

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.18
Printed on 17 June 2019 at 14:44:24

Project Information:

Assessed By: Demi Beneke (STRO027754) **Building Type:** Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 101.32m²

Site Reference : Park Lodge 5865

Plot Reference: House 1

Address : House 1

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.14 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 16.37 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.0 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 45.3 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.46 (max. 2.00)	1.80 (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: Database: (rev 443, product index 018050):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Ideal
Model: LOGIC SYSTEM
Model qualifier: s24IE
(Regular)
Efficiency 89.8 % SEDBUK2009
Minimum 88.0 % **OK**

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

Regulations Compliance Report

5 Cylinder insulation

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

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK
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 (South England):	Not significant	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	1.3m ²	
Windows facing: South East	0.72m ²	
Windows facing: South East	0.72m ²	
Windows facing: South West	1.07m ²	
Windows facing: North East	0.84m ²	
Windows facing: North East	1.3m ²	
Windows facing: South East	1.3m ²	
Windows facing: South West	1.3m ²	
Windows facing: South West	1.3m ²	
Ventilation rate:	4.00	
Blinds/curtains:	None	

10 Key features

Roofs U-value	0.11 W/m ² K
Party Walls U-value	0 W/m ² K
Floors U-value	0.12 W/m ² K
Secondary heating (wood logs)	
Secondary heating fuel wood logs	

Predicted Energy Assessment



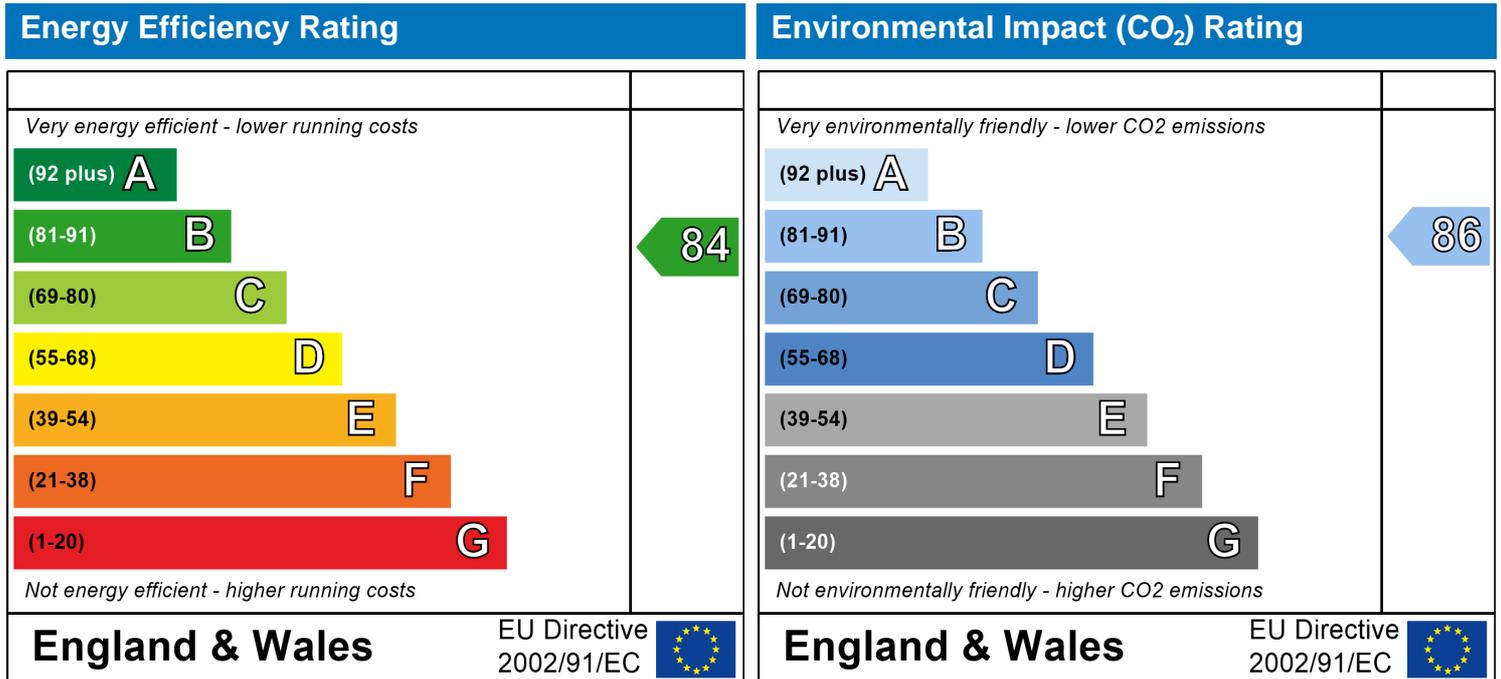
House 1

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

Semi-detached House
17 June 2019
Demi Beneke
101.32 m²

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

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



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

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

SAP Input

Property Details: House 1

Address: House 1
 Located in: England
 Region: South England
 UPRN:
 Date of assessment: 17 June 2019
 Date of certificate: 17 June 2019
 Assessment type: New dwelling design stage
 Transaction type: New dwelling
 Tenure type: Unknown
 Related party disclosure: No related party
 Thermal Mass Parameter: Indicative Value Medium
 Water use <= 125 litres/person/day: True
 PCDF Version: 443

Property description:

Dwelling type: House
 Detachment: Semi-detached
 Year Completed: 2019
 Floor Location: Floor area: Storey height:
 Floor 0 50.66 m² 2.38 m
 Floor 1 50.66 m² 2.68 m
 Living area: 14.87 m² (fraction 0.147)
 Front of dwelling faces: North East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
D1	Manufacturer	Solid			Wood
W5	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	Yes	Wood
W1	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W3	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W4	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W6	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W7	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W8	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W9	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W10	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
D1	mm	0.7	0	1.8	2.15	1
W5	16mm or more mm	0.7	0.71	1.4	3.13	1
W1	16mm or more	0.7	0.71	1.4	1.3	1
W2	16mm or more	0.7	0.71	1.4	0.72	1
W3	16mm or more	0.7	0.71	1.4	0.72	1
W4	16mm or more	0.7	0.71	1.4	1.07	1
W6	16mm or more	0.7	0.71	1.4	0.84	1
W7	16mm or more	0.7	0.71	1.4	1.3	1
W8	16mm or more	0.7	0.71	1.4	1.3	1
W9	16mm or more	0.7	0.71	1.4	1.3	1
W10	16mm or more	0.7	0.71	1.4	1.3	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
D1		External Walls	North East	1.023	2.1
W5		External Walls	South West	1.494	2.093

SAP Input

W1	External Walls	North East	1.022	1.275
W2	External Walls	South East	0.685	1.05
W3	External Walls	South East	0.685	1.05
W4	External Walls	South West	1.022	1.05
W6	External Walls	North East	0.797	1.05
W7	External Walls	North East	1.022	1.275
W8	External Walls	South East	1.022	1.275
W9	External Walls	South West	1.022	1.275
W10	External Walls	South West	1.022	1.275

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
External Walls	104.03	15.13	88.9	0.2	0	False	N/A
Plain Ceiling	50.66	0	50.66	0.11	0		N/A
Ground Floor	50.66			0.12			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Walls	46.15						N/A

Thermal bridges:

Thermal bridges:		User-defined (individual PSI-values) Y-Value = 0.0481					
		Length	Psi-value				
		10.816	0.059	E2	Other lintels (including other steel lintels)		
	[Approved]	8.299	0.04	E3	Sill		
	[Approved]	29.536	0.05	E4	Jamb		
		20.56	0.05	E5	Ground floor (normal)		
		20.56	0	E6	Intermediate floor within a dwelling		
	[Approved]	14.81	0.06	E10	Eaves (insulation at ceiling level)		
		5.75	0.048	E12	Gable (insulation at ceiling level)		
		15.18	0.04	E16	Corner (normal)		
		5.06	-0.052	E17	Corner (inverted internal area greater than external area)		
	[Approved]	10.12	0.06	E18	Party wall between dwellings		
		9.12	0.16	P1	Ground floor		
		9.12	0.07	P6	Ground floor (inverted)		
		9.12	0.24	P4	Roof (insulation at ceiling level)		

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	5

Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database
	Database: (rev 443, product index 018050) Efficiency: Winter 80.1 % Summer: 90.8
	Brand name: Ideal
	Model: LOGIC SYSTEM
	Model qualifier: s24IE
	(Regular boiler)
	Systems with radiators

SAP Input

Central heating pump : 2013 or later
Design flow temperature: Unknown
Boiler interlock: Yes
Weather Compensator

Main heating Control:

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

Secondary heating system:

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

Water heating:

Water heating: From main heating system
Water code: 901
Fuel : mains gas
Hot water cylinder
Cylinder volume: 210 litres
Cylinder insulation: Measured loss, 2.3kWh/day
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: True
Solar panel: False

Others:

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

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Demi Beneke	Stroma Number:	STRO027754
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.4.18

Property Address: House 1

Address : House 1

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	50.66	(1a) x	2.38	(2a) =	120.57
First floor	50.66	(1b) x	2.68	(2b) =	135.77
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	101.32	(4)			
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =				256.34

