

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.26  
Printed on 30 June 2020 at 09:50:56

## Project Information:

Assessed By: ()

Building Type: Flat

## Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 73.48m<sup>2</sup>

Site Reference : HO LA TW11

Plot Reference: Plot 8 - 2B4P

Address : Plot 8, 38-42 Hampton Road, Teddington, London, TW11 0JE

## Client Details:

Name: Howarth Homes

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

## 1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

16.4 kg/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER)

10.37 kg/m<sup>2</sup>

OK

## 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

40.0 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE)

34.7 kWh/m<sup>2</sup>

OK

## 2 Fabric U-values

### Element

### Average

### Highest

External wall

0.18 (max. 0.30)

0.18 (max. 0.70)

OK

Party wall

0.00 (max. 0.20)

-

OK

Floor

(no floor)

Roof

(no roof)

Openings

1.17 (max. 2.00)

1.20 (max. 3.30)

OK

## 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

## 3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

## 4 Heating efficiency

Main Heating system:

Database: (rev 452, product index 017929):

Boiler systems with radiators or underfloor heating - mains gas

Brand name: Ideal

Model: LOGIC COMBI

Model qualifier: ESP1 35

(Combi)

Efficiency 89.6 % SEDBUK2009

Minimum 88.0 %

OK

Secondary heating system:

None

# Regulations Compliance Report

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

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

No cylinder  
Boiler interlock: Yes **OK**

## 7 Low energy lights

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

## 8 Mechanical ventilation

Not applicable

## 9 Summertime temperature

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

Based on:

Overshading: Average or unknown  
Windows facing: South 4.42m<sup>2</sup>  
Windows facing: South 0.97m<sup>2</sup>  
Windows facing: North 0.97m<sup>2</sup>  
Windows facing: West 4.42m<sup>2</sup>  
Windows facing: West 3.15m<sup>2</sup>  
Ventilation rate: 6.00  
Blinds/curtains: Dark-coloured curtain or roller blind  
Closed 100% of daylight hours

## 10 Key features

Doors U-value 1 W/m<sup>2</sup>K  
Party Walls U-value 0 W/m<sup>2</sup>K  
Photovoltaic array

# SAP Input

## Property Details: Plot 8 - 2B4P

Address: Plot 8, 38-42 Hampton Road, Teddington, London, TW11 0JE  
 Located in: England  
 Region: Thames valley  
 UPRN:  
 Date of assessment: 03 March 2020  
 Date of certificate: 30 June 2020  
 Assessment type: New dwelling design stage  
 Transaction type: New dwelling  
 Tenure type: Unknown  
 Related party disclosure: No related party  
 Thermal Mass Parameter: Calculated 185.41  
 Water use <= 125 litres/person/day: True  
 PCDF Version: 452

## Property description:

Dwelling type: Flat  
 Detachment:  
 Year Completed: 2020  
 Floor Location: Floor area:  
 Storey height:  
 Floor 0 73.48 m<sup>2</sup> 2.8 m

Living area: 28.63 m<sup>2</sup> (fraction 0.39)  
 Front of dwelling faces: North

## Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Flat door	Manufacturer	Solid			Wood
Bedroom	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Living bay	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Living bay N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Living	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Bedroom 2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Flat door	mm	0.7	0	1	2.04	1
Bedroom	16mm or more	0.7	0.63	1.2	2.21	2
Living bay	16mm or more	0.7	0.63	1.2	0.97	1
Living bay N	16mm or more	0.7	0.63	1.2	0.97	1
Living	16mm or more	0.7	0.63	1.2	2.21	2
Bedroom 2	16mm or more	0.7	0.63	1.2	3.15	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Flat door		Corridor	North	0.97	2.1
Bedroom		Main wall	South	1.05	2.1
Living bay		Main wall	South	0.46	2.1
Living bay N		Main wall	North	0.46	2.1
Living		Main wall	West	1.05	2.1
Bedroom 2		Main wall	West	1.5	2.1

Overshading: Average or unknown

## Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Main wall	53.872	13.93	39.94	0.18	0	False	60
Corridor	5.404	2.04	3.36	0.18	0.43	False	60

# SAP Input

## Internal Elements

Internal	130.648	9
<b>Party Elements</b>		
Party	42.784	110
Party	73.48	30
Party	73.48	40

