

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.50  
Printed on 30 November 2021 at 16:39:41

## Project Information:

**Assessed By:** David Barsted (STRO032333)

**Building Type:** End-terrace House

## Dwelling Details:

### NEW DWELLING DESIGN STAGE

Total Floor Area: 74m<sup>2</sup>

**Site Reference :** New Project

**Plot Reference:** House 1 - Be Lean

**Address :** 9 Cheyne Avenue, London, TW2 6AN

## 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) 18.53 kg/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 19.49 kg/m<sup>2</sup> **Fail**

Excess emissions = 0.96 kg/m<sup>2</sup> (5.2 %)

## 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.1 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 49.6 kWh/m<sup>2</sup> **OK**

## 2 Fabric U-values

Element	Average	Highest	
External wall	0.23 (max. 0.30)	0.23 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.60 (max. 3.30)	OK

## 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

## 3 Air permeability

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

## 4 Heating efficiency

Main Heating system:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.6 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

## 5 Cylinder insulation

Hot water Storage:	No cylinder	N/A
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# Regulations Compliance Report

## 6 Controls

Space heating controls	Programmer, room thermostat and TRVs	OK
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	OK

## 7 Low energy lights

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

## 8 Mechanical ventilation

Not applicable

## 9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: North West	9.14m <sup>2</sup>	
Windows facing: South East	15.33m <sup>2</sup>	
Ventilation rate:	8.00	
Blinds/curtains:	None	

## 10 Key features

Roofs U-value	0.11 W/m <sup>2</sup> K
Party Walls U-value	0 W/m <sup>2</sup> K

# Thermal Bridge Report

## Property Details: House 1 - Be Lean

Address: 9 Cheyne Avenue, London, TW2 6AN  
Located in: England  
Region: Thames valley

## Thermal bridges:

Thermal bridges: User-defined = UD  
Default = D  
Approved = A  
User-defined (individual PSI-values) Y-Value = 0.0732

## External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Sill	0.04	9.68	E3	[A]
Jamb	0.05	31.7	E4	[A]
Ground floor (normal)	0.16	16.77	E5	[A]
Intermediate floor within a dwelling	0.07	16.77	E6	[A]
Eaves (insulation at ceiling level)	0.06	16.77	E10	[A]
Corner (normal)	0.09	10.48	E16	[A]
Party wall between dwellings	0.06	10.48	E18	[A]
Other lintels (including other steel lintels)	0.3	14.38	E2	[A]
Corner (inverted internal area greater than external area)	-0.09	10.48	E17	[A]

# Predicted Energy Assessment



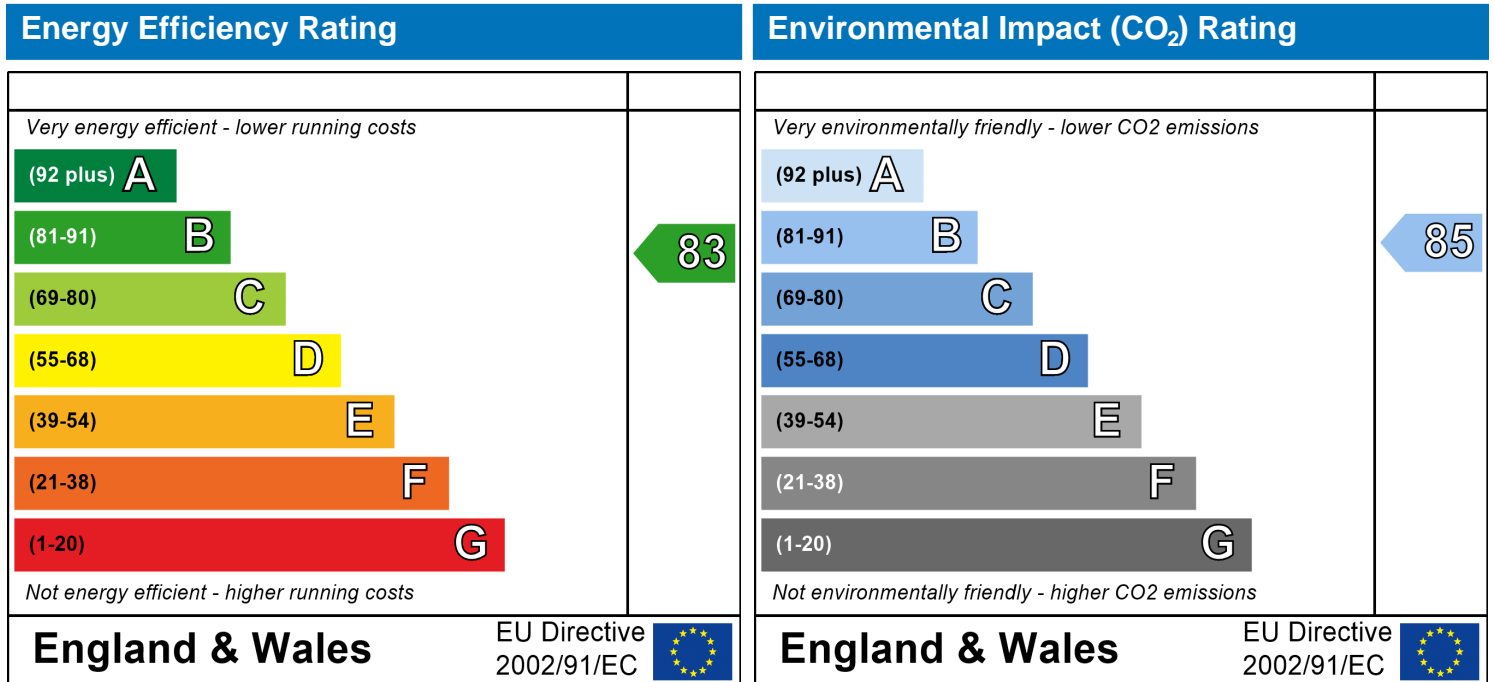
9 Cheyne Avenue  
London  
TW2 6AN

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

End-terrace House  
30 November 2021  
David Barsted  
74 m<sup>2</sup>

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 (CO<sub>2</sub>) 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 (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: House 1 - Be Lean

Address: 9 Cheyne Avenue, London, TW2 6AN  
 Located in: England  
 Region: Thames valley  
 UPRN:  
 Date of assessment: 30 November 2021  
 Date of certificate: 30 November 2021  
 Assessment type: New dwelling design stage  
 Transaction type: New dwelling  
 Tenure type: Unknown  
 Related party disclosure: No related party  
 Thermal Mass Parameter: Indicative Value Medium  
 Water use <= 125 litres/person/day: True  
 PCDF Version: 485

## Property description:

Dwelling type: House  
 Detachment: End-terrace  
 Year Completed: 2021  
 Floor Location: Floor area: Storey height:  
 Floor 0 37 m<sup>2</sup> 2.5 m  
 Floor 1 37 m<sup>2</sup> 2.7 m  
 Living area: 15 m<sup>2</sup> (fraction 0.197)  
 Front of dwelling faces: North West

## Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid			
Windows NW	SAP 2012	Windows	double-glazed	Yes	PVC-U
Windows SE	SAP 2012	Windows	double-glazed	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	mm	0.7	0.85	1.6	1.89	1
Windows NW	16mm or more	0.7	0.76	1.3	9.14	1
Windows SE	16mm or more	0.7	0.76	1.3	15.33	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		External Facade	North West	0	0
Windows NW		External Facade	North West	0	0
Windows SE		External Facade	South East	0	0

Overshading: Average or unknown

## Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
External Facade	87.88	26.36	61.52	0.23	0	False	N/A
Ceiling	36.64	0	36.64	0.12	0.5		N/A
Ground Floor	36.4			0.16			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Wall	38.93						N/A

## Thermal bridges:

# SAP Input

## Thermal bridges:

User-defined (individual PSI-values) Y-Value = 0.0732

	Length	Psi-value		
[Approved]	9.68	0.04	E3	Sill
[Approved]	31.7	0.05	E4	Jamb
[Approved]	16.77	0.16	E5	Ground floor (normal)
[Approved]	16.77	0.07	E6	Intermediate floor within a dwelling
[Approved]	16.77	0.06	E10	Eaves (insulation at ceiling level)
[Approved]	10.48	0.09	E16	Corner (normal)
[Approved]	10.48	0.06	E18	Party wall between dwellings
[Approved]	14.38	0.3	E2	Other lintels (including other steel lintels)
[Approved]	10.48	-0.09	E17	Corner (inverted internal area greater than external area)

## Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	1
Pressure test:	5

## Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Manufacturer Declaration
	Manufacturer's data
	Efficiency: 89.6% (SEDBUK2009)
	Condensing combi with automatic ignition
	Fuel Burning Type: Unknown
	Systems with radiators
	Central heating pump : 2013 or later
	Design flow temperature: Design flow temperature <= 45°C
	Room-sealed
	Boiler interlock: Yes
	Delayed start

## Main heating Control:

Main heating Control:	Programmer, room thermostat and TRVs
	Control code: 2106

## Secondary heating system:

Secondary heating system:	None
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## Water heating:

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

## Others:

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

# SAP Input

Photovoltaics: None  
Assess Zero Carbon Home: No

## SAP WorkSheet: New dwelling design stage

### User Details:

<b>Assessor Name:</b>	David Barsted	<b>Stroma Number:</b>	STRO032333
<b>Software Name:</b>	Stroma FSAP 2012	<b>Software Version:</b>	Version: 1.0.5.50

Property Address: House 1 - Be Lean

**Address :** 9 Cheyne Avenue, London, TW2 6AN

### 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	37	(1a) x	2.5	(2a) =	92.5 (3a)
First floor	37	(1b) x	2.7	(2b) =	99.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	192.4 (5)

### 2. Ventilation rate:

	main heating		secondary heating		other		total		m <sup>3</sup> 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) =	0.16 (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			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38 (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

	0.48	0.47	0.46	0.41	0.4	0.36	0.36	0.35	0.38	0.4	0.42	0.44
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(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
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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
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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
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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)m<sup>2</sup> x 0.5]