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration			0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$			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 $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$			0.37	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			2	(19)
Shelter factor $(20) = 1 - [0.075 \times (19)] =$			0.85	(20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$			0.31	(21)

Infiltration rate modified for monthly wind speed

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

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

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

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

0	(23c)
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a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

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

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

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

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

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

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(25)
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² -K	A X k kJ/K
Doors Type 1			2.15	x 1.8	= 3.87		(26)
Doors Type 2			3.13	x 1.4	= 4.382		(26)
Windows Type 1			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 2			0.72	x1/[1/(1.4)+ 0.04]	= 0.95		(27)
Windows Type 3			0.72	x1/[1/(1.4)+ 0.04]	= 0.95		(27)
Windows Type 4			1.07	x1/[1/(1.4)+ 0.04]	= 1.42		(27)
Windows Type 5			0.84	x1/[1/(1.4)+ 0.04]	= 1.11		(27)
Windows Type 6			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 7			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 8			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 9			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Floor			50.66	x 0.12	= 6.0792		(28)
Walls	104.03	15.13	88.9	x 0.2	= 17.78		(29)
Roof	50.66	0	50.66	x 0.11	= 5.57		(30)
Total area of elements, m ²			205.35				(31)
Party wall			46.15	x 0	= 0		(32)

* 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) =	50.74	(33)
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SAP WorkSheet: New dwelling design stage

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in $\text{kJ/m}^2\text{K}$ Indicative Value: Medium (35)

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

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

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	48.99	48.73	48.47	47.28	47.05	46.01	46.01	45.82	46.41	47.05	47.51	47.98	(38)

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

(39)m=	109.61	109.35	109.09	107.9	107.67	106.63	106.63	106.44	107.03	107.67	108.13	108.6	
Average = $\text{Sum}(39)_{1...12} / 12 =$												<input type="text" value="107.9"/> (39)	

Heat loss parameter (HLP), $\text{W/m}^2\text{K}$ (40)m = (39)m \div (4)

(40)m=	1.08	1.08	1.08	1.06	1.06	1.05	1.05	1.05	1.06	1.06	1.07	1.07	
Average = $\text{Sum}(40)_{1...12} / 12 =$												<input type="text" value="1.06"/> (40)	

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	109.5	105.52	101.54	97.56	93.57	89.59	89.59	93.57	97.56	101.54	105.52	109.5	
Total = $\text{Sum}(44)_{1...12} =$												<input type="text" value="1194.55"/> (44)	

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

(45)m=	162.39	142.02	146.56	127.77	122.6	105.79	98.03	112.5	113.84	132.67	144.82	157.26	
Total = $\text{Sum}(45)_{1...12} =$												<input type="text" value="1566.25"/> (45)	

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

(46)m=	24.36	21.3	21.98	19.17	18.39	15.87	14.71	16.87	17.08	19.9	21.72	23.59	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel (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): (48)

Temperature factor from Table 2b (49)

Energy lost from water storage, kWh/year (48) \times (49) = (50)

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

SAP WorkSheet: New dwelling design stage

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

0

 (51)

If community heating see section 4.3

Volume factor from Table 2a

0

 (52)

Temperature factor from Table 2b

0

 (53)

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

0

 (54)

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

1.24

 (55)

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

(56)m=

38.5	34.78	38.5	37.26	38.5	37.26	38.5	38.5	37.26	38.5	37.26	38.5
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 (56)

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

(57)m=

38.5	34.78	38.5	37.26	38.5	37.26	38.5	38.5	37.26	38.5	37.26	38.5
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 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

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

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

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
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 (59)

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

(61)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (61)

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

(62)m=

224.15	197.81	208.32	187.54	184.36	165.57	159.8	174.26	173.61	194.43	204.59	219.03
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (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=

224.15	197.81	208.32	187.54	184.36	165.57	159.8	174.26	173.61	194.43	204.59	219.03
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

2293.47

 (64)

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

(65)m=

103.4	91.85	98.14	90.3	90.18	82.99	82.01	86.82	85.67	93.52	95.97	101.7
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	165.08	165.08	165.08	165.08	165.08	165.08	165.08	165.08	165.08	165.08	165.08	165.08

 (66)

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

(67)m=

63.01	55.97	45.52	34.46	25.76	21.75	23.5	30.54	41	52.05	60.75	64.77
-------	-------	-------	-------	-------	-------	------	-------	----	-------	-------	-------

 (67)

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

(68)m=

385.74	389.74	379.65	358.18	331.07	305.6	288.58	284.57	294.66	316.13	343.24	368.72
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

54.26	54.26	54.26	54.26	54.26	54.26	54.26	54.26	54.26	54.26	54.26	54.26
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

138.99	136.69	131.91	125.42	121.2	115.27	110.23	116.69	118.98	125.7	133.29	136.7
--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	-------

 (72)

SAP WorkSheet: New dwelling design stage

Total internal gains =

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

(73)m=	700.03	694.68	669.37	630.35	590.32	554.9	534.59	544.09	566.93	606.18	649.57	682.47	(73)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
Northeast 0.9x	0.77	1.3	11.28	0.71	0.7	5.05 (75)
Northeast 0.9x	0.77	0.84	11.28	0.71	0.7	3.26 (75)
Northeast 0.9x	0.77	1.3	11.28	0.71	0.7	5.05 (75)
Northeast 0.9x	0.77	1.3	22.97	0.71	0.7	10.28 (75)
Northeast 0.9x	0.77	0.84	22.97	0.71	0.7	6.64 (75)
Northeast 0.9x	0.77	1.3	22.97	0.71	0.7	10.28 (75)
Northeast 0.9x	0.77	1.3	41.38	0.71	0.7	18.53 (75)
Northeast 0.9x	0.77	0.84	41.38	0.71	0.7	11.97 (75)
Northeast 0.9x	0.77	1.3	41.38	0.71	0.7	18.53 (75)
Northeast 0.9x	0.77	1.3	67.96	0.71	0.7	30.43 (75)
Northeast 0.9x	0.77	0.84	67.96	0.71	0.7	19.66 (75)
Northeast 0.9x	0.77	1.3	67.96	0.71	0.7	30.43 (75)
Northeast 0.9x	0.77	1.3	91.35	0.71	0.7	40.9 (75)
Northeast 0.9x	0.77	0.84	91.35	0.71	0.7	26.43 (75)
Northeast 0.9x	0.77	1.3	91.35	0.71	0.7	40.9 (75)
Northeast 0.9x	0.77	1.3	97.38	0.71	0.7	43.6 (75)
Northeast 0.9x	0.77	0.84	97.38	0.71	0.7	28.17 (75)
Northeast 0.9x	0.77	1.3	97.38	0.71	0.7	43.6 (75)
Northeast 0.9x	0.77	1.3	91.1	0.71	0.7	40.79 (75)
Northeast 0.9x	0.77	0.84	91.1	0.71	0.7	26.36 (75)
Northeast 0.9x	0.77	1.3	91.1	0.71	0.7	40.79 (75)
Northeast 0.9x	0.77	1.3	72.63	0.71	0.7	32.52 (75)
Northeast 0.9x	0.77	0.84	72.63	0.71	0.7	21.01 (75)
Northeast 0.9x	0.77	1.3	72.63	0.71	0.7	32.52 (75)
Northeast 0.9x	0.77	1.3	50.42	0.71	0.7	22.58 (75)
Northeast 0.9x	0.77	0.84	50.42	0.71	0.7	14.59 (75)
Northeast 0.9x	0.77	1.3	50.42	0.71	0.7	22.58 (75)
Northeast 0.9x	0.77	1.3	28.07	0.71	0.7	12.57 (75)
Northeast 0.9x	0.77	0.84	28.07	0.71	0.7	8.12 (75)
Northeast 0.9x	0.77	1.3	28.07	0.71	0.7	12.57 (75)
Northeast 0.9x	0.77	1.3	14.2	0.71	0.7	6.36 (75)
Northeast 0.9x	0.77	0.84	14.2	0.71	0.7	4.11 (75)
Northeast 0.9x	0.77	1.3	14.2	0.71	0.7	6.36 (75)
Northeast 0.9x	0.77	1.3	9.21	0.71	0.7	4.13 (75)