## Thermal bridges:

Thermal bridges:	User-defined (individual PSI-values) Y-Value = 0.1453			
	<b>Length</b>	<b>Psi-value</b>		
[Approved]	7.59	0.3	E2	Other lintels (including other steel lintels)
[Approved]	6.62	0.04	E3	Sill
[Approved]	33.6	0.05	E4	Jamb
[Approved]	0	0.16	E5	Ground floor (normal)
[Approved]	42.34	0.07	E7	Party floor between dwellings (in blocks of flats)
[Approved]	8.4	0.09	E16	Corner (normal)
[Approved]	5.6	-0.09	E17	Corner (inverted internal area greater than external area)
[Approved]	2.8	0.06	E18	Party wall between dwellings
	8.4	0.12	E25	Staggered party wall between dwellings
	0	0.16	P1	Ground floor
	30.56	0	P3	Intermediate floor between dwellings (in blocks of flats)

## Ventilation:

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

## Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database
	Database: (rev 452, product index 017929) Efficiency: Winter 87.3 % Summer: 90.5
	Brand name: Ideal
	Model: LOGIC COMBI
	Model qualifier: ESP1 35
	(Combi boiler)
	Systems with radiators
	Central heating pump : 2013 or later
	Design flow temperature: Unknown
	Boiler interlock: Yes
	Delayed start

## Main heating Control:

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

## Secondary heating system:

Secondary heating system:	None
---------------------------	------

## Water heating:

Water heating:	From main heating system
	Water code: 901

# SAP Input

Fuel :mains gas  
No hot water cylinder  
Solar panel: False

## Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	<u>Photovoltaic 1</u> Installed Peak power: 0.714 Tilt of collector: 30° Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

# DRAFT

## SAP WorkSheet: New dwelling design stage

User Details:

**Assessor Name:**

**Stroma Number:**

**Software Name:** Stroma FSAP 2012

**Software Version:**

Version: 1.0.4.26

Property Address: Plot 8 - 2B4P

**Address :** Plot 8, 38-42 Hampton Road, Teddington, London, TW11 0JE

**1. Overall dwelling dimensions:**

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	73.48 (1a)	x	2.8 (2a)	=	205.74 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.48 (4)				
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =				205.74 (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					2	=	2	x 10 =	20 (7a)
Number of passive vents					0	=	0	x 10 =	0 (7b)
Number of flueless gas fires					0	=	0	x 40 =	0 (7c)

DRAFT

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 ÷ (5) = 0.1 (8)

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.35 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.3 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=

5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=

1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
------	------	------	-----	------	------	------	------	---	------	------	------

# SAP WorkSheet: New dwelling design stage

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

0.38	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.3	0.32	0.33	0.35
------	------	------	------	------	------	------	------	-----	------	------	------

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

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

(25)m= 0.57 0.57 0.57 0.55 0.55 0.54 0.54 0.54 0.54 0.55 0.56 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			2.04	x 1	= 2.04		(26)
Windows Type 1			2.21	x 1/[1/( 1.2 )+ 0.04]	= 2.53		(27)
Windows Type 2			0.97	x 1/[1/( 1.2 )+ 0.04]	= 1.11		(27)
Windows Type 3			0.97	x 1/[1/( 1.2 )+ 0.04]	= 1.11		(27)
Windows Type 4			2.21	x 1/[1/( 1.2 )+ 0.04]	= 2.53		(27)
Windows Type 5			3.15	x 1/[1/( 1.2 )+ 0.04]	= 3.61		(27)
Walls Type1	53.87	13.93	39.94	x 0.18	= 7.19	60	2396.52 (29)
Walls Type2	5.4	2.04	3.36	x 0.17	= 0.56	60	201.84 (29)
Total area of elements, m <sup>2</sup>			59.28				(31)
Party wall			42.78	x 0	= 0	110	4706.24 (32)
Party floor			73.48			40	2939.2 (32a)
Party ceiling			73.48			30	2204.4 (32b)
Internal wall **			130.65			9	1175.832 (32c)

\* 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) = 25.74 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13624.03 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m<sup>2</sup>K = (34) ÷ (4) = 185.41 (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 8.61 (36)