(24d)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6
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### 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m <sup>2</sup> )	Openings m <sup>2</sup>	Net Area A ,m <sup>2</sup>	U-value W/m <sup>2</sup> K	A X U (W/K)	k-value kJ/m <sup>2</sup> -K	A X k kJ/K
Doors			<input type="text" value="1.89"/>	x <input type="text" value="1.6"/>	= <input type="text" value="3.024"/>		<input type="text" value=""/> (26)
Windows Type 1			<input type="text" value="9.14"/>	x 1/[1/( 1.3)+ 0.04]	= <input type="text" value="11.29"/>		<input type="text" value=""/> (27)
Windows Type 2			<input type="text" value="15.33"/>	x 1/[1/( 1.3)+ 0.04]	= <input type="text" value="18.94"/>		<input type="text" value=""/> (27)
Floor			<input type="text" value="36.4"/>	x <input type="text" value="0.16"/>	= <input type="text" value="5.824"/>	<input type="text" value=""/>	<input type="text" value=""/> (28)
Walls	<input type="text" value="87.88"/>	<input type="text" value="26.36"/>	<input type="text" value="61.52"/>	x <input type="text" value="0.23"/>	= <input type="text" value="14.15"/>	<input type="text" value=""/>	<input type="text" value=""/> (29)
Roof	<input type="text" value="36.64"/>	<input type="text" value="0"/>	<input type="text" value="36.64"/>	x <input type="text" value="0.11"/>	= <input type="text" value="4.15"/>	<input type="text" value=""/>	<input type="text" value=""/> (30)
Total area of elements, m <sup>2</sup>			<input type="text" value="160.92"/>				<input type="text" value=""/> (31)
Party wall			<input type="text" value="38.93"/>	x <input type="text" value="0"/>	= <input type="text" value="0"/>	<input type="text" value=""/>	<input type="text" value=""/> (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) =  (33)

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

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m<sup>2</sup>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 x Y) calculated using Appendix K  (36)

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

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

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

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

(38)m=	39.02	38.74	38.46	37.16	36.92	35.79	35.79	35.58	36.22	36.92	37.41	37.93	(38)
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Heat transfer coefficient, W/K

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

(39)m=	108.18	107.9	107.62	106.32	106.08	104.95	104.95	104.74	105.38	106.08	106.57	107.09	
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Average = Sum(39)<sub>1...12</sub> / 12 =

106.32 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.46	1.46	1.45	1.44	1.43	1.42	1.42	1.42	1.42	1.43	1.44	1.45	
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Average = Sum(40)<sub>1...12</sub> / 12 =

1.44 (40)

Number of days in month (Table 1a)

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

**4. Water heating energy requirement: kWh/year:**

Assumed occupancy, N 2.34 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.76 (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=	98.73	95.14	91.55	87.96	84.37	80.78	80.78	84.37	87.96	91.55	95.14	98.73	
	Total = Sum(44) <sub>1...12</sub> =											1077.07 (44)	

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

(45)m=	146.42	128.06	132.14	115.21	110.54	95.39	88.39	101.43	102.64	119.62	130.57	141.8	
	Total = Sum(45) <sub>1...12</sub> =											1412.21 (45)	

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

(46)m=	21.96	19.21	19.82	17.28	16.58	14.31	13.26	15.21	15.4	17.94	19.59	21.27	(46)
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Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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# SAP WorkSheet: New dwelling design stage

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

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

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

(59)m= 

0	0	0	0	0	0	0	0	0	0	0	0
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 (59)

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

(61)m= 

50.31	43.79	46.65	43.38	42.99	39.84	41.16	42.99	43.38	46.65	46.92	50.31
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 (61)

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

(62)m= 

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
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 (62)

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

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

(63)m= 

0	0	0	0	0	0	0	0	0	0	0	0
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 (63)

Output from water heater

(64)m= 

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
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Output from water heater (annual)<sub>1...12</sub> 1950.6 (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= 

61.26	53.53	55.6	49.15	47.5	41.68	39.68	44.47	44.97	51.44	55.15	59.73
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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
(66)m=	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35

 (66)

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

(67)m= 

46.01	40.87	33.24	25.16	18.81	15.88	17.16	22.3	29.93	38.01	44.36	47.29
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 (67)

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

(68)m= 

308.13	311.33	303.27	286.12	264.46	244.11	230.52	227.32	235.38	252.53	274.18	294.53
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 (68)

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

(69)m= 

51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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= 

-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57
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 (71)

Water heating gains (Table 5)

(72)m= 

82.34	79.65	74.73	68.26	63.85	57.88	53.34	59.78	62.46	69.14	76.59	80.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m= 

537.64	533.01	512.4	480.7	448.28	419.03	402.17	410.56	428.93	460.83	496.3	523.26
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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 <sup>2</sup>	Flux Table 6a	g <sub>-</sub> Table 6b	FF Table 6c	Gains (W)
Southeast 0.9x	0.77	15.33	36.79	0.76	0.7	207.95
Southeast 0.9x	0.77	15.33	62.67	0.76	0.7	354.22

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Southeast 0.9x	0.77	x	15.33	x	85.75	x	0.76	x	0.7	=	484.66	(77)
Southeast 0.9x	0.77	x	15.33	x	106.25	x	0.76	x	0.7	=	600.51	(77)
Southeast 0.9x	0.77	x	15.33	x	119.01	x	0.76	x	0.7	=	672.62	(77)
Southeast 0.9x	0.77	x	15.33	x	118.15	x	0.76	x	0.7	=	667.76	(77)
Southeast 0.9x	0.77	x	15.33	x	113.91	x	0.76	x	0.7	=	643.79	(77)
Southeast 0.9x	0.77	x	15.33	x	104.39	x	0.76	x	0.7	=	589.99	(77)
Southeast 0.9x	0.77	x	15.33	x	92.85	x	0.76	x	0.7	=	524.78	(77)
Southeast 0.9x	0.77	x	15.33	x	69.27	x	0.76	x	0.7	=	391.49	(77)
Southeast 0.9x	0.77	x	15.33	x	44.07	x	0.76	x	0.7	=	249.08	(77)
Southeast 0.9x	0.77	x	15.33	x	31.49	x	0.76	x	0.7	=	177.96	(77)
Northwest 0.9x	0.77	x	9.14	x	11.28	x	0.76	x	0.7	=	38.02	(81)
Northwest 0.9x	0.77	x	9.14	x	22.97	x	0.76	x	0.7	=	77.39	(81)
Northwest 0.9x	0.77	x	9.14	x	41.38	x	0.76	x	0.7	=	139.43	(81)
Northwest 0.9x	0.77	x	9.14	x	67.96	x	0.76	x	0.7	=	228.99	(81)
Northwest 0.9x	0.77	x	9.14	x	91.35	x	0.76	x	0.7	=	307.81	(81)
Northwest 0.9x	0.77	x	9.14	x	97.38	x	0.76	x	0.7	=	328.16	(81)
Northwest 0.9x	0.77	x	9.14	x	91.1	x	0.76	x	0.7	=	306.98	(81)
Northwest 0.9x	0.77	x	9.14	x	72.63	x	0.76	x	0.7	=	244.73	(81)
Northwest 0.9x	0.77	x	9.14	x	50.42	x	0.76	x	0.7	=	169.9	(81)
Northwest 0.9x	0.77	x	9.14	x	28.07	x	0.76	x	0.7	=	94.58	(81)
Northwest 0.9x	0.77	x	9.14	x	14.2	x	0.76	x	0.7	=	47.84	(81)
Northwest 0.9x	0.77	x	9.14	x	9.21	x	0.76	x	0.7	=	31.05	(81)

Solar gains in watts, calculated for each month

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

(83)m=	245.97	431.61	624.09	829.5	980.43	995.92	950.78	834.72	694.68	486.06	296.92	209.01	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	783.61	964.62	1136.49	1310.2	1428.71	1414.95	1352.95	1245.28	1123.62	946.9	793.21	732.27	(84)
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### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.91	0.8	0.64	0.46	0.34	0.38	0.61	0.87	0.97	0.99	(86)

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

(87)m=	19.75	20.03	20.37	20.71	20.91	20.98	21	20.99	20.95	20.66	20.14	19.7	(87)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	------	------

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

(88)m=	19.72	19.72	19.72	19.74	19.74	19.75	19.75	19.75	19.74	19.74	19.73	19.73	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.98	0.95	0.89	0.75	0.57	0.38	0.24	0.28	0.51	0.82	0.95	0.98	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.63	18.9	19.22	19.54	19.69	19.74	19.75	19.75	19.72	19.5	19.02	18.59	(90)
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fLA = Living area ÷ (4) =

0.2

 (91)

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Mean internal temperature (for the whole dwelling) =  $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.86	19.13	19.45	19.77	19.94	19.99	20	20	19.97	19.74	19.25	18.82	(92)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(93)m=	18.71	18.98	19.3	19.62	19.79	19.84	19.85	19.85	19.82	19.59	19.1	18.67	(93)
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### 8. Space heating requirement

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

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

(94)m=	0.97	0.94	0.88	0.75	0.57	0.38	0.25	0.29	0.52	0.81	0.94	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains,  $hmG_m$ ,  $W = (94)m \times (84)m$

(95)m=	760.78	906.13	995.65	980.83	815.15	544.3	340.52	360.28	582.18	768.41	749.31	715.32	(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,  $L_m$ ,  $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1558.93	1518.75	1377.99	1140.31	857.71	550.33	341.24	361.58	602.75	953.33	1278.57	1549.19	(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=	593.83	411.68	284.46	114.83	31.66	0	0	0	0	137.58	381.07	620.4	
<b>Total per year (kWh/year) = Sum(98)<sub>1...5,9...12</sub> =</b>												2575.5	(98)

Space heating requirement in  $kWh/m^2/year$

34.8	(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)
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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

90.4	(206)
------	-------

Efficiency of secondary/supplementary heating system, %

0	(208)
---	-------

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

Space heating requirement (calculated above)

593.83	411.68	284.46	114.83	31.66	0	0	0	0	137.58	381.07	620.4
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	-------

(211)m =  $\{[(98)m \times (204)]\} \times 100 \div (206)$

656.89	455.4	314.67	127.02	35.02	0	0	0	0	152.19	421.54	686.28
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**Total (kWh/year) = Sum(211)<sub>1...5,10...12</sub> =** 2849 (211)

Space heating fuel (secondary),  $kWh/month$

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

(215)m=	0	0	0	0	0	0	0	0	0	0	0
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**Total (kWh/year) = Sum(215)<sub>1...5,10...12</sub> =** 0 (215)

#### Water heating

Output from water heater (calculated above)

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
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Efficiency of water heater

81.1	(216)
------	-------

(217)m=	87.89	87.45	86.57	84.76	82.55	81.1	81.1	81.1	81.1	85.06	87.22	88.01	(217)
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Fuel for water heating,  $kWh/month$

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

(219)m=	223.83	196.52	206.54	187.09	185.99	166.74	159.75	178.08	180.05	195.47	203.5	218.27
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**Total = Sum(219a)<sub>1...12</sub> =** 2301.83 (219)

## SAP WorkSheet: New dwelling design stage

Annual totals	kWh/year	kWh/year
Space heating fuel used, main system 1		2849
Water heating fuel used		2301.83
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		325.04 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5550.87 (338)

### 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	x 0.01 = 99.15 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 = 80.1 (247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 = 9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a)			
Energy for lighting	(232)	13.19	x 0.01 = 42.87 (250)
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
<b>Total energy cost</b>	(245)...(247) + (250)...(254) =		352.01 (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] =	1.24 (257)
<b>SAP rating (Section 12)</b>		82.67 (258)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 615.38 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 497.19 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1112.58 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 168.69 (268)
Total CO2, kg/year		sum of (265)...(271) =	1320.2 (272)