SAP WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	0.84	x	9.21	x	0.71	x	0.7	=	2.67	(75)
Northeast 0.9x	0.77	x	1.3	x	9.21	x	0.71	x	0.7	=	4.13	(75)
Southeast 0.9x	0.77	x	0.72	x	36.79	x	0.71	x	0.7	=	9.12	(77)
Southeast 0.9x	0.77	x	0.72	x	36.79	x	0.71	x	0.7	=	9.12	(77)
Southeast 0.9x	0.77	x	1.3	x	36.79	x	0.71	x	0.7	=	16.47	(77)
Southeast 0.9x	0.77	x	0.72	x	62.67	x	0.71	x	0.7	=	15.54	(77)
Southeast 0.9x	0.77	x	0.72	x	62.67	x	0.71	x	0.7	=	15.54	(77)
Southeast 0.9x	0.77	x	1.3	x	62.67	x	0.71	x	0.7	=	28.06	(77)
Southeast 0.9x	0.77	x	0.72	x	85.75	x	0.71	x	0.7	=	21.27	(77)
Southeast 0.9x	0.77	x	0.72	x	85.75	x	0.71	x	0.7	=	21.27	(77)
Southeast 0.9x	0.77	x	1.3	x	85.75	x	0.71	x	0.7	=	38.4	(77)
Southeast 0.9x	0.77	x	0.72	x	106.25	x	0.71	x	0.7	=	26.35	(77)
Southeast 0.9x	0.77	x	0.72	x	106.25	x	0.71	x	0.7	=	26.35	(77)
Southeast 0.9x	0.77	x	1.3	x	106.25	x	0.71	x	0.7	=	47.57	(77)
Southeast 0.9x	0.77	x	0.72	x	119.01	x	0.71	x	0.7	=	29.51	(77)
Southeast 0.9x	0.77	x	0.72	x	119.01	x	0.71	x	0.7	=	29.51	(77)
Southeast 0.9x	0.77	x	1.3	x	119.01	x	0.71	x	0.7	=	53.29	(77)
Southeast 0.9x	0.77	x	0.72	x	118.15	x	0.71	x	0.7	=	29.3	(77)
Southeast 0.9x	0.77	x	0.72	x	118.15	x	0.71	x	0.7	=	29.3	(77)
Southeast 0.9x	0.77	x	1.3	x	118.15	x	0.71	x	0.7	=	52.9	(77)
Southeast 0.9x	0.77	x	0.72	x	113.91	x	0.71	x	0.7	=	28.25	(77)
Southeast 0.9x	0.77	x	0.72	x	113.91	x	0.71	x	0.7	=	28.25	(77)
Southeast 0.9x	0.77	x	1.3	x	113.91	x	0.71	x	0.7	=	51	(77)
Southeast 0.9x	0.77	x	0.72	x	104.39	x	0.71	x	0.7	=	25.89	(77)
Southeast 0.9x	0.77	x	0.72	x	104.39	x	0.71	x	0.7	=	25.89	(77)
Southeast 0.9x	0.77	x	1.3	x	104.39	x	0.71	x	0.7	=	46.74	(77)
Southeast 0.9x	0.77	x	0.72	x	92.85	x	0.71	x	0.7	=	23.03	(77)
Southeast 0.9x	0.77	x	0.72	x	92.85	x	0.71	x	0.7	=	23.03	(77)
Southeast 0.9x	0.77	x	1.3	x	92.85	x	0.71	x	0.7	=	41.57	(77)
Southeast 0.9x	0.77	x	0.72	x	69.27	x	0.71	x	0.7	=	17.18	(77)
Southeast 0.9x	0.77	x	0.72	x	69.27	x	0.71	x	0.7	=	17.18	(77)
Southeast 0.9x	0.77	x	1.3	x	69.27	x	0.71	x	0.7	=	31.01	(77)
Southeast 0.9x	0.77	x	0.72	x	44.07	x	0.71	x	0.7	=	10.93	(77)
Southeast 0.9x	0.77	x	0.72	x	44.07	x	0.71	x	0.7	=	10.93	(77)
Southeast 0.9x	0.77	x	1.3	x	44.07	x	0.71	x	0.7	=	19.73	(77)
Southeast 0.9x	0.77	x	0.72	x	31.49	x	0.71	x	0.7	=	7.81	(77)
Southeast 0.9x	0.77	x	0.72	x	31.49	x	0.71	x	0.7	=	7.81	(77)
Southeast 0.9x	0.77	x	1.3	x	31.49	x	0.71	x	0.7	=	14.1	(77)
Southwest 0.9x	0.77	x	1.07	x	36.79		0.71	x	0.7	=	13.56	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.71	x	0.7	=	16.47	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.71	x	0.7	=	16.47	(79)

SAP WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	1.07	x	62.67	0.71	x	0.7	=	23.1	(79)
Southwest0.9x	0.77	x	1.3	x	62.67	0.71	x	0.7	=	28.06	(79)
Southwest0.9x	0.77	x	1.3	x	62.67	0.71	x	0.7	=	28.06	(79)
Southwest0.9x	0.77	x	1.07	x	85.75	0.71	x	0.7	=	31.6	(79)
Southwest0.9x	0.77	x	1.3	x	85.75	0.71	x	0.7	=	38.4	(79)
Southwest0.9x	0.77	x	1.3	x	85.75	0.71	x	0.7	=	38.4	(79)
Southwest0.9x	0.77	x	1.07	x	106.25	0.71	x	0.7	=	39.16	(79)
Southwest0.9x	0.77	x	1.3	x	106.25	0.71	x	0.7	=	47.57	(79)
Southwest0.9x	0.77	x	1.3	x	106.25	0.71	x	0.7	=	47.57	(79)
Southwest0.9x	0.77	x	1.07	x	119.01	0.71	x	0.7	=	43.86	(79)
Southwest0.9x	0.77	x	1.3	x	119.01	0.71	x	0.7	=	53.29	(79)
Southwest0.9x	0.77	x	1.3	x	119.01	0.71	x	0.7	=	53.29	(79)
Southwest0.9x	0.77	x	1.07	x	118.15	0.71	x	0.7	=	43.54	(79)
Southwest0.9x	0.77	x	1.3	x	118.15	0.71	x	0.7	=	52.9	(79)
Southwest0.9x	0.77	x	1.3	x	118.15	0.71	x	0.7	=	52.9	(79)
Southwest0.9x	0.77	x	1.07	x	113.91	0.71	x	0.7	=	41.98	(79)
Southwest0.9x	0.77	x	1.3	x	113.91	0.71	x	0.7	=	51	(79)
Southwest0.9x	0.77	x	1.3	x	113.91	0.71	x	0.7	=	51	(79)
Southwest0.9x	0.77	x	1.07	x	104.39	0.71	x	0.7	=	38.47	(79)
Southwest0.9x	0.77	x	1.3	x	104.39	0.71	x	0.7	=	46.74	(79)
Southwest0.9x	0.77	x	1.3	x	104.39	0.71	x	0.7	=	46.74	(79)
Southwest0.9x	0.77	x	1.07	x	92.85	0.71	x	0.7	=	34.22	(79)
Southwest0.9x	0.77	x	1.3	x	92.85	0.71	x	0.7	=	41.57	(79)
Southwest0.9x	0.77	x	1.3	x	92.85	0.71	x	0.7	=	41.57	(79)
Southwest0.9x	0.77	x	1.07	x	69.27	0.71	x	0.7	=	25.53	(79)
Southwest0.9x	0.77	x	1.3	x	69.27	0.71	x	0.7	=	31.01	(79)
Southwest0.9x	0.77	x	1.3	x	69.27	0.71	x	0.7	=	31.01	(79)
Southwest0.9x	0.77	x	1.07	x	44.07	0.71	x	0.7	=	16.24	(79)
Southwest0.9x	0.77	x	1.3	x	44.07	0.71	x	0.7	=	19.73	(79)
Southwest0.9x	0.77	x	1.3	x	44.07	0.71	x	0.7	=	19.73	(79)
Southwest0.9x	0.77	x	1.07	x	31.49	0.71	x	0.7	=	11.6	(79)
Southwest0.9x	0.77	x	1.3	x	31.49	0.71	x	0.7	=	14.1	(79)
Southwest0.9x	0.77	x	1.3	x	31.49	0.71	x	0.7	=	14.1	(79)

Solar gains in watts, calculated for each month

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

(83)m=	94.6	165.58	238.35	315.09	370.97	376.23	359.42	316.52	264.73	186.18	114.12	80.43	(83)
--------	------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(84)m=	794.63	860.26	907.71	945.44	961.3	931.13	894.01	860.61	831.66	792.36	763.69	762.9	(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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

SAP WorkSheet: New dwelling design stage

(86)m=	0.99	0.99	0.98	0.94	0.86	0.69	0.52	0.56	0.79	0.95	0.99	0.99	(86)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(87)m=	20.02	20.15	20.35	20.61	20.83	20.96	20.99	20.99	20.92	20.65	20.29	20	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	------

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

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

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

(89)m=	0.99	0.98	0.97	0.92	0.81	0.6	0.41	0.45	0.71	0.93	0.98	0.99	(89)
--------	------	------	------	------	------	-----	------	------	------	------	------	------	------

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

(90)m=	18.73	18.91	19.2	19.58	19.87	20.02	20.04	20.04	19.98	19.64	19.13	18.7	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =	0.15	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.92	19.09	19.37	19.73	20.01	20.15	20.18	20.18	20.12	19.79	19.3	18.89	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(93)m=	18.92	19.09	19.37	19.73	20.01	20.15	20.18	20.18	20.12	19.79	19.3	18.89	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.92	0.81	0.61	0.42	0.46	0.72	0.92	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	784.63	842.91	873.73	866.8	779.7	572.43	379.29	398.53	598.34	728.92	745.77	754.96	(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)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m – (96)m]

(97)m=	1602.45	1551.71	1403.94	1168.53	895.02	592.26	381.5	402.05	643.91	989.69	1319.63	1595.38	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	608.45	476.31	394.47	217.24	85.8	0	0	0	0	194.01	413.18	625.27	
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3014.73	(98)
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Space heating requirement in kWh/m²/year

	29.75	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

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

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

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 0.9 (204)