# SAP WorkSheet: New dwelling design stage

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	
(38)m=	38.75	38.57	38.38	37.53	37.36	36.62	36.62	36.48	36.9	37.36	37.69	38.03	(38)

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

(39)m=	73.11	72.92	72.74	71.88	71.72	70.97	70.97	70.83	71.26	71.72	72.05	72.39	
Average = Sum(39) <sub>1...12</sub> / 12 =												<input type="text" value="71.88"/>	(39)

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

(40)m=	0.99	0.99	0.99	0.98	0.98	0.97	0.97	0.96	0.97	0.98	0.98	0.99	
Average = Sum(40) <sub>1...12</sub> / 12 =												<input type="text" value="0.98"/>	(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 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=	98.43	94.85	91.27	87.69	84.11	80.53	80.53	84.11	87.69	91.27	94.85	98.43	
Total = Sum(44) <sub>1...12</sub> =												<input type="text" value="1073.76"/>	(44)

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

(45)m=	145.97	127.66	131.74	114.85	110.2	95.1	88.12	101.12	102.33	119.25	130.17	141.36	
Total = Sum(45) <sub>1...12</sub> =												<input type="text" value="1407.86"/>	(45)

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)

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

(46)m=	21.89	19.15	19.76	17.23	16.53	14.26	13.22	15.17	15.35	17.89	19.53	21.2	(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)



# SAP WorkSheet: New dwelling design stage

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0
---

(58)

Primary circuit loss calculated for each month  $(59)m = (58) \div 365 \times (41)m$

(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  $(61)m = (60) \div 365 \times (41)m$

(61)m=	14.1	12.72	14.05	13.55	13.98	13.5	13.93	13.96	13.53	14.02	13.61	14.09	(61)
--------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(62)m=	160.07	140.38	145.78	128.41	124.18	108.59	102.05	115.08	115.86	133.27	143.78	155.45	(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=	160.07	140.38	145.78	128.41	124.18	108.59	102.05	115.08	115.86	133.27	143.78	155.45	(64)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

1572.89
---------

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=	52.06	45.63	47.31	41.58	40.14	34.99	32.78	37.11	37.41	43.16	46.68	50.52	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	139.65	139.65	139.65	139.65	139.65	139.65	139.65	139.65	139.65	139.65	139.65	139.65	(66)

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

(67)m=	46.37	41.19	33.5	25.36	18.96	16	17.29	22.48	30.17	38.31	44.71	47.66	(67)
--------	-------	-------	------	-------	-------	----	-------	-------	-------	-------	-------	-------	------

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

(68)m=	306.39	309.57	301.55	284.5	262.97	242.73	229.21	226.03	234.05	251.1	272.63	292.87	(68)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	------

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

(69)m=	51.29	51.29	51.29	51.29	51.29	51.29	51.29	51.29	51.29	51.29	51.29	51.29	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	(71)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water heating gains (Table 5)

(72)m=	69.97	67.9	63.59	57.75	53.95	48.6	44.06	49.88	51.95	58.01	64.84	67.91	(72)
--------	-------	------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	523.57	519.49	499.49	468.45	436.72	408.18	391.41	399.24	417.01	448.26	483.03	509.28	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