# SAP WorkSheet: New dwelling design stage

<b>CO2 emissions per m<sup>2</sup></b>	$(272) \div (4) =$	<input type="text" value="17.84"/>	(273)
El rating (section 14)		<input type="text" value="85"/>	(274)

## 13a. Primary Energy

	<b>Energy</b> kWh/year	<b>Primary</b> factor	<b>P. Energy</b> kWh/year
Space heating (main system 1)	(211) x	<input type="text" value="1.22"/>	= <input type="text" value="3475.78"/> (261)
Space heating (secondary)	(215) x	<input type="text" value="3.07"/>	= <input type="text" value="0"/> (263)
Energy for water heating	(219) x	<input type="text" value="1.22"/>	= <input type="text" value="2808.23"/> (264)
Space and water heating	$(261) + (262) + (263) + (264) =$		<input type="text" value="6284.01"/> (265)
Electricity for pumps, fans and electric keep-hot	(231) x	<input type="text" value="3.07"/>	= <input type="text" value="230.25"/> (267)
Electricity for lighting	(232) x	<input type="text" value="0"/>	= <input type="text" value="997.86"/> (268)
'Total Primary Energy		$\text{sum of (265)...(271) =}$	<input type="text" value="7512.13"/> (272)
<b>Primary energy kWh/m<sup>2</sup>/year</b>		$(272) \div (4) =$	<input type="text" value="101.52"/> (273)

## EPC Costs WorkSheet: New dwelling design stage

### User Details:

<b>Assessor Name:</b>	David Barsted	<b>Stroma Number:</b>	STRO032333
<b>Software Name:</b>	Stroma FSAP 2012	<b>Software Version:</b>	Version: 1.0.5.50

Property Address: House 1 - Be Lean

**Address :** 9 Cheyne Avenue, London, TW2 6AN

### 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	37	(1a) x	2.5	(2a) =	92.5 (3a)
First floor	37	(1b) x	2.7	(2b) =	99.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	192.4 (5)

### 2. Ventilation rate:

	main heating		secondary heating		other		total		m <sup>3</sup> 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) =	0.16 (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			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38 (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=	3.9	3.6	3.6	3.4	3.4	3.2	3.3	3.1	3.1	3.3	3.2	3.6
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# EPC Costs WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	0.98	0.9	0.9	0.85	0.85	0.8	0.82	0.78	0.78	0.82	0.8	0.9
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.34	0.34	0.32	0.32	0.3	0.31	0.29	0.29	0.31	0.3	0.34
------	------	------	------	------	-----	------	------	------	------	-----	------

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)
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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)
---------	---	---	---	---	---	---	---	---	---	---	---	---	-------

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

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

**3. Heat losses and heat loss parameter:**

ELEMENT	Gross area (m <sup>2</sup> )	Openings m <sup>2</sup>	Net Area A ,m <sup>2</sup>	U-value W/m <sup>2</sup> K	A X U (W/K)	k-value kJ/m <sup>2</sup> -K	A X k kJ/K
Doors			1.89	x 1.6	= 3.024		(26)
Windows Type 1			9.14	x 1/[1/(1.3)+0.04]	= 11.29		(27)
Windows Type 2			15.33	x 1/[1/(1.3)+0.04]	= 18.94		(27)
Floor			36.4	x 0.16	= 5.824		(28)
Walls	87.88	26.36	61.52	x 0.23	= 14.15		(29)
Roof	36.64	0	36.64	x 0.11	= 4.15		(30)
Total area of elements, m <sup>2</sup>			160.92				(31)
Party wall			38.93	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) = 57.38 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 10750.06 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m<sup>2</sup>K Indicative Value: Medium 250 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 11.78 (36)

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

Total fabric heat loss (33) + (36) = 69.16 (37)

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

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

## EPC Costs WorkSheet: New dwelling design stage

(38)m= 

36	35.37	35.37	34.98	34.98	34.61	34.79	34.43	34.43	34.79	34.61	35.37
----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (38)

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

(39)m= 

105.16	104.53	104.53	104.14	104.14	103.77	103.95	103.6	103.6	103.95	103.77	104.53
--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------

Average = Sum(39)<sub>1...12</sub> /12= 

104.14
--------

 (39)

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

(40)m= 

1.42	1.41	1.41	1.41	1.41	1.4	1.4	1.4	1.4	1.4	1.4	1.41
------	------	------	------	------	-----	-----	-----	-----	-----	-----	------

Average = Sum(40)<sub>1...12</sub> /12= 

1.41
------

 (40)

Number of days in month (Table 1a)

(41)m= 

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

 (41)

**4. Water heating energy requirement: kWh/year:**

Assumed occupancy, N 

2.34
------

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

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

89.76
-------

 (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
98.73	95.14	91.55	87.96	84.37	80.78	80.78	84.37	87.96	91.55	95.14	98.73

Total = Sum(44)<sub>1...12</sub> = 

1077.07
---------

 (44)

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

(45)m= 

146.42	128.06	132.14	115.21	110.54	95.39	88.39	101.43	102.64	119.62	130.57	141.8
--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	-------

Total = Sum(45)<sub>1...12</sub> = 

1412.21
---------

 (45)

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

(46)m= 

21.96	19.21	19.82	17.28	16.58	14.31	13.26	15.21	15.4	17.94	19.59	21.27
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (46)

Water storage loss:

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

0
---

 (47)

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

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

Water storage loss:

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

0
---

 (48)

Temperature factor from Table 2b 

0
---

 (49)

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

0
---

 (50)

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

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

0
---

 (51)

If community heating see section 4.3

Volume factor from Table 2a 

0
---

 (52)

Temperature factor from Table 2b 

0
---

 (53)

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

0
---

 (54)

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

0
---

 (55)

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

(56)m= 

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

 (56)

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

(57)m= 

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

 (57)

# EPC Costs WorkSheet: New dwelling design stage

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

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

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

(59)m= 

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

 (59)

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

(61)m= 

50.31	43.79	46.65	43.38	42.99	39.84	41.16	42.99	43.38	46.65	46.92	50.31
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (61)

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

(62)m= 

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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= 

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)<sub>1...12</sub> 1950.6 (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= 

61.26	53.53	55.6	49.15	47.5	41.68	39.68	44.47	44.97	51.44	55.15	59.73
-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (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
(66)m=	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35	140.35

 (66)

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

(67)m= 

46.01	40.87	33.24	25.16	18.81	15.88	17.16	22.3	29.93	38.01	44.36	47.29
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

 (67)

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

(68)m= 

308.13	311.33	303.27	286.12	264.46	244.11	230.52	227.32	235.38	252.53	274.18	294.53
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m= 

51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37	51.37
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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= 

-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m= 

82.34	79.65	74.73	68.26	63.85	57.88	53.34	59.78	62.46	69.14	76.59	80.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m= 

537.64	533.01	512.4	480.7	448.28	419.03	402.17	410.56	428.93	460.83	496.3	523.26
--------	--------	-------	-------	--------	--------	--------	--------	--------	--------	-------	--------

 (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 <sup>2</sup>	Flux Table 6a	g <sub>o</sub> Table 6b	FF Table 6c	Gains (W)
Southeast 0.9x	0.77	15.33	41.61	0.76	0.7	235.16
Southeast 0.9x	0.77	15.33	60.61	0.76	0.7	342.54

## EPC Costs WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	15.33	x	84.44	x	0.76	x	0.7	=	477.24	(77)
Southeast 0.9x	0.77	x	15.33	x	107.38	x	0.76	x	0.7	=	606.86	(77)
Southeast 0.9x	0.77	x	15.33	x	117.92	x	0.76	x	0.7	=	666.45	(77)
Southeast 0.9x	0.77	x	15.33	x	125.66	x	0.76	x	0.7	=	710.22	(77)
Southeast 0.9x	0.77	x	15.33	x	120.27	x	0.76	x	0.7	=	679.76	(77)
Southeast 0.9x	0.77	x	15.33	x	110.91	x	0.76	x	0.7	=	626.86	(77)
Southeast 0.9x	0.77	x	15.33	x	98.3	x	0.76	x	0.7	=	555.58	(77)
Southeast 0.9x	0.77	x	15.33	x	73.85	x	0.76	x	0.7	=	417.38	(77)
Southeast 0.9x	0.77	x	15.33	x	48.14	x	0.76	x	0.7	=	272.05	(77)
Southeast 0.9x	0.77	x	15.33	x	34.14	x	0.76	x	0.7	=	192.92	(77)
Northwest 0.9x	0.77	x	9.14	x	13.35	x	0.76	x	0.7	=	44.97	(81)
Northwest 0.9x	0.77	x	9.14	x	23.37	x	0.76	x	0.7	=	78.75	(81)
Northwest 0.9x	0.77	x	9.14	x	42.97	x	0.76	x	0.7	=	144.79	(81)
Northwest 0.9x	0.77	x	9.14	x	71.92	x	0.76	x	0.7	=	242.35	(81)
Northwest 0.9x	0.77	x	9.14	x	93.84	x	0.76	x	0.7	=	316.22	(81)
Northwest 0.9x	0.77	x	9.14	x	106.82	x	0.76	x	0.7	=	359.94	(81)
Northwest 0.9x	0.77	x	9.14	x	99.44	x	0.76	x	0.7	=	335.07	(81)
Northwest 0.9x	0.77	x	9.14	x	80.49	x	0.76	x	0.7	=	271.22	(81)
Northwest 0.9x	0.77	x	9.14	x	56.2	x	0.76	x	0.7	=	189.36	(81)
Northwest 0.9x	0.77	x	9.14	x	31.55	x	0.76	x	0.7	=	106.3	(81)
Northwest 0.9x	0.77	x	9.14	x	16.25	x	0.76	x	0.7	=	54.76	(81)
Northwest 0.9x	0.77	x	9.14	x	10.42	x	0.76	x	0.7	=	35.13	(81)

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

(83)m=	280.13	421.3	622.04	849.22	982.67	1070.16	1014.83	898.08	744.94	523.68	326.82	228.05	(83)
--------	--------	-------	--------	--------	--------	---------	---------	--------	--------	--------	--------	--------	------

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

(84)m=	817.78	954.3	1134.43	1329.92	1430.95	1489.2	1417	1308.64	1173.88	984.51	823.11	751.31	(84)
--------	--------	-------	---------	---------	---------	--------	------	---------	---------	--------	--------	--------	------

### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.95	0.88	0.73	0.53	0.31	0.19	0.22	0.47	0.79	0.94	0.98	(86)

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

(87)m=	19.99	20.2	20.54	20.83	20.96	21	21	21	20.98	20.81	20.36	19.93	(87)
--------	-------	------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

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

(88)m=	19.75	19.75	19.75	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.76	19.75	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.96	0.93	0.85	0.67	0.45	0.23	0.1	0.12	0.37	0.72	0.92	0.97	(89)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