Efficiency of main space heating system 1 93.8 (206)

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

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

608.45	476.31	394.47	217.24	85.8	0	0	0	0	194.01	413.18	625.27
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

583.8	457.02	378.49	208.44	82.32	0	0	0	0	186.15	396.44	599.94
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Total (kWh/year) =Sum(211) _{1...5,10...12} =	2892.6	(211)
---	--------	-------

SAP WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	93.61	73.28	60.69	33.42	13.2	0	0	0	0	29.85	63.57	96.2	
Total (kWh/year) =Sum(215) _{1...5,10...12} =												463.81	(215)

Water heating

Output from water heater (calculated above)

	224.15	197.81	208.32	187.54	184.36	165.57	159.8	174.26	173.61	194.43	204.59	219.03		
Efficiency of water heater													80.1	(216)
(217)m=	87.41	87.13	86.53	85.23	82.99	80.1	80.1	80.1	80.1	84.83	86.69	87.52		

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	256.44	227.04	240.76	220.05	222.16	206.7	199.5	217.55	216.74	229.2	236	250.25	
Total = Sum(219a) _{1...12} =												2722.4	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2892.6
Space heating fuel used, secondary		463.81
Water heating fuel used		2722.4
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
Electricity for lighting		445.14

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48	100.66 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	4.23	19.62 (242)
Water heating cost (other fuel)	(219)	3.48	94.74 (247)
Pumps, fans and electric keep-hot	(231)	13.19	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	58.71 (250)
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		403.63 (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] =	1.16	(257)
SAP rating (Section 12)		83.84	(258)

SAP WorkSheet: New dwelling design stage

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	=	624.8 (261)
Space heating (secondary)	(215) x		0.019	=	8.81 (263)
Water heating	(219) x		0.216	=	588.04 (264)
Space and water heating	(261) + (262) + (263) + (264) =				1221.65 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93 (267)
Electricity for lighting	(232) x		0.519	=	231.03 (268)
Total CO2, kg/year			sum of (265)...(271) =		1491.61 (272)
CO2 emissions per m²			(272) ÷ (4) =		14.72 (273)
El rating (section 14)					86 (274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x		1.22	=	3528.97 (261)
Space heating (secondary)	(215) x		1.04	=	482.36 (263)
Energy for water heating	(219) x		1.22	=	3321.33 (264)
Space and water heating	(261) + (262) + (263) + (264) =				7332.66 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	230.25 (267)
Electricity for lighting	(232) x		0	=	1366.6 (268)
'Total Primary Energy			sum of (265)...(271) =		8929.51 (272)
Primary energy kWh/m²/year			(272) ÷ (4) =		88.13 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Demi Beneke	Stroma Number:	STRO027754
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.4.18

Property Address: House 1

Address : House 1

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	50.66	(1a) x	2.38	(2a) =	120.57 (3a)
First floor	50.66	(1b) x	2.68	(2b) =	135.77 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	101.32	(4)			
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =				256.34 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration	[(9)-1]x0.1 =		0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)	
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.37 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.31 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37
-----	------	------	------	------	-----	-----	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(25)
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² -K	A X k kJ/K
Doors Type 1			2.15	x 1.8	= 3.87		(26)
Doors Type 2			3.13	x 1.4	= 4.382		(26)
Windows Type 1			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 2			0.72	x1/[1/(1.4)+ 0.04]	= 0.95		(27)
Windows Type 3			0.72	x1/[1/(1.4)+ 0.04]	= 0.95		(27)
Windows Type 4			1.07	x1/[1/(1.4)+ 0.04]	= 1.42		(27)
Windows Type 5			0.84	x1/[1/(1.4)+ 0.04]	= 1.11		(27)
Windows Type 6			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 7			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 8			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Windows Type 9			1.3	x1/[1/(1.4)+ 0.04]	= 1.72		(27)
Floor			50.66	x 0.12	= 6.0792		(28)
Walls	104.03	15.13	88.9	x 0.2	= 17.78		(29)
Roof	50.66	0	50.66	x 0.11	= 5.57		(30)
Total area of elements, m ²			205.35				(31)
Party wall			46.15	x 0	= 0		(32)

* 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) = 50.74 (33)

DER WorkSheet: New dwelling design stage

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in $\text{kJ/m}^2\text{K}$ Indicative Value: Medium (35)

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

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

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	48.99	48.73	48.47	47.28	47.05	46.01	46.01	45.82	46.41	47.05	47.51	47.98	(38)

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

(39)m=	109.61	109.35	109.09	107.9	107.67	106.63	106.63	106.44	107.03	107.67	108.13	108.6	(39)
Average = $\text{Sum}(39)_{1...12} / 12 =$												<input type="text" value="107.9"/> (39)	

Heat loss parameter (HLP), $\text{W/m}^2\text{K}$ (40)m = (39)m \div (4)

(40)m=	1.08	1.08	1.08	1.06	1.06	1.05	1.05	1.05	1.06	1.06	1.07	1.07	(40)
Average = $\text{Sum}(40)_{1...12} / 12 =$												<input type="text" value="1.06"/> (40)	

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N (42)

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

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	109.5	105.52	101.54	97.56	93.57	89.59	89.59	93.57	97.56	101.54	105.52	109.5	(44)
Total = $\text{Sum}(44)_{1...12} =$												<input type="text" value="1194.55"/> (44)	

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

(45)m=	162.39	142.02	146.56	127.77	122.6	105.79	98.03	112.5	113.84	132.67	144.82	157.26	(45)
Total = $\text{Sum}(45)_{1...12} =$												<input type="text" value="1566.25"/> (45)	

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

(46)m=

24.36	21.3	21.98	19.17	18.39	15.87	14.71	16.87	17.08	19.9	21.72	23.59
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(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel (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): (48)

Temperature factor from Table 2b (49)

Energy lost from water storage, kWh/year (48) \times (49) = (50)

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

DER WorkSheet: New dwelling design stage

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

0

 (51)

If community heating see section 4.3

Volume factor from Table 2a

0

 (52)

Temperature factor from Table 2b

0

 (53)

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

0

 (54)

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

1.24

 (55)

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

(56)m=

38.5	34.78	38.5	37.26	38.5	37.26	38.5	38.5	37.26	38.5	37.26	38.5
------	-------	------	-------	------	-------	------	------	-------	------	-------	------

 (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=

38.5	34.78	38.5	37.26	38.5	37.26	38.5	38.5	37.26	38.5	37.26	38.5
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 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

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

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

(59)m=

23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26
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 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

224.15	197.81	208.32	187.54	184.36	165.57	159.8	174.26	173.61	194.43	204.59	219.03
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (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=

224.15	197.81	208.32	187.54	184.36	165.57	159.8	174.26	173.61	194.43	204.59	219.03
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

2293.47

 (64)

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

(65)m=

103.4	91.85	98.14	90.3	90.18	82.99	82.01	86.82	85.67	93.52	95.97	101.7
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 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	137.57	137.57	137.57	137.57	137.57	137.57	137.57	137.57	137.57	137.57	137.57	137.57

 (66)

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

(67)m=

25.21	22.39	18.21	13.78	10.3	8.7	9.4	12.22	16.4	20.82	24.3	25.91
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 (67)

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

(68)m=

258.44	261.13	254.37	239.98	221.82	204.75	193.35	190.66	197.42	211.81	229.97	247.04
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 (68)

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

(69)m=

36.76	36.76	36.76	36.76	36.76	36.76	36.76	36.76	36.76	36.76	36.76	36.76
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

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

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

(71)m=

-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

138.99	136.69	131.91	125.42	121.2	115.27	110.23	116.69	118.98	125.7	133.29	136.7
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 (72)

