91)

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

(92)m=	18.37	18.65	19.03	19.49	19.87	20.07	20.11	20.11	20	19.52	18.85	18.33	(92)

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

(93)m=	18.37	18.65	19.03	19.49	19.87	20.07	20.11	20.11	20	19.52	18.85	18.33	(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	0.85	0.66	0.46	0.51	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	937.47	1174.23	1344.71	1432.97	1357.24	1034.41	695.39	728.34	1046.49	1114.11	958.08	870.6	(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=	2905.99	2831.96	2574.57	2150.93	1654.24	1096.1	703.54	741.66	1187.67	1805.78	2391.33	2889.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1464.58	1113.99	915.02	516.93	220.97	0	0	0	0	514.6	1031.93	1501.96	(98)

	Total per year (kWh/year) = Sum(98)1...5,9...12 =	7279.97	(98)
Space heating requirement in kWh/m²/year		41.59	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	1464.58	1113.99	915.02	516.93	220.97	0	0	0	0	514.6	1031.93	1501.96		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1566.4	1191.43	978.63	552.86	236.33	0	0	0	0	550.37	1103.67	1606.37		(211)
Total (kWh/year) =Sum(211)1...5,10...12=													7786.07	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	222.57	196.15	205.92	184.49	180.72	161.37	154.88	170.09	169.83	191.31	202.42	217.18		
Efficiency of water heater													79.8	(216)
(217)m=	88.93	88.72	88.32	87.42	85.35	79.8	79.8	79.8	79.8	87.33	88.55	88.99		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	250.29	221.09	233.14	211.05	211.74	202.22	194.08	213.15	212.82	219.08	228.59	244.05		
Total = Sum(219a)1...12 =													2641.29	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			7786.07	
Water heating fuel used			2641.29	
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			549.53	(232)

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	=	1681.79	(261)

TER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	570.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2252.31	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	285.21	(268)
Total CO2, kg/year		sum of (265)…(271) =		2576.44	(272)

TER = 15.49 (273)