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

(90)m=	18.89	19.09	19.4	19.65	19.74	19.76	19.76	19.76	19.76	19.64	19.25	18.83	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.2

## EPC Costs WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) =  $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	19.11	19.32	19.63	19.89	19.99	20.01	20.01	20.01	20.01	19.88	19.48	19.06	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.96	19.17	19.48	19.74	19.84	19.86	19.86	19.86	19.86	19.73	19.33	18.91	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

### 8. Space heating requirement

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

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

Utilisation factor for gains,  $hm$ :

(94)m=	0.96	0.93	0.84	0.67	0.46	0.23	0.11	0.13	0.38	0.72	0.92	0.97	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains,  $hmG_m$ ,  $W = (94)m \times (84)m$

(95)m=	782.42	882.86	952.01	895.17	656.57	348.32	151.87	172.35	446.79	709.91	753.51	726.15	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	5.5	6	7.8	10.3	13.4	16.5	18.4	18.2	15.5	12	8.4	5.5	(96)
--------	-----	---	-----	------	------	------	------	------	------	----	-----	-----	------

Heat loss rate for mean internal temperature,  $L_m$ ,  $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1415.71	1376.32	1221.43	983.07	670.63	348.84	151.88	172.38	451.35	803.61	1134	1401.39	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	------	---------	------

Space heating requirement for each month,  $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	471.17	331.61	200.45	63.29	10.46	0	0	0	0	69.72	273.95	502.38	
<b>Total per year (kWh/year) = Sum(98)<sub>1...5,9...12</sub> =</b>												1923.03	(98)

Space heating requirement in  $kWh/m^2/year$

25.99	(99)
-------	------

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

#### Space heating:

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

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

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

Efficiency of main space heating system 1  (206)

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

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

Space heating requirement (calculated above)

471.17	331.61	200.45	63.29	10.46	0	0	0	0	69.72	273.95	502.38
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m =  $\{[(98)m \times (204)]\} \times 100 \div (206)$  (211)

(211)m=	521.2	366.83	221.74	70.02	11.57	0	0	0	0	77.12	303.05	555.73	
<b>Total (kWh/year) = Sum(211)<sub>1...5,10...12</sub> =</b>												2127.25	(211)

Space heating fuel (secondary),  $kWh/month$

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

(215)m=	0	0	0	0	0	0	0	0	0	0	0		
<b>Total (kWh/year) = Sum(215)<sub>1...5,10...12</sub> =</b>												0	(215)

#### Water heating

Output from water heater (calculated above)

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater  (216)

(217)m= (217)

87.45	86.99	85.76	83.55	81.64	81.1	81.1	81.1	81.1	83.64	86.5	87.62
-------	-------	-------	-------	-------	------	------	------	------	-------	------	-------

Fuel for water heating,  $kWh/month$

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

(219)m=	224.97	197.54	208.48	189.8	188.08	166.74	159.75	178.08	180.05	198.79	205.2	219.25	
<b>Total = Sum(219a)<sub>1...12</sub> =</b>												2316.72	(219)

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Annual totals	kWh/year	kWh/year
Space heating fuel used, main system 1		2127.25
Water heating fuel used		2316.72
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75 (231)
Electricity for lighting		325.04 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4844 (338)

### 10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.74	x 0.01 = 79.56 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	19.12	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	3.74	x 0.01 = 86.65 (247)
Pumps, fans and electric keep-hot	(231)	0	x 0.01 = 14.34 (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)	0	x 0.01 = 62.15 (250)
Additional standing charges (Table 12)			94 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
<b>Total energy cost</b>	(245)...(247) + (250)...(254) =		336.69 (255)

### 11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.16 (257)
<b>SAP rating (Section 12)</b>		83.88 (258)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 459.49 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 500.41 (264)
Space and water heating	(261) + (262) + (263) + (264) =		959.9 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 168.69 (268)
Total CO2, kg/year		sum of (265)...(271) =	1167.52 (272)

## EPC Costs WorkSheet: New dwelling design stage

<b>Dwelling CO2 Emission Rate</b>	(272) ÷ (4) =	15.78	(273)
El rating (section 14)		87	(274)

### 13a. Primary Energy

	<b>Energy kWh/year</b>		<b>Primary factor</b>		<b>P. Energy kWh/year</b>
Space heating (main system 1)	(211) x		1.22	=	2595.24 (261)
Space heating (secondary)	(215) x		3.07	=	0 (263)
Energy for water heating	(219) x		1.22	=	2826.4 (264)
Space and water heating	(261) + (262) + (263) + (264) =				5421.64 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	230.25 (267)
Electricity for lighting	(232) x		0	=	997.86 (268)
'Total Primary Energy	sum of (265)...(271) =				6649.75 (272)
<b>Primary energy kWh/m<sup>2</sup>/year</b>	(272) ÷ (4) =				89.86 (273)

## TFEE WorkSheet: New dwelling design stage

### User Details:

<b>Assessor Name:</b>	David Barsted	<b>Stroma Number:</b>	STRO032333
<b>Software Name:</b>	Stroma FSAP 2012	<b>Software Version:</b>	Version: 1.0.5.50

Property Address: House 1 - Be Lean

**Address :** 9 Cheyne Avenue, London, TW2 6AN

### 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	37	(1a) x	2.5	(2a) =	92.5 (3a)
First floor	37	(1b) x	2.7	(2b) =	99.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	192.4 (5)

### 2. Ventilation rate:

	main heating		secondary heating		other		total		m <sup>3</sup> 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) =	0.16 (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			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38 (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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# TFEE 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

0.48	0.47	0.46	0.41	0.4	0.36	0.36	0.35	0.38	0.4	0.42	0.44
------	------	------	------	-----	------	------	------	------	-----	------	------

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<sup>2</sup> x 0.5]

(24d)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6	(25)
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### 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m <sup>2</sup> )	Openings m <sup>2</sup>	Net Area A ,m <sup>2</sup>	U-value W/m <sup>2</sup> K	A X U (W/K)	k-value kJ/m <sup>2</sup> -K	A X k kJ/K
Doors			1.89	x 1	= 1.89		(26)
Windows Type 1			6.2	x 1/[1/( 1.4 )+ 0.04]	= 8.22		(27)
Windows Type 2			10.41	x 1/[1/( 1.4 )+ 0.04]	= 13.8		(27)
Floor			36.4	x 0.13	= 4.732		(28)
Walls	87.88	18.5	69.38	x 0.18	= 12.49		(29)
Roof	36.64	0	36.64	x 0.13	= 4.76		(30)
Total area of elements, m <sup>2</sup>			160.92				(31)
Party wall			38.93	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) = 45.89 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 11221.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m<sup>2</sup>K Indicative Value: Medium 250 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.11 (36)

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

Total fabric heat loss (33) + (36) = 53 (37)

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

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

# TFEE WorkSheet: New dwelling design stage

(38)m=	39.02	38.74	38.46	37.16	36.92	35.79	35.79	35.58	36.22	36.92	37.41	37.93	(38)
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Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	92.02	91.74	91.46	90.16	89.92	88.79	88.79	88.58	89.22	89.92	90.41	90.93	
Average = Sum(39) <sub>1...12</sub> / 12 =												90.16	(39)

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

(40)m=	1.24	1.24	1.24	1.22	1.22	1.2	1.2	1.2	1.21	1.22	1.22	1.23	
Average = Sum(40) <sub>1...12</sub> / 12 =												1.22	(40)

Number of days in month (Table 1a)

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

**4. Water heating energy requirement: kWh/year:**

Assumed occupancy, N 2.34 (42)  
 if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)  
 if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.76 (43)  
 Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.73	95.14	91.55	87.96	84.37	80.78	80.78	84.37	87.96	91.55	95.14	98.73	
Total = Sum(44) <sub>1...12</sub> =												1077.07	(44)

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

(45)m=	146.42	128.06	132.14	115.21	110.54	95.39	88.39	101.43	102.64	119.62	130.57	141.8	
Total = Sum(45) <sub>1...12</sub> =												1412.21	(45)

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

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
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Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

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

# TFEE WorkSheet: New dwelling design stage

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

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

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

(59)m= 

0	0	0	0	0	0	0	0	0	0	0	0
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 (59)

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

(61)m= 

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

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

(62)m= 

124.45	108.85	112.32	97.92	93.96	81.08	75.13	86.22	87.25	101.68	110.99	120.53
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 (62)

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

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

(63)m= 

0	0	0	0	0	0	0	0	0	0	0	0
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 (63)

Output from water heater

(64)m= 

124.45	108.85	112.32	97.92	93.96	81.08	75.13	86.22	87.25	101.68	110.99	120.53
--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------

Output from water heater (annual)<sub>1...12</sub> 1200.38 (64)

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

(65)m= 

31.11	27.21	28.08	24.48	23.49	20.27	18.78	21.55	21.81	25.42	27.75	30.13
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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
(66)m=	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96

 (66)

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

(67)m= 

18.4	16.35	13.29	10.06	7.52	6.35	6.86	8.92	11.97	15.2	17.74	18.91
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 (67)

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

(68)m= 

206.45	208.59	203.19	191.7	177.19	163.56	154.45	152.3	157.7	169.2	183.7	197.34
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 (68)

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

(69)m= 

34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7
------	------	------	------	------	------	------	------	------	------	------	------

 (69)

Pumps and fans gains (Table 5a)

(70)m= 

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

 (70)

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

(71)m= 

-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57
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 (71)

Water heating gains (Table 5)

(72)m= 

41.82	40.49	37.74	34	31.57	28.15	25.25	28.97	30.29	34.17	38.54	40.5
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 (72)

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

(73)m= 

324.76	323.52	312.31	293.85	274.37	256.15	244.64	248.28	258.06	276.65	298.07	314.84
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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 <sup>2</sup>	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
Southeast 0.9x	0.77	10.41	36.79	0.63	0.7	117.06 (77)
Southeast 0.9x	0.77	10.41	62.67	0.63	0.7	199.39 (77)