DER WorkSheet: New dwelling design stage

Total internal gains =

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

(73)m=	489.91	487.47	471.76	446.45	420.6	395.99	380.24	386.84	400.08	425.61	454.84	476.91
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(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g ₋ Table 6b	FF Table 6c	Gains (W)
Northeast 0.9x	0.77	1.3	11.28	0.71	0.7	5.05 (75)
Northeast 0.9x	0.77	0.84	11.28	0.71	0.7	3.26 (75)
Northeast 0.9x	0.77	1.3	11.28	0.71	0.7	5.05 (75)
Northeast 0.9x	0.77	1.3	22.97	0.71	0.7	10.28 (75)
Northeast 0.9x	0.77	0.84	22.97	0.71	0.7	6.64 (75)
Northeast 0.9x	0.77	1.3	22.97	0.71	0.7	10.28 (75)
Northeast 0.9x	0.77	1.3	41.38	0.71	0.7	18.53 (75)
Northeast 0.9x	0.77	0.84	41.38	0.71	0.7	11.97 (75)
Northeast 0.9x	0.77	1.3	41.38	0.71	0.7	18.53 (75)
Northeast 0.9x	0.77	1.3	67.96	0.71	0.7	30.43 (75)
Northeast 0.9x	0.77	0.84	67.96	0.71	0.7	19.66 (75)
Northeast 0.9x	0.77	1.3	67.96	0.71	0.7	30.43 (75)
Northeast 0.9x	0.77	1.3	91.35	0.71	0.7	40.9 (75)
Northeast 0.9x	0.77	0.84	91.35	0.71	0.7	26.43 (75)
Northeast 0.9x	0.77	1.3	91.35	0.71	0.7	40.9 (75)
Northeast 0.9x	0.77	1.3	97.38	0.71	0.7	43.6 (75)
Northeast 0.9x	0.77	0.84	97.38	0.71	0.7	28.17 (75)
Northeast 0.9x	0.77	1.3	97.38	0.71	0.7	43.6 (75)
Northeast 0.9x	0.77	1.3	91.1	0.71	0.7	40.79 (75)
Northeast 0.9x	0.77	0.84	91.1	0.71	0.7	26.36 (75)
Northeast 0.9x	0.77	1.3	91.1	0.71	0.7	40.79 (75)
Northeast 0.9x	0.77	1.3	72.63	0.71	0.7	32.52 (75)
Northeast 0.9x	0.77	0.84	72.63	0.71	0.7	21.01 (75)
Northeast 0.9x	0.77	1.3	72.63	0.71	0.7	32.52 (75)
Northeast 0.9x	0.77	1.3	50.42	0.71	0.7	22.58 (75)
Northeast 0.9x	0.77	0.84	50.42	0.71	0.7	14.59 (75)
Northeast 0.9x	0.77	1.3	50.42	0.71	0.7	22.58 (75)
Northeast 0.9x	0.77	1.3	28.07	0.71	0.7	12.57 (75)
Northeast 0.9x	0.77	0.84	28.07	0.71	0.7	8.12 (75)
Northeast 0.9x	0.77	1.3	28.07	0.71	0.7	12.57 (75)
Northeast 0.9x	0.77	1.3	14.2	0.71	0.7	6.36 (75)
Northeast 0.9x	0.77	0.84	14.2	0.71	0.7	4.11 (75)
Northeast 0.9x	0.77	1.3	14.2	0.71	0.7	6.36 (75)
Northeast 0.9x	0.77	1.3	9.21	0.71	0.7	4.13 (75)

DER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	0.84	x	9.21	x	0.71	x	0.7	=	2.67	(75)
Northeast 0.9x	0.77	x	1.3	x	9.21	x	0.71	x	0.7	=	4.13	(75)
Southeast 0.9x	0.77	x	0.72	x	36.79	x	0.71	x	0.7	=	9.12	(77)
Southeast 0.9x	0.77	x	0.72	x	36.79	x	0.71	x	0.7	=	9.12	(77)
Southeast 0.9x	0.77	x	1.3	x	36.79	x	0.71	x	0.7	=	16.47	(77)
Southeast 0.9x	0.77	x	0.72	x	62.67	x	0.71	x	0.7	=	15.54	(77)
Southeast 0.9x	0.77	x	0.72	x	62.67	x	0.71	x	0.7	=	15.54	(77)
Southeast 0.9x	0.77	x	1.3	x	62.67	x	0.71	x	0.7	=	28.06	(77)
Southeast 0.9x	0.77	x	0.72	x	85.75	x	0.71	x	0.7	=	21.27	(77)
Southeast 0.9x	0.77	x	0.72	x	85.75	x	0.71	x	0.7	=	21.27	(77)
Southeast 0.9x	0.77	x	1.3	x	85.75	x	0.71	x	0.7	=	38.4	(77)
Southeast 0.9x	0.77	x	0.72	x	106.25	x	0.71	x	0.7	=	26.35	(77)
Southeast 0.9x	0.77	x	0.72	x	106.25	x	0.71	x	0.7	=	26.35	(77)
Southeast 0.9x	0.77	x	1.3	x	106.25	x	0.71	x	0.7	=	47.57	(77)
Southeast 0.9x	0.77	x	0.72	x	119.01	x	0.71	x	0.7	=	29.51	(77)
Southeast 0.9x	0.77	x	0.72	x	119.01	x	0.71	x	0.7	=	29.51	(77)
Southeast 0.9x	0.77	x	1.3	x	119.01	x	0.71	x	0.7	=	53.29	(77)
Southeast 0.9x	0.77	x	0.72	x	118.15	x	0.71	x	0.7	=	29.3	(77)
Southeast 0.9x	0.77	x	0.72	x	118.15	x	0.71	x	0.7	=	29.3	(77)
Southeast 0.9x	0.77	x	1.3	x	118.15	x	0.71	x	0.7	=	52.9	(77)
Southeast 0.9x	0.77	x	0.72	x	113.91	x	0.71	x	0.7	=	28.25	(77)
Southeast 0.9x	0.77	x	0.72	x	113.91	x	0.71	x	0.7	=	28.25	(77)
Southeast 0.9x	0.77	x	1.3	x	113.91	x	0.71	x	0.7	=	51	(77)
Southeast 0.9x	0.77	x	0.72	x	104.39	x	0.71	x	0.7	=	25.89	(77)
Southeast 0.9x	0.77	x	0.72	x	104.39	x	0.71	x	0.7	=	25.89	(77)
Southeast 0.9x	0.77	x	1.3	x	104.39	x	0.71	x	0.7	=	46.74	(77)
Southeast 0.9x	0.77	x	0.72	x	92.85	x	0.71	x	0.7	=	23.03	(77)
Southeast 0.9x	0.77	x	0.72	x	92.85	x	0.71	x	0.7	=	23.03	(77)
Southeast 0.9x	0.77	x	1.3	x	92.85	x	0.71	x	0.7	=	41.57	(77)
Southeast 0.9x	0.77	x	0.72	x	69.27	x	0.71	x	0.7	=	17.18	(77)
Southeast 0.9x	0.77	x	0.72	x	69.27	x	0.71	x	0.7	=	17.18	(77)
Southeast 0.9x	0.77	x	1.3	x	69.27	x	0.71	x	0.7	=	31.01	(77)
Southeast 0.9x	0.77	x	0.72	x	44.07	x	0.71	x	0.7	=	10.93	(77)
Southeast 0.9x	0.77	x	0.72	x	44.07	x	0.71	x	0.7	=	10.93	(77)
Southeast 0.9x	0.77	x	1.3	x	44.07	x	0.71	x	0.7	=	19.73	(77)
Southeast 0.9x	0.77	x	0.72	x	31.49	x	0.71	x	0.7	=	7.81	(77)
Southeast 0.9x	0.77	x	0.72	x	31.49	x	0.71	x	0.7	=	7.81	(77)
Southeast 0.9x	0.77	x	1.3	x	31.49	x	0.71	x	0.7	=	14.1	(77)
Southwest 0.9x	0.77	x	1.07	x	36.79		0.71	x	0.7	=	13.56	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.71	x	0.7	=	16.47	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.71	x	0.7	=	16.47	(79)

DER WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	1.07	x	62.67	0.71	x	0.7	=	23.1	(79)
Southwest0.9x	0.77	x	1.3	x	62.67	0.71	x	0.7	=	28.06	(79)
Southwest0.9x	0.77	x	1.3	x	62.67	0.71	x	0.7	=	28.06	(79)
Southwest0.9x	0.77	x	1.07	x	85.75	0.71	x	0.7	=	31.6	(79)
Southwest0.9x	0.77	x	1.3	x	85.75	0.71	x	0.7	=	38.4	(79)
Southwest0.9x	0.77	x	1.3	x	85.75	0.71	x	0.7	=	38.4	(79)
Southwest0.9x	0.77	x	1.07	x	106.25	0.71	x	0.7	=	39.16	(79)
Southwest0.9x	0.77	x	1.3	x	106.25	0.71	x	0.7	=	47.57	(79)
Southwest0.9x	0.77	x	1.3	x	106.25	0.71	x	0.7	=	47.57	(79)
Southwest0.9x	0.77	x	1.07	x	119.01	0.71	x	0.7	=	43.86	(79)
Southwest0.9x	0.77	x	1.3	x	119.01	0.71	x	0.7	=	53.29	(79)
Southwest0.9x	0.77	x	1.3	x	119.01	0.71	x	0.7	=	53.29	(79)
Southwest0.9x	0.77	x	1.07	x	118.15	0.71	x	0.7	=	43.54	(79)
Southwest0.9x	0.77	x	1.3	x	118.15	0.71	x	0.7	=	52.9	(79)
Southwest0.9x	0.77	x	1.3	x	118.15	0.71	x	0.7	=	52.9	(79)
Southwest0.9x	0.77	x	1.07	x	113.91	0.71	x	0.7	=	41.98	(79)
Southwest0.9x	0.77	x	1.3	x	113.91	0.71	x	0.7	=	51	(79)
Southwest0.9x	0.77	x	1.3	x	113.91	0.71	x	0.7	=	51	(79)
Southwest0.9x	0.77	x	1.07	x	104.39	0.71	x	0.7	=	38.47	(79)
Southwest0.9x	0.77	x	1.3	x	104.39	0.71	x	0.7	=	46.74	(79)
Southwest0.9x	0.77	x	1.3	x	104.39	0.71	x	0.7	=	46.74	(79)
Southwest0.9x	0.77	x	1.07	x	92.85	0.71	x	0.7	=	34.22	(79)
Southwest0.9x	0.77	x	1.3	x	92.85	0.71	x	0.7	=	41.57	(79)
Southwest0.9x	0.77	x	1.3	x	92.85	0.71	x	0.7	=	41.57	(79)
Southwest0.9x	0.77	x	1.07	x	69.27	0.71	x	0.7	=	25.53	(79)
Southwest0.9x	0.77	x	1.3	x	69.27	0.71	x	0.7	=	31.01	(79)
Southwest0.9x	0.77	x	1.3	x	69.27	0.71	x	0.7	=	31.01	(79)
Southwest0.9x	0.77	x	1.07	x	44.07	0.71	x	0.7	=	16.24	(79)
Southwest0.9x	0.77	x	1.3	x	44.07	0.71	x	0.7	=	19.73	(79)
Southwest0.9x	0.77	x	1.3	x	44.07	0.71	x	0.7	=	19.73	(79)
Southwest0.9x	0.77	x	1.07	x	31.49	0.71	x	0.7	=	11.6	(79)
Southwest0.9x	0.77	x	1.3	x	31.49	0.71	x	0.7	=	14.1	(79)
Southwest0.9x	0.77	x	1.3	x	31.49	0.71	x	0.7	=	14.1	(79)