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Southeast 0.9x	0.77	x	10.41	x	85.75	x	0.63	x	0.7	=	272.82	(77)
Southeast 0.9x	0.77	x	10.41	x	106.25	x	0.63	x	0.7	=	338.03	(77)
Southeast 0.9x	0.77	x	10.41	x	119.01	x	0.63	x	0.7	=	378.62	(77)
Southeast 0.9x	0.77	x	10.41	x	118.15	x	0.63	x	0.7	=	375.89	(77)
Southeast 0.9x	0.77	x	10.41	x	113.91	x	0.63	x	0.7	=	362.39	(77)
Southeast 0.9x	0.77	x	10.41	x	104.39	x	0.63	x	0.7	=	332.11	(77)
Southeast 0.9x	0.77	x	10.41	x	92.85	x	0.63	x	0.7	=	295.4	(77)
Southeast 0.9x	0.77	x	10.41	x	69.27	x	0.63	x	0.7	=	220.37	(77)
Southeast 0.9x	0.77	x	10.41	x	44.07	x	0.63	x	0.7	=	140.21	(77)
Southeast 0.9x	0.77	x	10.41	x	31.49	x	0.63	x	0.7	=	100.18	(77)
Northwest 0.9x	0.77	x	6.2	x	11.28	x	0.63	x	0.7	=	21.38	(81)
Northwest 0.9x	0.77	x	6.2	x	22.97	x	0.63	x	0.7	=	43.52	(81)
Northwest 0.9x	0.77	x	6.2	x	41.38	x	0.63	x	0.7	=	78.4	(81)
Northwest 0.9x	0.77	x	6.2	x	67.96	x	0.63	x	0.7	=	128.76	(81)
Northwest 0.9x	0.77	x	6.2	x	91.35	x	0.63	x	0.7	=	173.08	(81)
Northwest 0.9x	0.77	x	6.2	x	97.38	x	0.63	x	0.7	=	184.52	(81)
Northwest 0.9x	0.77	x	6.2	x	91.1	x	0.63	x	0.7	=	172.62	(81)
Northwest 0.9x	0.77	x	6.2	x	72.63	x	0.63	x	0.7	=	137.61	(81)
Northwest 0.9x	0.77	x	6.2	x	50.42	x	0.63	x	0.7	=	95.54	(81)
Northwest 0.9x	0.77	x	6.2	x	28.07	x	0.63	x	0.7	=	53.18	(81)
Northwest 0.9x	0.77	x	6.2	x	14.2	x	0.63	x	0.7	=	26.9	(81)
Northwest 0.9x	0.77	x	6.2	x	9.21	x	0.63	x	0.7	=	17.46	(81)

Solar gains in watts, calculated for each month

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

(83)m=	138.44	242.91	351.22	466.79	551.71	560.41	535.01	469.72	390.94	273.55	167.11	117.64	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	463.19	566.43	663.53	760.65	826.08	816.56	779.66	718.01	649	550.2	465.18	432.48	(84)
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### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.65	0.49	0.55	0.81	0.97	0.99	1	(86)

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

(87)m=	19.66	19.86	20.16	20.53	20.81	20.96	20.99	20.99	20.88	20.49	20.01	19.63	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.89	19.89	19.89	19.91	19.91	19.92	19.92	19.92	19.92	19.91	19.9	19.9	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.92	0.78	0.56	0.38	0.43	0.73	0.95	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.67	18.87	19.17	19.54	19.79	19.9	19.92	19.92	19.85	19.51	19.03	18.65	(90)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.2

 (91)

## TFEE WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) =  $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.87	19.07	19.37	19.74	20	20.12	20.14	20.13	20.06	19.71	19.23	18.85	(92)
--------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.87	19.07	19.37	19.74	20	20.12	20.14	20.13	20.06	19.71	19.23	18.85	(93)
--------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	------

### 8. Space heating requirement

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

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

Utilisation factor for gains,  $hm$ :

(94)m=	1	0.99	0.97	0.91	0.78	0.58	0.4	0.45	0.74	0.95	0.99	1	(94)
--------	---	------	------	------	------	------	-----	------	------	------	------	---	------

Useful gains,  $hmGm$ ,  $W = (94)m \times (84)m$

(95)m=	461.19	560.12	643.73	694.51	646.94	472.52	311.65	326.67	478.68	520.67	460.74	431.11	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

Heat loss rate for mean internal temperature,  $Lm$ ,  $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1340.94	1300.16	1177.02	977.08	746	489.73	313.92	330.81	532.07	819.38	1096.54	1332	(97)
--------	---------	---------	---------	--------	-----	--------	--------	--------	--------	--------	---------	------	------

Space heating requirement for each month,  $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	654.53	497.31	396.77	203.45	73.7	0	0	0	0	222.25	457.78	670.27	
--------	--------	--------	--------	--------	------	---	---	---	---	--------	--------	--------	--

Total per year ( $kWh/year$ ) =  $Sum(98)_{1...5,9...12} =$  3176.05 (98)

Space heating requirement in  $kWh/m^2/year$

	42.92	(99)
--	-------	------

### 8c. Space cooling requirement

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

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

Heat loss rate  $Lm$  (calculated using  $25^\circ C$  internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	834.59	657.02	673.18	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss  $hm$

(101)m=	0	0	0	0	0	0.91	0.95	0.93	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss,  $hmLm$  (Watts) =  $(100)m \times (101)m$

(102)m=	0	0	0	0	0	756.77	624.6	627.13	0	0	0	0	(102)
---------	---	---	---	---	---	--------	-------	--------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	1041.33	996.42	925.78	0	0	0	0	(103)
---------	---	---	---	---	---	---------	--------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous ( $kWh$ ) =  $0.024 \times [(103)m - (102)m] \times (41)m$

set (104)m to zero if  $(104)m < 3 \times (98)m$

(104)m=	0	0	0	0	0	204.88	276.63	222.19	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total =  $Sum(104) =$  703.7 (104)

Cooled fraction

$f C = \text{cooled area} \div (4) =$  1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total =  $Sum(106) =$  0 (106)

Space cooling requirement for month =  $(104)m \times (105) \times (106)m$

(107)m=	0	0	0	0	0	51.22	69.16	55.55	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total =  $Sum(107) =$  175.92 (107)

Space cooling requirement in  $kWh/m^2/year$

(107)  $\div$  (4) = 2.38 (108)

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

Fabric Energy Efficiency (99) + (108) = 45.3 (109)

# TFEE WorkSheet: New dwelling design stage

Target Fabric Energy Efficiency (TFEE)

52.09 (109)

## DFEE WorkSheet: New dwelling design stage

### User Details:

<b>Assessor Name:</b>	David Barsted	<b>Stroma Number:</b>	STRO032333
<b>Software Name:</b>	Stroma FSAP 2012	<b>Software Version:</b>	Version: 1.0.5.50

Property Address: House 1 - Be Lean

**Address :** 9 Cheyne Avenue, London, TW2 6AN

### 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	37	(1a) x	2.5	(2a) =	92.5 (3a)
First floor	37	(1b) x	2.7	(2b) =	99.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	192.4 (5)

### 2. Ventilation rate:

	main heating		secondary heating		other		total		m <sup>3</sup> 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) =	0.16 (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			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38 (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
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

# DFEE 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

0.48	0.47	0.46	0.41	0.4	0.36	0.36	0.35	0.38	0.4	0.42	0.44
------	------	------	------	-----	------	------	------	------	-----	------	------

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=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6	(24d)
---------	------	------	------	------	------	------	------	------	------	------	------	-----	-------

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

(25)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6	(25)
--------	------	------	------	------	------	------	------	------	------	------	------	-----	------

### 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.89	x 1.6	= 3.024		(26)
Windows Type 1			9.14	x 1/[1/(1.3)+0.04]	= 11.29		(27)
Windows Type 2			15.33	x 1/[1/(1.3)+0.04]	= 18.94		(27)
Floor			36.4	x 0.16	= 5.824		(28)
Walls	87.88	26.36	61.52	x 0.23	= 14.15		(29)
Roof	36.64	0	36.64	x 0.11	= 4.15		(30)
Total area of elements, m²			160.92				(31)
Party wall			38.93	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) = 57.38 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 10750.06 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 11.78 (36)

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

Total fabric heat loss (33) + (36) = 69.16 (37)

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

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

(38)m=	39.02	38.74	38.46	37.16	36.92	35.79	35.79	35.58	36.22	36.92	37.41	37.93	(38)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(39)m=	108.18	107.9	107.62	106.32	106.08	104.95	104.95	104.74	105.38	106.08	106.57	107.09	
Average = Sum(39) <sub>1...12</sub> / 12 =												106.32	(39)

Heat loss parameter (HLP), W/m<sup>2</sup>K (40)m = (39)m ÷ (4)

(40)m=	1.46	1.46	1.45	1.44	1.43	1.42	1.42	1.42	1.42	1.43	1.44	1.45	
Average = Sum(40) <sub>1...12</sub> / 12 =												1.44	(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 x [1 - exp(-0.000349 x (TFA - 13.9)<sup>2</sup>)] + 0.0013 x (TFA - 13.9)  
 if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day V<sub>d,average</sub> = (25 x 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	
Hot water usage in litres per day for each month V <sub>d,m</sub> = factor from Table 1c x (43)													
(44)m=	98.73	95.14	91.55	87.96	84.37	80.78	80.78	84.37	87.96	91.55	95.14	98.73	
Total = Sum(44) <sub>1...12</sub> =												1077.07	(44)

Energy content of hot water used - calculated monthly = 4.190 x V<sub>d,m</sub> x nm x DT<sub>m</sub> / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	146.42	128.06	132.14	115.21	110.54	95.39	88.39	101.43	102.64	119.62	130.57	141.8	
Total = Sum(45) <sub>1...12</sub> =												1412.21	(45)

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

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

Water storage loss:

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

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

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

If community heating see section 4.3

Volume factor from Table 2a  (52)

Temperature factor from Table 2b  (53)

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

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

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

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

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

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

# DFEE WorkSheet: New dwelling design stage

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

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

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

(59)m= 

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

 (59)

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

(61)m= 

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

 (61)

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

(62)m= 

124.45	108.85	112.32	97.92	93.96	81.08	75.13	86.22	87.25	101.68	110.99	120.53
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 (62)

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

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

(63)m= 

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

 (63)

Output from water heater

(64)m= 

124.45	108.85	112.32	97.92	93.96	81.08	75.13	86.22	87.25	101.68	110.99	120.53
--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------

Output from water heater (annual)<sub>1...12</sub> 1200.38 (64)

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

(65)m= 

31.11	27.21	28.08	24.48	23.49	20.27	18.78	21.55	21.81	25.42	27.75	30.13
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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
(66)m=	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96

 (66)

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

(67)m= 

18.4	16.35	13.29	10.06	7.52	6.35	6.86	8.92	11.97	15.2	17.74	18.92
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 (67)

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

(68)m= 

206.45	208.59	203.19	191.7	177.19	163.56	154.45	152.3	157.7	169.2	183.7	197.34
--------	--------	--------	-------	--------	--------	--------	-------	-------	-------	-------	--------

 (68)

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

(69)m= 

34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7
------	------	------	------	------	------	------	------	------	------	------	------

 (69)

Pumps and fans gains (Table 5a)

(70)m= 

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

 (70)

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

(71)m= 

-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m= 

41.82	40.49	37.74	34	31.57	28.15	25.25	28.97	30.29	34.17	38.54	40.5
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 (72)

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

(73)m= 

324.76	323.52	312.32	293.85	274.38	256.15	244.64	248.28	258.06	276.65	298.07	314.84
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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 <sup>2</sup>	Flux Table 6a	g <sub>-</sub> Table 6b	FF Table 6c	Gains (W)
Southeast 0.9x	0.77	15.33	36.79	0.76	0.7	207.95 (77)
Southeast 0.9x	0.77	15.33	62.67	0.76	0.7	354.22 (77)