Solar gains in watts, calculated for each month

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

(83)m=

94.6	165.58	238.35	315.09	370.97	376.23	359.42	316.52	264.73	186.18	114.12	80.43
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 (83)

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

(84)m=

584.51	653.05	710.1	761.54	791.57	772.22	739.66	703.36	664.81	611.79	568.95	557.35
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 (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
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DER WorkSheet: New dwelling design stage

(86)m=	1	1	0.99	0.98	0.92	0.79	0.61	0.66	0.88	0.98	1	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	19.96	20.18	20.47	20.75	20.93	20.99	20.98	20.86	20.51	20.12	19.81	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.03	20.03	20.04	20.04	20.04	20.04	20.03	20.03	20.02	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.89	0.7	0.49	0.54	0.82	0.97	1	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.45	18.64	18.96	19.39	19.77	19.99	20.03	20.03	19.92	19.45	18.88	18.42	(90)
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fLA = Living area ÷ (4) =	0.15	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.65	18.83	19.14	19.55	19.91	20.13	20.17	20.17	20.05	19.61	19.06	18.63	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.65	18.83	19.14	19.55	19.91	20.13	20.17	20.17	20.05	19.61	19.06	18.63	(93)
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8. Space heating requirement

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

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

(94)m=	1	0.99	0.99	0.96	0.89	0.71	0.51	0.56	0.82	0.97	0.99	1	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	582.53	648.8	699.7	730.79	700.75	549.93	375.84	392.8	548.41	591.56	564.96	555.88	(95)
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Monthly average external temperature from Table 8

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

(97)m=	1573.1	1523.44	1378.48	1148.78	883.97	589.37	381.06	401.33	637.23	969.79	1293.51	1566.72	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	736.98	587.76	505.01	300.95	136.32	0	0	0	0	281.41	524.56	752.07	(98)
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Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	3825.06	(98)
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Space heating requirement in kWh/m²/year

37.75	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

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

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

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 0.9 (204)

Efficiency of main space heating system 1 93.8 (206)

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

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

736.98	587.76	505.01	300.95	136.32	0	0	0	0	281.41	524.56	752.07
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

707.13	563.95	484.55	288.76	130.8	0	0	0	0	270.01	503.31	721.6
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Total (kWh/year) =Sum(211) _{1...5,10...12} =	3670.1	(211)
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DER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month

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

(215)m=	113.38	90.42	77.69	46.3	20.97	0	0	0	0	43.29	80.7	115.7	
Total (kWh/year) =Sum(215) _{1...5,10...12} =												588.47	(215)

Water heating

Output from water heater (calculated above)

224.15	197.81	208.32	187.54	184.36	165.57	159.8	174.26	173.61	194.43	204.59	219.03
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Efficiency of water heater 80.1 (216)

(217)m=	87.84	87.61	87.14	86.09	84.06	80.1	80.1	80.1	80.1	85.82	87.28	87.93	
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Fuel for water heating, kWh/month

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

(219)m=	255.19	225.77	239.06	217.83	219.33	206.7	199.5	217.55	216.74	226.56	234.42	249.1	
Total = Sum(219a) _{1...12} =												2707.75	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3670.1
Space heating fuel used, secondary		588.47
Water heating fuel used		2707.75
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		445.14 (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	=	792.74	(261)
Space heating (secondary)	(215) x	0.019	=	11.18	(263)
Water heating	(219) x	0.216	=	584.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1388.8 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	231.03	(268)
Total CO2, kg/year	sum of (265)...(271) =				1658.75 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =				16.37 (273)
El rating (section 14)					85 (274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Demi Beneke	Stroma Number:	STRO027754
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.4.18

Property Address: House 1

Address : House 1

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	50.66	(1a) x	2.38	(2a) =	120.57
First floor	50.66	(1b) x	2.68	(2b) =	135.77
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	101.32	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	256.34

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							4	x 10 =	40
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.41	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.35	(21)

Infiltration rate modified for monthly wind speed

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

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

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0	(23a)
---	-------

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

0	(23b)
---	-------

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

0	(23c)
---	-------

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

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)
---------	-----	------	------	------	------	------	------	------	------	------	------	------	-------

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

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors Type 1			2.15	x 1	= 2.15		(26)
Doors Type 2			3.13	x 1.2	= 3.756		(26)
Windows Type 1			1.3	x 1/[1/(1.4)+0.04]	= 1.72		(27)
Windows Type 2			0.72	x 1/[1/(1.4)+0.04]	= 0.95		(27)
Windows Type 3			0.72	x 1/[1/(1.4)+0.04]	= 0.95		(27)
Windows Type 4			1.07	x 1/[1/(1.4)+0.04]	= 1.42		(27)
Windows Type 5			0.84	x 1/[1/(1.4)+0.04]	= 1.11		(27)
Windows Type 6			1.3	x 1/[1/(1.4)+0.04]	= 1.72		(27)
Windows Type 7			1.3	x 1/[1/(1.4)+0.04]	= 1.72		(27)
Windows Type 8			1.3	x 1/[1/(1.4)+0.04]	= 1.72		(27)
Windows Type 9			1.3	x 1/[1/(1.4)+0.04]	= 1.72		(27)
Floor			50.66	x 0.13	= 6.5858		(28)
Walls	104.03	15.13	88.9	x 0.18	= 16		(29)
Roof	50.66	0	50.66	x 0.13	= 6.59		(30)
Total area of elements, m²			205.35				(31)
Party wall			46.15	x 0	= 0		(32)

* 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) =	48.14	(33)
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TER WorkSheet: New dwelling design stage

Heat capacity $C_m = S(A \times k)$ ((28)...(30) + (32) + (32a)...(32e) = (34)

Thermal mass parameter (TMP = $C_m \div TFA$) in $\text{kJ/m}^2\text{K}$ Indicative Value: Medium (35)

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

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

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	50.49	50.17	49.86	48.39	48.12	46.84	46.84	46.61	47.33	48.12	48.67	49.25	(38)

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

(39)m=	109.56	109.24	108.93	107.47	107.19	105.92	105.92	105.68	106.41	107.19	107.75	108.33	(39)
Average = $\text{Sum}(39)_{1...12} / 12 =$												<input type="text" value="107.47"/> (39)	

Heat loss parameter (HLP), $\text{W/m}^2\text{K}$ (40)m = (39)m \div (4)

(40)m=	1.08	1.08	1.08	1.06	1.06	1.05	1.05	1.04	1.05	1.06	1.06	1.07	(40)
Average = $\text{Sum}(40)_{1...12} / 12 =$												<input type="text" value="1.06"/> (40)	

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N (42)

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

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	109.5	105.52	101.54	97.56	93.57	89.59	89.59	93.57	97.56	101.54	105.52	109.5	(44)
Total = $\text{Sum}(44)_{1...12} =$												<input type="text" value="1194.55"/> (44)	

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

(45)m=	162.39	142.02	146.56	127.77	122.6	105.79	98.03	112.5	113.84	132.67	144.82	157.26	(45)
Total = $\text{Sum}(45)_{1...12} =$												<input type="text" value="1566.25"/> (45)	

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

(46)m=

24.36	21.3	21.98	19.17	18.39	15.87	14.71	16.87	17.08	19.9	21.72	23.59
-------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel (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): (48)

Temperature factor from Table 2b (49)

Energy lost from water storage, kWh/year (48) \times (49) = (50)

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

TER WorkSheet: New dwelling design stage

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) x (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
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 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (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 x (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 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=

214.13	188.76	198.3	177.85	174.35	155.87	149.78	164.24	163.92	184.41	194.89	209.01
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

214.13	188.76	198.3	177.85	174.35	155.87	149.78	164.24	163.92	184.41	194.89	209.01
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2175.52

 (64)

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

(65)m=

95.39	84.61	90.13	82.55	82.16	75.24	73.99	78.8	77.91	85.51	88.21	93.69
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 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	137.57	137.57	137.57	137.57	137.57	137.57	137.57	137.57	137.57	137.57	137.57	137.57

 (66)

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

(67)m=

25.21	22.39	18.21	13.78	10.3	8.7	9.4	12.22	16.4	20.82	24.3	25.91
-------	-------	-------	-------	------	-----	-----	-------	------	-------	------	-------