## DFEE WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	15.33	x	85.75	x	0.76	x	0.7	=	484.66	(77)
Southeast 0.9x	0.77	x	15.33	x	106.25	x	0.76	x	0.7	=	600.51	(77)
Southeast 0.9x	0.77	x	15.33	x	119.01	x	0.76	x	0.7	=	672.62	(77)
Southeast 0.9x	0.77	x	15.33	x	118.15	x	0.76	x	0.7	=	667.76	(77)
Southeast 0.9x	0.77	x	15.33	x	113.91	x	0.76	x	0.7	=	643.79	(77)
Southeast 0.9x	0.77	x	15.33	x	104.39	x	0.76	x	0.7	=	589.99	(77)
Southeast 0.9x	0.77	x	15.33	x	92.85	x	0.76	x	0.7	=	524.78	(77)
Southeast 0.9x	0.77	x	15.33	x	69.27	x	0.76	x	0.7	=	391.49	(77)
Southeast 0.9x	0.77	x	15.33	x	44.07	x	0.76	x	0.7	=	249.08	(77)
Southeast 0.9x	0.77	x	15.33	x	31.49	x	0.76	x	0.7	=	177.96	(77)
Northwest 0.9x	0.77	x	9.14	x	11.28	x	0.76	x	0.7	=	38.02	(81)
Northwest 0.9x	0.77	x	9.14	x	22.97	x	0.76	x	0.7	=	77.39	(81)
Northwest 0.9x	0.77	x	9.14	x	41.38	x	0.76	x	0.7	=	139.43	(81)
Northwest 0.9x	0.77	x	9.14	x	67.96	x	0.76	x	0.7	=	228.99	(81)
Northwest 0.9x	0.77	x	9.14	x	91.35	x	0.76	x	0.7	=	307.81	(81)
Northwest 0.9x	0.77	x	9.14	x	97.38	x	0.76	x	0.7	=	328.16	(81)
Northwest 0.9x	0.77	x	9.14	x	91.1	x	0.76	x	0.7	=	306.98	(81)
Northwest 0.9x	0.77	x	9.14	x	72.63	x	0.76	x	0.7	=	244.73	(81)
Northwest 0.9x	0.77	x	9.14	x	50.42	x	0.76	x	0.7	=	169.9	(81)
Northwest 0.9x	0.77	x	9.14	x	28.07	x	0.76	x	0.7	=	94.58	(81)
Northwest 0.9x	0.77	x	9.14	x	14.2	x	0.76	x	0.7	=	47.84	(81)
Northwest 0.9x	0.77	x	9.14	x	9.21	x	0.76	x	0.7	=	31.05	(81)

Solar gains in watts, calculated for each month

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

(83)m=	245.97	431.61	624.09	829.5	980.43	995.92	950.78	834.72	694.68	486.06	296.92	209.01	(83)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	570.73	755.13	936.41	1123.36	1254.81	1252.07	1195.42	1083.01	952.74	762.72	594.99	523.85	(84)
--------	--------	--------	--------	---------	---------	---------	---------	---------	--------	--------	--------	--------	------

### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.86	0.7	0.52	0.38	0.44	0.69	0.92	0.99	1	(86)

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

(87)m=	19.51	19.8	20.19	20.61	20.87	20.97	20.99	20.99	20.91	20.52	19.92	19.46	(87)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.72	19.72	19.72	19.74	19.74	19.75	19.75	19.75	19.74	19.74	19.73	19.73	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.93	0.82	0.63	0.42	0.28	0.32	0.59	0.89	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.39	18.68	19.06	19.45	19.66	19.74	19.75	19.75	19.71	19.39	18.81	18.35	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.2

 (91)

## DFEE WorkSheet: New dwelling design stage

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

(92)m=	18.62	18.91	19.29	19.69	19.91	19.99	20	20	19.95	19.62	19.04	18.58	(92)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(93)m=	18.62	18.91	19.29	19.69	19.91	19.99	20	20	19.95	19.62	19.04	18.58	(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	0.97	0.93	0.82	0.64	0.44	0.3	0.35	0.61	0.89	0.98	0.99	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

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

(95)m=	565.08	733.7	867.28	917.66	804.06	554.94	355.45	374.4	578.42	677.27	581.87	520.1	(95)
--------	--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1549.22	1511.78	1376.58	1147.17	870.75	565.56	356.9	377.13	616.49	956.63	1272.34	1539.67	(97)
--------	---------	---------	---------	---------	--------	--------	-------	--------	--------	--------	---------	---------	------

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

(98)m=	732.2	522.87	378.92	165.25	49.62	0	0	0	0	207.84	497.14	758.55	
--------	-------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	--

Total per year (kWh/year) = Sum(98)<sub>1...5,9...12</sub> = 3312.38 (98)

Space heating requirement in kWh/m<sup>2</sup>/year

44.76 (99)

### 8c. Space cooling requirement

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

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

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	986.51	776.61	796.01	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.94	0.97	0.95	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m × (101)m

(102)m=	0	0	0	0	0	928.99	752.33	759.74	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	1550.36	1482.38	1352.4	0	0	0	0	(103)
---------	---	---	---	---	---	---------	---------	--------	---	---	---	---	-------

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

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

(104)m=	0	0	0	0	0	447.38	543.16	440.94	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = Sum(104) = 1431.48 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(106) = 0 (106)

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

(107)m=	0	0	0	0	0	111.85	135.79	110.23	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = Sum(107) = 357.87 (107)

Space cooling requirement in kWh/m<sup>2</sup>/year

(107) ÷ (4) = 89.47 (108)

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

Fabric Energy Efficiency (99) + (108) = 49.6 (109)

## DFEE WorkSheet: New dwelling design stage

## DER WorkSheet: New dwelling design stage

### User Details:

<b>Assessor Name:</b>	David Barsted	<b>Stroma Number:</b>	STRO032333
<b>Software Name:</b>	Stroma FSAP 2012	<b>Software Version:</b>	Version: 1.0.5.50

Property Address: House 1 - Be Lean

**Address :** 9 Cheyne Avenue, London, TW2 6AN

### 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	37	(1a) x	2.5	(2a) =	92.5 (3a)
First floor	37	(1b) x	2.7	(2b) =	99.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	192.4 (5)

### 2. Ventilation rate:

	main heating		secondary heating		other		total		m <sup>3</sup> 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) =	0.16 (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			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38 (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
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.48	0.47	0.46	0.41	0.4	0.36	0.36	0.35	0.38	0.4	0.42	0.44
------	------	------	------	-----	------	------	------	------	-----	------	------

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<sup>2</sup> x 0.5]

(24d)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6	(25)
--------	------	------	------	------	------	------	------	------	------	------	------	-----	------

### 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m <sup>2</sup> )	Openings m <sup>2</sup>	Net Area A ,m <sup>2</sup>	U-value W/m <sup>2</sup> K	A X U (W/K)	k-value kJ/m <sup>2</sup> -K	A X k kJ/K
Doors			1.89	x 1.6	= 3.024		(26)
Windows Type 1			9.14	x 1/[1/(1.3)+0.04]	= 11.29		(27)
Windows Type 2			15.33	x 1/[1/(1.3)+0.04]	= 18.94		(27)
Floor			36.4	x 0.16	= 5.824		(28)
Walls	87.88	26.36	61.52	x 0.23	= 14.15		(29)
Roof	36.64	0	36.64	x 0.11	= 4.15		(30)
Total area of elements, m <sup>2</sup>			160.92				(31)
Party wall			38.93	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) = 57.38 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 10750.06 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m<sup>2</sup>K Indicative Value: Medium 250 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 11.78 (36)

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

Total fabric heat loss (33) + (36) = 69.16 (37)

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

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

(38)m=	39.02	38.74	38.46	37.16	36.92	35.79	35.79	35.58	36.22	36.92	37.41	37.93	(38)
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Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	108.18	107.9	107.62	106.32	106.08	104.95	104.95	104.74	105.38	106.08	106.57	107.09	
Average = Sum(39) <sub>1...12</sub> / 12 =												106.32	(39)

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

(40)m=	1.46	1.46	1.45	1.44	1.43	1.42	1.42	1.42	1.42	1.43	1.44	1.45	
Average = Sum(40) <sub>1...12</sub> / 12 =												1.44	(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 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)  
 if TFA ≤ 13.9, N = 1

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.73	95.14	91.55	87.96	84.37	80.78	80.78	84.37	87.96	91.55	95.14	98.73	
Total = Sum(44) <sub>1...12</sub> =												1077.07	(44)

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

(45)m=	146.42	128.06	132.14	115.21	110.54	95.39	88.39	101.43	102.64	119.62	130.57	141.8	
Total = Sum(45) <sub>1...12</sub> =												1412.21	(45)

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

(46)m=	21.96	19.21	19.82	17.28	16.58	14.31	13.26	15.21	15.4	17.94	19.59	21.27	(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) x (49) =  (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a  (52)

Temperature factor from Table 2b  (53)

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

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

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

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

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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## DER WorkSheet: New dwelling design stage

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

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

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

(59)m= 

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

 (59)

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

(61)m= 

50.31	43.79	46.65	43.38	42.99	39.84	41.16	42.99	43.38	46.65	46.92	50.31
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 (61)

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

(62)m= 

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
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 (62)

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

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

(63)m= 

0	0	0	0	0	0	0	0	0	0	0	0
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 (63)

Output from water heater

(64)m= 

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)<sub>1...12</sub> 1950.6 (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= 

61.26	53.53	55.6	49.15	47.5	41.68	39.68	44.47	44.97	51.44	55.15	59.73
-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (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
(66)m=	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96

 (66)

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

(67)m= 

18.4	16.35	13.29	10.06	7.52	6.35	6.86	8.92	11.97	15.2	17.74	18.92
------	-------	-------	-------	------	------	------	------	-------	------	-------	-------

 (67)

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

(68)m= 

206.45	208.59	203.19	191.7	177.19	163.56	154.45	152.3	157.7	169.2	183.7	197.34
--------	--------	--------	-------	--------	--------	--------	-------	-------	-------	-------	--------

 (68)

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

(69)m= 

34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7
------	------	------	------	------	------	------	------	------	------	------	------

 (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= 

-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m= 

82.34	79.65	74.73	68.26	63.85	57.88	53.34	59.78	62.46	69.14	76.59	80.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m= 

368.28	365.68	352.31	331.12	309.65	288.88	275.73	282.09	293.23	314.62	339.13	357.62
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 <sup>2</sup>	Flux Table 6a	g <sub>-</sub> Table 6b	FF Table 6c	Gains (W)
Southeast 0.9x	0.77	15.33	36.79	0.76	0.7	207.95 (77)
Southeast 0.9x	0.77	15.33	62.67	0.76	0.7	354.22 (77)