 (67)

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

(68)m=

258.44	261.13	254.37	239.98	221.82	204.75	193.35	190.66	197.42	211.81	229.97	247.04
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

36.76	36.76	36.76	36.76	36.76	36.76	36.76	36.76	36.76	36.76	36.76	36.76
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06	-110.06
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

128.21	125.91	121.14	114.65	110.43	104.5	99.45	105.92	108.21	114.93	122.52	125.92
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 (72)

TER WorkSheet: New dwelling design stage

Total internal gains =

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

(73)m=	479.13	476.7	460.98	435.68	409.83	385.22	369.47	376.07	389.31	414.84	444.06	466.14
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(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g ₋ Table 6b	FF Table 6c	Gains (W)
Northeast 0.9x	0.77	1.3	11.28	0.63	0.7	4.48 (75)
Northeast 0.9x	0.77	0.84	11.28	0.63	0.7	2.9 (75)
Northeast 0.9x	0.77	1.3	11.28	0.63	0.7	4.48 (75)
Northeast 0.9x	0.77	1.3	22.97	0.63	0.7	9.12 (75)
Northeast 0.9x	0.77	0.84	22.97	0.63	0.7	5.9 (75)
Northeast 0.9x	0.77	1.3	22.97	0.63	0.7	9.12 (75)
Northeast 0.9x	0.77	1.3	41.38	0.63	0.7	16.44 (75)
Northeast 0.9x	0.77	0.84	41.38	0.63	0.7	10.62 (75)
Northeast 0.9x	0.77	1.3	41.38	0.63	0.7	16.44 (75)
Northeast 0.9x	0.77	1.3	67.96	0.63	0.7	27 (75)
Northeast 0.9x	0.77	0.84	67.96	0.63	0.7	17.45 (75)
Northeast 0.9x	0.77	1.3	67.96	0.63	0.7	27 (75)
Northeast 0.9x	0.77	1.3	91.35	0.63	0.7	36.29 (75)
Northeast 0.9x	0.77	0.84	91.35	0.63	0.7	23.45 (75)
Northeast 0.9x	0.77	1.3	91.35	0.63	0.7	36.29 (75)
Northeast 0.9x	0.77	1.3	97.38	0.63	0.7	38.69 (75)
Northeast 0.9x	0.77	0.84	97.38	0.63	0.7	25 (75)
Northeast 0.9x	0.77	1.3	97.38	0.63	0.7	38.69 (75)
Northeast 0.9x	0.77	1.3	91.1	0.63	0.7	36.19 (75)
Northeast 0.9x	0.77	0.84	91.1	0.63	0.7	23.39 (75)
Northeast 0.9x	0.77	1.3	91.1	0.63	0.7	36.19 (75)
Northeast 0.9x	0.77	1.3	72.63	0.63	0.7	28.85 (75)
Northeast 0.9x	0.77	0.84	72.63	0.63	0.7	18.64 (75)
Northeast 0.9x	0.77	1.3	72.63	0.63	0.7	28.85 (75)
Northeast 0.9x	0.77	1.3	50.42	0.63	0.7	20.03 (75)
Northeast 0.9x	0.77	0.84	50.42	0.63	0.7	12.94 (75)
Northeast 0.9x	0.77	1.3	50.42	0.63	0.7	20.03 (75)
Northeast 0.9x	0.77	1.3	28.07	0.63	0.7	11.15 (75)
Northeast 0.9x	0.77	0.84	28.07	0.63	0.7	7.21 (75)
Northeast 0.9x	0.77	1.3	28.07	0.63	0.7	11.15 (75)
Northeast 0.9x	0.77	1.3	14.2	0.63	0.7	5.64 (75)
Northeast 0.9x	0.77	0.84	14.2	0.63	0.7	3.64 (75)
Northeast 0.9x	0.77	1.3	14.2	0.63	0.7	5.64 (75)
Northeast 0.9x	0.77	1.3	9.21	0.63	0.7	3.66 (75)

TER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	0.84	x	9.21	x	0.63	x	0.7	=	2.37	(75)
Northeast 0.9x	0.77	x	1.3	x	9.21	x	0.63	x	0.7	=	3.66	(75)
Southeast 0.9x	0.77	x	0.72	x	36.79	x	0.63	x	0.7	=	8.1	(77)
Southeast 0.9x	0.77	x	0.72	x	36.79	x	0.63	x	0.7	=	8.1	(77)
Southeast 0.9x	0.77	x	1.3	x	36.79	x	0.63	x	0.7	=	14.62	(77)
Southeast 0.9x	0.77	x	0.72	x	62.67	x	0.63	x	0.7	=	13.79	(77)
Southeast 0.9x	0.77	x	0.72	x	62.67	x	0.63	x	0.7	=	13.79	(77)
Southeast 0.9x	0.77	x	1.3	x	62.67	x	0.63	x	0.7	=	24.9	(77)
Southeast 0.9x	0.77	x	0.72	x	85.75	x	0.63	x	0.7	=	18.87	(77)
Southeast 0.9x	0.77	x	0.72	x	85.75	x	0.63	x	0.7	=	18.87	(77)
Southeast 0.9x	0.77	x	1.3	x	85.75	x	0.63	x	0.7	=	34.07	(77)
Southeast 0.9x	0.77	x	0.72	x	106.25	x	0.63	x	0.7	=	23.38	(77)
Southeast 0.9x	0.77	x	0.72	x	106.25	x	0.63	x	0.7	=	23.38	(77)
Southeast 0.9x	0.77	x	1.3	x	106.25	x	0.63	x	0.7	=	42.21	(77)
Southeast 0.9x	0.77	x	0.72	x	119.01	x	0.63	x	0.7	=	26.19	(77)
Southeast 0.9x	0.77	x	0.72	x	119.01	x	0.63	x	0.7	=	26.19	(77)
Southeast 0.9x	0.77	x	1.3	x	119.01	x	0.63	x	0.7	=	47.28	(77)
Southeast 0.9x	0.77	x	0.72	x	118.15	x	0.63	x	0.7	=	26	(77)
Southeast 0.9x	0.77	x	0.72	x	118.15	x	0.63	x	0.7	=	26	(77)
Southeast 0.9x	0.77	x	1.3	x	118.15	x	0.63	x	0.7	=	46.94	(77)
Southeast 0.9x	0.77	x	0.72	x	113.91	x	0.63	x	0.7	=	25.06	(77)
Southeast 0.9x	0.77	x	0.72	x	113.91	x	0.63	x	0.7	=	25.06	(77)
Southeast 0.9x	0.77	x	1.3	x	113.91	x	0.63	x	0.7	=	45.26	(77)
Southeast 0.9x	0.77	x	0.72	x	104.39	x	0.63	x	0.7	=	22.97	(77)
Southeast 0.9x	0.77	x	0.72	x	104.39	x	0.63	x	0.7	=	22.97	(77)
Southeast 0.9x	0.77	x	1.3	x	104.39	x	0.63	x	0.7	=	41.47	(77)
Southeast 0.9x	0.77	x	0.72	x	92.85	x	0.63	x	0.7	=	20.43	(77)
Southeast 0.9x	0.77	x	0.72	x	92.85	x	0.63	x	0.7	=	20.43	(77)
Southeast 0.9x	0.77	x	1.3	x	92.85	x	0.63	x	0.7	=	36.89	(77)
Southeast 0.9x	0.77	x	0.72	x	69.27	x	0.63	x	0.7	=	15.24	(77)
Southeast 0.9x	0.77	x	0.72	x	69.27	x	0.63	x	0.7	=	15.24	(77)
Southeast 0.9x	0.77	x	1.3	x	69.27	x	0.63	x	0.7	=	27.52	(77)
Southeast 0.9x	0.77	x	0.72	x	44.07	x	0.63	x	0.7	=	9.7	(77)
Southeast 0.9x	0.77	x	0.72	x	44.07	x	0.63	x	0.7	=	9.7	(77)
Southeast 0.9x	0.77	x	1.3	x	44.07	x	0.63	x	0.7	=	17.51	(77)
Southeast 0.9x	0.77	x	0.72	x	31.49	x	0.63	x	0.7	=	6.93	(77)
Southeast 0.9x	0.77	x	0.72	x	31.49	x	0.63	x	0.7	=	6.93	(77)
Southeast 0.9x	0.77	x	1.3	x	31.49	x	0.63	x	0.7	=	12.51	(77)
Southwest 0.9x	0.77	x	1.07	x	36.79		0.63	x	0.7	=	12.03	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.63	x	0.7	=	14.62	(79)
Southwest 0.9x	0.77	x	1.3	x	36.79		0.63	x	0.7	=	14.62	(79)

TER WorkSheet: New dwelling design stage

Southwest0.9x	0.77	x	1.07	x	62.67	0.63	x	0.7	=	20.49	(79)
Southwest0.9x	0.77	x	1.3	x	62.67	0.63	x	0.7	=	24.9	(79)
Southwest0.9x	0.77	x	1.3	x	62.67	0.63	x	0.7	=	24.9	(79)
Southwest0.9x	0.77	x	1.07	x	85.75	0.63	x	0.7	=	28.04	(79)
Southwest0.9x	0.77	x	1.3	x	85.75	0.63	x	0.7	=	34.07	(79)
Southwest0.9x	0.77	x	1.3	x	85.75	0.63	x	0.7	=	34.07	(79)
Southwest0.9x	0.77	x	1.07	x	106.25	0.63	x	0.7	=	34.74	(79)
Southwest0.9x	0.77	x	1.3	x	106.25	0.63	x	0.7	=	42.21	(79)
Southwest0.9x	0.77	x	1.3	x	106.25	0.63	x	0.7	=	42.21	(79)
Southwest0.9x	0.77	x	1.07	x	119.01	0.63	x	0.7	=	38.92	(79)
Southwest0.9x	0.77	x	1.3	x	119.01	0.63	x	0.7	=	47.28	(79)
Southwest0.9x	0.77	x	1.3	x	119.01	0.63	x	0.7	=	47.28	(79)
Southwest0.9x	0.77	x	1.07	x	118.15	0.63	x	0.7	=	38.64	(79)
Southwest0.9x	0.77	x	1.3	x	118.15	0.63	x	0.7	=	46.94	(79)
Southwest0.9x	0.77	x	1.3	x	118.15	0.63	x	0.7	=	46.94	(79)
Southwest0.9x	0.77	x	1.07	x	113.91	0.63	x	0.7	=	37.25	(79)
Southwest0.9x	0.77	x	1.3	x	113.91	0.63	x	0.7	=	45.26	(79)
Southwest0.9x	0.77	x	1.3	x	113.91	0.63	x	0.7	=	45.26	(79)
Southwest0.9x	0.77	x	1.07	x	104.39	0.63	x	0.7	=	34.14	(79)
Southwest0.9x	0.77	x	1.3	x	104.39	0.63	x	0.7	=	41.47	(79)
Southwest0.9x	0.77	x	1.3	x	104.39	0.63	x	0.7	=	41.47	(79)
Southwest0.9x	0.77	x	1.07	x	92.85	0.63	x	0.7	=	30.36	(79)
Southwest0.9x	0.77	x	1.3	x	92.85	0.63	x	0.7	=	36.89	(79)
Southwest0.9x	0.77	x	1.3	x	92.85	0.63	x	0.7	=	36.89	(79)
Southwest0.9x	0.77	x	1.07	x	69.27	0.63	x	0.7	=	22.65	(79)
Southwest0.9x	0.77	x	1.3	x	69.27	0.63	x	0.7	=	27.52	(79)
Southwest0.9x	0.77	x	1.3	x	69.27	0.63	x	0.7	=	27.52	(79)
Southwest0.9x	0.77	x	1.07	x	44.07	0.63	x	0.7	=	14.41	(79)
Southwest0.9x	0.77	x	1.3	x	44.07	0.63	x	0.7	=	17.51	(79)
Southwest0.9x	0.77	x	1.3	x	44.07	0.63	x	0.7	=	17.51	(79)
Southwest0.9x	0.77	x	1.07	x	31.49	0.63	x	0.7	=	10.3	(79)
Southwest0.9x	0.77	x	1.3	x	31.49	0.63	x	0.7	=	12.51	(79)
Southwest0.9x	0.77	x	1.3	x	31.49	0.63	x	0.7	=	12.51	(79)

Solar gains in watts, calculated for each month

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

(83)m=	83.94	146.92	211.49	279.59	329.17	333.83	318.92	280.85	234.9	165.2	101.26	71.37	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	563.07	623.62	672.47	715.27	739	719.05	688.39	656.92	624.21	580.04	545.32	537.51	(84)
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7. Mean internal temperature (heating season)

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

21 (85)

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

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

(86)m=	1	1	0.99	0.98	0.94	0.82	0.65	0.7	0.9	0.99	1	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	19.93	20.14	20.44	20.71	20.92	20.98	20.97	20.84	20.49	20.1	19.79	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.03	20.04	20.05	20.05	20.05	20.04	20.04	20.03	20.03	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.91	0.74	0.52	0.57	0.85	0.98	1	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.42	18.6	18.91	19.34	19.73	19.98	20.04	20.04	19.9	19.42	18.86	18.4	(90)
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$fLA = \text{Living area} \div (4) =$	0.15	(91)
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Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.63	18.8	19.09	19.5	19.88	20.12	20.18	20.17	20.04	19.58	19.04	18.61	(92)
--------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.63	18.8	19.09	19.5	19.88	20.12	20.18	20.17	20.04	19.58	19.04	18.61	(93)
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8. Space heating requirement

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

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

(94)m=	1	0.99	0.99	0.97	0.91	0.75	0.54	0.59	0.85	0.97	0.99	1	(94)
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Useful gains, hmGm , $W = (94)m \times (84)m$

(95)m=	561.46	620.3	664.58	692.18	669.11	536.32	372.01	387.9	529.99	564.26	542.14	536.31	(95)
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Monthly average external temperature from Table 8

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

(97)m=	1569.5	1518.12	1371.71	1139.51	876.38	584.62	378.81	398.7	631.89	962.42	1286.57	1560.7	(97)
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Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	749.98	603.34	526.1	322.07	154.21	0	0	0	0	296.23	535.99	762.15	(98)
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$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1...5,9...12} =$	3950.07	(98)
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Space heating requirement in kWh/m²/year

$\text{Space heating requirement in kWh/m}^2\text{/year}$	38.99	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

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

749.98	603.34	526.1	322.07	154.21	0	0	0	0	296.23	535.99	762.15
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(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)

802.12	645.28	562.68	344.47	164.93	0	0	0	0	316.83	573.26	815.13
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$\text{Total (kWh/year)} = \text{Sum}(211)_{1...5,10...12} =$	4224.68	(211)
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TER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month

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

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

Water heating

Output from water heater (calculated above)

214.13	188.76	198.3	177.85	174.35	155.87	149.78	164.24	163.92	184.41	194.89	209.01
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Efficiency of water heater 79.8 (216)

(217)m=	87.88	87.7	87.3	86.38	84.49	79.8	79.8	79.8	79.8	86.07	87.38	87.96	
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Fuel for water heating, kWh/month

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

(219)m=	243.66	215.24	227.16	205.89	206.35	195.33	187.69	205.82	205.41	214.26	223.05	237.61	
Total = Sum(219a) _{1...12} =												2567.48	(219)

Annual totals

Space heating fuel used, main system 1 kWh/year 4224.68 kWh/year

Water heating fuel used 2567.48

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 445.14 (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	=	912.53 (261)
Space heating (secondary)	(215) x		0.519	=	0 (263)
Water heating	(219) x		0.216	=	554.58 (264)
Space and water heating	(261) + (262) + (263) + (264) =				1467.11 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93 (267)
Electricity for lighting	(232) x		0.519	=	231.03 (268)
Total CO2, kg/year	sum of (265)...(271) =				1737.06 (272)

TER = 17.14 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 17 June 2019

Property Details: House 1

Dwelling type:	Semi-detached House
Located in:	England
Region:	South England
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	North East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	None
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	338.37	(P1)
Transmission heat loss coefficient:	60.6	
Summer heat loss coefficient:	398.99	(P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North East (W1)	0	1
South East (W2)	0	1
South East (W3)	0	1
South West (W4)	0	1
North East (W6)	0	1
North East (W7)	0	1
South East (W8)	0	1
South West (W9)	0	1
South West (W10)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North East (W1)	1	0.9	1	0.9	(P8)
South East (W2)	1	0.9	1	0.9	(P8)
South East (W3)	1	0.9	1	0.9	(P8)
South West (W4)	1	0.9	1	0.9	(P8)
North East (W6)	1	0.9	1	0.9	(P8)
North East (W7)	1	0.9	1	0.9	(P8)
South East (W8)	1	0.9	1	0.9	(P8)
South West (W9)	1	0.9	1	0.9	(P8)
South West (W10)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains
North East (W1)	0.9 x	1.3	106.05	0.71	0.7	0.9	55.5
South East (W2)	0.9 x	0.72	127.31	0.71	0.7	0.9	36.9
South East (W3)	0.9 x	0.72	127.31	0.71	0.7	0.9	36.9
South West (W4)	0.9 x	1.07	127.31	0.71	0.7	0.9	54.84
North East (W6)	0.9 x	0.84	106.05	0.71	0.7	0.9	35.86
North East (W7)	0.9 x	1.3	106.05	0.71	0.7	0.9	55.5

SAP 2012 Overheating Assessment

South East (W8)	0.9 x	1.3	127.31	0.71	0.7	0.9	66.63
South West (W9)	0.9 x	1.3	127.31	0.71	0.7	0.9	66.63
South West (W10)	0.9 x	1.3	127.31	0.71	0.7	0.9	66.63
						Total	475.39 (P3/P4)

Internal gains:

	June	July	August
Internal gains	551.9	531.59	541.09
Total summer gains	1062.12	1006.98	967.03 (P5)
Summer gain/loss ratio	2.66	2.52	2.42 (P6)
Mean summer external temperature (South England)	15.4	17.3	17.3
Thermal mass temperature increment	0.25	0.25	0.25
Threshold temperature	18.31	20.07	19.97 (P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant
Assessment of likelihood of high internal temperature:	<u>Not significant</u>		