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Southeast 0.9x	0.77	x	15.33	x	85.75	x	0.76	x	0.7	=	484.66	(77)
Southeast 0.9x	0.77	x	15.33	x	106.25	x	0.76	x	0.7	=	600.51	(77)
Southeast 0.9x	0.77	x	15.33	x	119.01	x	0.76	x	0.7	=	672.62	(77)
Southeast 0.9x	0.77	x	15.33	x	118.15	x	0.76	x	0.7	=	667.76	(77)
Southeast 0.9x	0.77	x	15.33	x	113.91	x	0.76	x	0.7	=	643.79	(77)
Southeast 0.9x	0.77	x	15.33	x	104.39	x	0.76	x	0.7	=	589.99	(77)
Southeast 0.9x	0.77	x	15.33	x	92.85	x	0.76	x	0.7	=	524.78	(77)
Southeast 0.9x	0.77	x	15.33	x	69.27	x	0.76	x	0.7	=	391.49	(77)
Southeast 0.9x	0.77	x	15.33	x	44.07	x	0.76	x	0.7	=	249.08	(77)
Southeast 0.9x	0.77	x	15.33	x	31.49	x	0.76	x	0.7	=	177.96	(77)
Northwest 0.9x	0.77	x	9.14	x	11.28	x	0.76	x	0.7	=	38.02	(81)
Northwest 0.9x	0.77	x	9.14	x	22.97	x	0.76	x	0.7	=	77.39	(81)
Northwest 0.9x	0.77	x	9.14	x	41.38	x	0.76	x	0.7	=	139.43	(81)
Northwest 0.9x	0.77	x	9.14	x	67.96	x	0.76	x	0.7	=	228.99	(81)
Northwest 0.9x	0.77	x	9.14	x	91.35	x	0.76	x	0.7	=	307.81	(81)
Northwest 0.9x	0.77	x	9.14	x	97.38	x	0.76	x	0.7	=	328.16	(81)
Northwest 0.9x	0.77	x	9.14	x	91.1	x	0.76	x	0.7	=	306.98	(81)
Northwest 0.9x	0.77	x	9.14	x	72.63	x	0.76	x	0.7	=	244.73	(81)
Northwest 0.9x	0.77	x	9.14	x	50.42	x	0.76	x	0.7	=	169.9	(81)
Northwest 0.9x	0.77	x	9.14	x	28.07	x	0.76	x	0.7	=	94.58	(81)
Northwest 0.9x	0.77	x	9.14	x	14.2	x	0.76	x	0.7	=	47.84	(81)
Northwest 0.9x	0.77	x	9.14	x	9.21	x	0.76	x	0.7	=	31.05	(81)

Solar gains in watts, calculated for each month

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

(83)m=	245.97	431.61	624.09	829.5	980.43	995.92	950.78	834.72	694.68	486.06	296.92	209.01	(83)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	614.25	797.29	976.4	1160.62	1290.08	1284.8	1226.51	1116.82	987.91	800.69	636.04	566.63	(84)
--------	--------	--------	-------	---------	---------	--------	---------	---------	--------	--------	--------	--------	------

### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.85	0.69	0.51	0.37	0.42	0.67	0.91	0.98	0.99	(86)

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

(87)m=	19.56	19.85	20.23	20.63	20.88	20.97	20.99	20.99	20.92	20.55	19.97	19.51	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.72	19.72	19.72	19.74	19.74	19.75	19.75	19.75	19.74	19.74	19.73	19.73	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.97	0.92	0.81	0.62	0.41	0.27	0.31	0.57	0.88	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.44	18.73	19.1	19.47	19.67	19.74	19.75	19.75	19.71	19.42	18.86	18.4	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =

0.2

 (91)

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Mean internal temperature (for the whole dwelling) =  $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.67	18.96	19.33	19.71	19.91	19.99	20	20	19.95	19.65	19.08	18.63	(92)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(93)m=	18.52	18.81	19.18	19.56	19.76	19.84	19.85	19.85	19.8	19.5	18.93	18.48	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	------

### 8. Space heating requirement

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

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

Utilisation factor for gains,  $hm$ :

(94)m=	0.99	0.97	0.91	0.8	0.62	0.42	0.28	0.32	0.58	0.87	0.97	0.99	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

Useful gains,  $hmG_m$ ,  $W = (94)m \times (84)m$

(95)m=	606.13	769.57	893.2	927.05	798.1	541.41	340.12	359.48	570.45	695.66	617.93	561.08	(95)
--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

Heat loss rate for mean internal temperature,  $L_m$ ,  $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1538.43	1500.47	1364.23	1133.28	855.53	549.95	341.18	361.46	601.21	943.67	1261.17	1528.96	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month,  $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	693.63	491.17	350.45	148.49	42.72	0	0	0	0	184.52	463.14	720.11	
$Total\ per\ year\ (kWh/year) = Sum(98)_{1...5,9...12} =$												3094.23	(98)

Space heating requirement in  $kWh/m^2/year$

41.81	(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

90.4	(206)
------	-------

Efficiency of secondary/supplementary heating system, %

0	(208)
---	-------

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

Space heating requirement (calculated above)

693.63	491.17	350.45	148.49	42.72	0	0	0	0	184.52	463.14	720.11
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)m =  $\{[(98)m \times (204)]\} \times 100 \div (206)$

767.29	543.33	387.67	164.26	47.26	0	0	0	0	204.11	512.32	796.58
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

3422.82	(211)
---------	-------

Space heating fuel (secondary),  $kWh/month$

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

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

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

0	(215)
---	-------

#### Water heating

Output from water heater (calculated above)

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

81.1	(216)
------	-------

(217)m=	88.17	87.79	87.03	85.35	82.96	81.1	81.1	81.1	81.1	85.74	87.62	88.27	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating,  $kWh/month$

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

(219)m=	223.13	195.75	205.45	185.81	185.08	166.74	159.75	178.08	180.05	193.93	202.58	217.64	
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$Total = Sum(219a)_{1...12} =$

2293.99	(219)
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Annual totals	kWh/year	kWh/year
Space heating fuel used, main system 1		3422.82
Water heating fuel used		2293.99
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		325.04 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6116.84 (338)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x		0.216	=	739.33 (261)
Space heating (secondary)	(215) x		0.519	=	0 (263)
Water heating	(219) x		0.216	=	495.5 (264)
Space and water heating		(261) + (262) + (263) + (264) =			1234.83 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93 (267)
Electricity for lighting	(232) x		0.519	=	168.69 (268)
Total CO2, kg/year		sum of (265)...(271) =			1442.45 (272)
<b>Dwelling CO2 Emission Rate</b>		(272) ÷ (4) =			19.49 (273)
EI rating (section 14)					84 (274)

## TER WorkSheet: New dwelling design stage

### User Details:

<b>Assessor Name:</b>	David Barsted	<b>Stroma Number:</b>	STRO032333
<b>Software Name:</b>	Stroma FSAP 2012	<b>Software Version:</b>	Version: 1.0.5.50

Property Address: House 1 - Be Lean

**Address :** 9 Cheyne Avenue, London, TW2 6AN

### 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	37	(1a) x	2.5	(2a) =	92.5 (3a)
First floor	37	(1b) x	2.7	(2b) =	99.9 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	74	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	192.4 (5)

### 2. Ventilation rate:

	main heating		secondary heating		other		total		m <sup>3</sup> 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) =	0.16 (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			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=

5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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# TER WorkSheet: New dwelling 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

0.48	0.47	0.46	0.41	0.4	0.36	0.36	0.35	0.38	0.4	0.42	0.44
------	------	------	------	-----	------	------	------	------	-----	------	------

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<sup>2</sup> x 0.5]

(24d)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6	(24d)
---------	------	------	------	------	------	------	------	------	------	------	------	-----	-------

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

(25)m=	0.61	0.61	0.61	0.59	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.6	(25)
--------	------	------	------	------	------	------	------	------	------	------	------	-----	------

### 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m <sup>2</sup> )	Openings m <sup>2</sup>	Net Area A ,m <sup>2</sup>	U-value W/m <sup>2</sup> K	A X U (W/K)	k-value kJ/m <sup>2</sup> -K	A X k kJ/K
Doors			1.89	x 1	= 1.89		(26)
Windows Type 1			6.2	x 1/[1/(1.4)+0.04]	= 8.22		(27)
Windows Type 2			10.41	x 1/[1/(1.4)+0.04]	= 13.8		(27)
Floor			36.4	x 0.13	= 4.732		(28)
Walls	87.88	18.5	69.38	x 0.18	= 12.49		(29)
Roof	36.64	0	36.64	x 0.13	= 4.76		(30)
Total area of elements, m <sup>2</sup>			160.92				(31)
Party wall			38.93	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) = 45.89 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 11221.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m<sup>2</sup>K Indicative Value: Medium 250 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.11 (36)

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

Total fabric heat loss (33) + (36) = 53 (37)

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

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

## TER WorkSheet: New dwelling design stage

(38)m=	39.02	38.74	38.46	37.16	36.92	35.79	35.79	35.58	36.22	36.92	37.41	37.93	(38)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Heat transfer coefficient, W/K

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

(39)m=	92.02	91.74	91.46	90.16	89.92	88.79	88.79	88.58	89.22	89.92	90.41	90.93	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

Average = Sum(39)<sub>1...12</sub> / 12 =

90.16	(39)
-------	------

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.24	1.24	1.24	1.22	1.22	1.2	1.2	1.2	1.21	1.22	1.22	1.23	
--------	------	------	------	------	------	-----	-----	-----	------	------	------	------	--

Average = Sum(40)<sub>1...12</sub> / 12 =

1.22	(40)
------	------

Number of days in month (Table 1a)

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

**4. Water heating energy requirement: kWh/year:**

Assumed occupancy, N  (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36  (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=	98.73	95.14	91.55	87.96	84.37	80.78	80.78	84.37	87.96	91.55	95.14	98.73	
	Total = Sum(44) <sub>1...12</sub> =												
	<input style="width: 100px;" type="text" value="1077.07"/>											(44)	

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

(45)m=	146.42	128.06	132.14	115.21	110.54	95.39	88.39	101.43	102.64	119.62	130.57	141.8	
	Total = Sum(45) <sub>1...12</sub> =												
	<input style="width: 100px;" type="text" value="1412.21"/>											(45)	

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

(46)m=	21.96	19.21	19.82	17.28	16.58	14.31	13.26	15.21	15.4	17.94	19.59	21.27	(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) x (49) =  (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a  (52)

Temperature factor from Table 2b  (53)

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

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

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

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

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

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



# TER WorkSheet: New dwelling design stage

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

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

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

(59)m= 

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

 (59)

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

(61)m= 

50.31	43.79	46.65	43.38	42.99	39.84	41.16	42.99	43.38	46.65	46.92	50.31
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (61)

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

(62)m= 

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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= 

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)<sub>1...12</sub> 1950.6 (64)

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

(65)m= 

61.26	53.53	55.6	49.15	47.5	41.68	39.68	44.47	44.97	51.44	55.15	59.73
-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------

 (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
(66)m=	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96	116.96

 (66)

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

(67)m= 

18.4	16.35	13.29	10.06	7.52	6.35	6.86	8.92	11.97	15.2	17.74	18.91
------	-------	-------	-------	------	------	------	------	-------	------	-------	-------

 (67)

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

(68)m= 

206.45	208.59	203.19	191.7	177.19	163.56	154.45	152.3	157.7	169.2	183.7	197.34
--------	--------	--------	-------	--------	--------	--------	-------	-------	-------	-------	--------

 (68)

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

(69)m= 

34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7	34.7
------	------	------	------	------	------	------	------	------	------	------	------

 (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= 

-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57	-93.57
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m= 

82.34	79.65	74.73	68.26	63.85	57.88	53.34	59.78	62.46	69.14	76.59	80.28
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m= 

368.28	365.68	352.3	331.11	309.65	288.88	275.73	282.09	293.23	314.62	339.13	357.62
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 <sup>2</sup>	Flux Table 6a	g <sub>-</sub> Table 6b	FF Table 6c	Gains (W)
Southeast 0.9x	0.77	10.41	36.79	0.63	0.7	117.06 (77)
Southeast 0.9x	0.77	10.41	62.67	0.63	0.7	199.39 (77)



## TER WorkSheet: New dwelling design stage

Southeast 0.9x	0.77	x	10.41	x	85.75	x	0.63	x	0.7	=	272.82	(77)
Southeast 0.9x	0.77	x	10.41	x	106.25	x	0.63	x	0.7	=	338.03	(77)
Southeast 0.9x	0.77	x	10.41	x	119.01	x	0.63	x	0.7	=	378.62	(77)
Southeast 0.9x	0.77	x	10.41	x	118.15	x	0.63	x	0.7	=	375.89	(77)
Southeast 0.9x	0.77	x	10.41	x	113.91	x	0.63	x	0.7	=	362.39	(77)
Southeast 0.9x	0.77	x	10.41	x	104.39	x	0.63	x	0.7	=	332.11	(77)
Southeast 0.9x	0.77	x	10.41	x	92.85	x	0.63	x	0.7	=	295.4	(77)
Southeast 0.9x	0.77	x	10.41	x	69.27	x	0.63	x	0.7	=	220.37	(77)
Southeast 0.9x	0.77	x	10.41	x	44.07	x	0.63	x	0.7	=	140.21	(77)
Southeast 0.9x	0.77	x	10.41	x	31.49	x	0.63	x	0.7	=	100.18	(77)
Northwest 0.9x	0.77	x	6.2	x	11.28	x	0.63	x	0.7	=	21.38	(81)
Northwest 0.9x	0.77	x	6.2	x	22.97	x	0.63	x	0.7	=	43.52	(81)
Northwest 0.9x	0.77	x	6.2	x	41.38	x	0.63	x	0.7	=	78.4	(81)
Northwest 0.9x	0.77	x	6.2	x	67.96	x	0.63	x	0.7	=	128.76	(81)
Northwest 0.9x	0.77	x	6.2	x	91.35	x	0.63	x	0.7	=	173.08	(81)
Northwest 0.9x	0.77	x	6.2	x	97.38	x	0.63	x	0.7	=	184.52	(81)
Northwest 0.9x	0.77	x	6.2	x	91.1	x	0.63	x	0.7	=	172.62	(81)
Northwest 0.9x	0.77	x	6.2	x	72.63	x	0.63	x	0.7	=	137.61	(81)
Northwest 0.9x	0.77	x	6.2	x	50.42	x	0.63	x	0.7	=	95.54	(81)
Northwest 0.9x	0.77	x	6.2	x	28.07	x	0.63	x	0.7	=	53.18	(81)
Northwest 0.9x	0.77	x	6.2	x	14.2	x	0.63	x	0.7	=	26.9	(81)
Northwest 0.9x	0.77	x	6.2	x	9.21	x	0.63	x	0.7	=	17.46	(81)

Solar gains in watts, calculated for each month

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

(83)m=	138.44	242.91	351.22	466.79	551.71	560.41	535.01	469.72	390.94	273.55	167.11	117.64	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	506.71	608.58	703.52	797.91	861.36	849.29	810.75	751.81	684.17	588.17	506.23	475.25	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.63	0.47	0.53	0.78	0.96	0.99	1	(86)

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

(87)m=	19.71	19.91	20.2	20.56	20.83	20.96	20.99	20.99	20.9	20.53	20.05	19.68	(87)
--------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(88)m=	19.89	19.89	19.89	19.91	19.91	19.92	19.92	19.92	19.92	19.91	19.9	19.9	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	------

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

(89)m=	1	0.99	0.97	0.9	0.76	0.54	0.36	0.41	0.7	0.94	0.99	1	(89)
--------	---	------	------	-----	------	------	------	------	-----	------	------	---	------

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

(90)m=	18.19	18.47	18.9	19.41	19.75	19.9	19.92	19.92	19.84	19.38	18.7	18.15	(90)
--------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =

0.2

 (91)

## TER WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) =  $fLA \times T1 + (1 - fLA) \times T2$

(92)m=	18.5	18.76	19.16	19.64	19.97	20.11	20.14	20.13	20.05	19.62	18.97	18.46	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.5	18.76	19.16	19.64	19.97	20.11	20.14	20.13	20.05	19.62	18.97	18.46	(93)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

### 8. Space heating requirement

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

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

Utilisation factor for gains,  $hm$ :

(94)m=	0.99	0.98	0.96	0.9	0.76	0.56	0.38	0.44	0.71	0.93	0.99	0.99	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

Useful gains,  $hmG_m$ ,  $W = (94)m \times (84)m$

(95)m=	503.16	598.76	676.01	715.75	656.39	474.64	311.98	327.37	486.04	547.36	498.83	472.73	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

Heat loss rate for mean internal temperature,  $L_m$ ,  $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1306.28	1271.91	1157.98	968.5	743.72	489.49	313.9	330.8	531.28	810.75	1073.43	1296.6	(97)
--------	---------	---------	---------	-------	--------	--------	-------	-------	--------	--------	---------	--------	------

Space heating requirement for each month,  $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	597.52	452.36	358.58	181.98	64.97	0	0	0	0	195.96	413.71	612.96	
<b>Total per year (kWh/year) = Sum(98)<sub>1...5,9...12</sub> =</b>												2878.05	(98)

Space heating requirement in  $kWh/m^2/year$

38.89	(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) 

1	(202)
---	-------

Fraction of total heating from main system 1 

1	(204)
---	-------

Efficiency of main space heating system 1 

93.4	(206)
------	-------

Efficiency of secondary/supplementary heating system, % 

0	(208)
---	-------

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

Space heating requirement (calculated above)

597.52	452.36	358.58	181.98	64.97	0	0	0	0	195.96	413.71	612.96
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)m =  $\{[(98)m \times (204)]\} \times 100 \div (206)$  (211)

	639.74	484.32	383.92	194.84	69.56	0	0	0	0	209.81	442.95	656.28	
<b>Total (kWh/year) = Sum(211)<sub>1...5,10...12</sub> =</b>												3081.43	(211)

Space heating fuel (secondary),  $kWh/month$

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

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
<b>Total (kWh/year) = Sum(215)<sub>1...5,10...12</sub> =</b>												0	(215)

#### Water heating

Output from water heater (calculated above)

196.73	171.85	178.8	158.58	153.54	135.23	129.56	144.43	146.02	166.27	177.49	192.11
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater 

80.3	(216)
------	-------

(217)m= 

87.67	(217)
-------	-------

87.67	87.37	86.77	85.4	83.06	80.3	80.3	80.3	80.3	85.47	87.11	87.77
-------	-------	-------	------	-------	------	------	------	------	-------	-------	-------

Fuel for water heating,  $kWh/month$

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

(219)m=	224.4	196.68	206.06	185.7	184.85	168.4	161.34	179.86	181.84	194.55	203.76	218.89	
<b>Total = Sum(219a)<sub>1...12</sub> =</b>												2306.33	(219)

## TER WorkSheet: New dwelling design stage

**Annual totals**

	kWh/year	kWh/year
Space heating fuel used, main system 1		3081.43
Water heating fuel used		2306.33
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		325 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5787.76 (338)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x		0.216	=	665.59 (261)
Space heating (secondary)	(215) x		0.519	=	0 (263)
Water heating	(219) x		0.216	=	498.17 (264)
Space and water heating	(261) + (262) + (263) + (264) =				1163.76 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93 (267)
Electricity for lighting	(232) x		0.519	=	168.68 (268)
Total CO2, kg/year		sum of (265)...(271) =			1371.36 (272)
 <b>TER =</b>					 18.53 (273)

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 30 November 2021

## Property Details: House 1 - Be Lean

<b>Dwelling type:</b>	End-terrace House
<b>Located in:</b>	England
<b>Region:</b>	Thames valley
<b>Cross ventilation possible:</b>	Yes
<b>Number of storeys:</b>	2
<b>Front of dwelling faces:</b>	North West
<b>Overshading:</b>	Average or unknown
<b>Overhangs:</b>	None
<b>Thermal mass parameter:</b>	Indicative Value Medium
<b>Night ventilation:</b>	False
<b>Blinds, curtains, shutters:</b>	None
<b>Ventilation rate during hot weather (ach):</b>	8 ( Windows fully open)

## Overheating Details:

<b>Summer ventilation heat loss coefficient:</b>	507.94	<b>(P1)</b>
<b>Transmission heat loss coefficient:</b>	69.2	
<b>Summer heat loss coefficient:</b>	577.1	<b>(P2)</b>

## Overhangs:

<b>Orientation:</b>	<b>Ratio:</b>	<b>Z_overhangs:</b>
North West (Windows NW)		1
South East (Windows SE)		1

## Solar shading:

<b>Orientation:</b>	<b>Z blinds:</b>	<b>Solar access:</b>	<b>Overhangs:</b>	<b>Z summer:</b>	
North West (Windows NW)		0.9	1	0.9	<b>(P8)</b>
South East (Windows SE)		0.9	1	0.9	<b>(P8)</b>

## Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
North West (Windows NW)	9.14	98.85	0.76	0.7	0.9	389.31
South East (Windows SE)	15.33	119.92	0.76	0.7	0.9	792.21
					<b>Total</b>	<b>1181.52 (P3/P4)</b>

## Internal gains:

	June	July	August
Internal gains	416.03	399.17	407.56
Total summer gains	1667.94	1580.69	1465.09 <b>(P5)</b>
Summer gain/loss ratio	2.89	2.74	2.54 <b>(P6)</b>
Mean summer external temperature (Thames valley)	16	17.9	17.8
Thermal mass temperature increment	0.25	0.25	0.25
Threshold temperature	19.14	20.89	20.59 <b>(P7)</b>
<b>Likelihood of high internal temperature</b>	<b>Not significant</b>	<b>Slight</b>	<b>Slight</b>

**Assessment of likelihood of high internal temperature:** Slight