## 6. Solar gains:

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

# SAP WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d	Area m <sup>2</sup>	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)							
North	0.9x	0.77	x	0.97	x	10.63	x	0.63	x	0.7	=	3.15	(74)
North	0.9x	0.77	x	0.97	x	20.32	x	0.63	x	0.7	=	6.02	(74)
North	0.9x	0.77	x	0.97	x	34.53	x	0.63	x	0.7	=	10.24	(74)
North	0.9x	0.77	x	0.97	x	55.46	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	0.97	x	74.72	x	0.63	x	0.7	=	22.15	(74)
North	0.9x	0.77	x	0.97	x	79.99	x	0.63	x	0.7	=	23.71	(74)
North	0.9x	0.77	x	0.97	x	74.68	x	0.63	x	0.7	=	22.14	(74)
North	0.9x	0.77	x	0.97	x	59.25	x	0.63	x	0.7	=	17.56	(74)
North	0.9x	0.77	x	0.97	x	41.52	x	0.63	x	0.7	=	12.31	(74)
North	0.9x	0.77	x	0.97	x	24.19	x	0.63	x	0.7	=	7.17	(74)
North	0.9x	0.77	x	0.97	x	13.12	x	0.63	x	0.7	=	3.89	(74)
North	0.9x	0.77	x	0.97	x	8.86	x	0.63	x	0.7	=	2.63	(74)
South	0.9x	0.77	x	2.21	x	46.75	x	0.63	x	0.7	=	63.15	(78)
South	0.9x	0.77	x	0.97	x	46.75	x	0.63	x	0.7	=	13.86	(78)
South	0.9x	0.77	x	2.21	x	76.57	x	0.63	x	0.7	=	103.43	(78)
South	0.9x	0.77	x	0.97	x	76.57	x	0.63	x	0.7	=	22.7	(78)
South	0.9x	0.77	x	2.21	x	97.53	x	0.63	x	0.7	=	131.75	(78)
South	0.9x	0.77	x	0.97	x	97.53	x	0.63	x	0.7	=	28.91	(78)
South	0.9x	0.77	x	2.21	x	110.23	x	0.63	x	0.7	=	148.91	(78)
South	0.9x	0.77	x	0.97	x	110.23	x	0.63	x	0.7	=	32.68	(78)
South	0.9x	0.77	x	2.21	x	114.87	x	0.63	x	0.7	=	155.17	(78)
South	0.9x	0.77	x	0.97	x	114.87	x	0.63	x	0.7	=	34.05	(78)
South	0.9x	0.77	x	2.21	x	110.55	x	0.63	x	0.7	=	149.33	(78)
South	0.9x	0.77	x	0.97	x	110.55	x	0.63	x	0.7	=	32.77	(78)
South	0.9x	0.77	x	2.21	x	108.01	x	0.63	x	0.7	=	145.9	(78)
South	0.9x	0.77	x	0.97	x	108.01	x	0.63	x	0.7	=	32.02	(78)
South	0.9x	0.77	x	2.21	x	104.89	x	0.63	x	0.7	=	141.69	(78)
South	0.9x	0.77	x	0.97	x	104.89	x	0.63	x	0.7	=	31.1	(78)
South	0.9x	0.77	x	2.21	x	101.89	x	0.63	x	0.7	=	137.63	(78)
South	0.9x	0.77	x	0.97	x	101.89	x	0.63	x	0.7	=	30.2	(78)
South	0.9x	0.77	x	2.21	x	82.59	x	0.63	x	0.7	=	111.56	(78)
South	0.9x	0.77	x	0.97	x	82.59	x	0.63	x	0.7	=	24.48	(78)
South	0.9x	0.77	x	2.21	x	55.42	x	0.63	x	0.7	=	74.86	(78)
South	0.9x	0.77	x	0.97	x	55.42	x	0.63	x	0.7	=	16.43	(78)
South	0.9x	0.77	x	2.21	x	40.4	x	0.63	x	0.7	=	54.57	(78)
South	0.9x	0.77	x	0.97	x	40.4	x	0.63	x	0.7	=	11.98	(78)
West	0.9x	0.77	x	2.21	x	19.64	x	0.63	x	0.7	=	26.53	(80)
West	0.9x	0.77	x	3.15	x	19.64	x	0.63	x	0.7	=	18.91	(80)
West	0.9x	0.77	x	2.21	x	38.42	x	0.63	x	0.7	=	51.9	(80)

## SAP WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.15	x	38.42	x	0.63	x	0.7	=	36.99	(80)
West	0.9x	0.77	x	2.21	x	63.27	x	0.63	x	0.7	=	85.47	(80)
West	0.9x	0.77	x	3.15	x	63.27	x	0.63	x	0.7	=	60.91	(80)
West	0.9x	0.77	x	2.21	x	92.28	x	0.63	x	0.7	=	124.65	(80)
West	0.9x	0.77	x	3.15	x	92.28	x	0.63	x	0.7	=	88.84	(80)
West	0.9x	0.77	x	2.21	x	113.09	x	0.63	x	0.7	=	152.77	(80)
West	0.9x	0.77	x	3.15	x	113.09	x	0.63	x	0.7	=	108.87	(80)
West	0.9x	0.77	x	2.21	x	115.77	x	0.63	x	0.7	=	156.38	(80)
West	0.9x	0.77	x	3.15	x	115.77	x	0.63	x	0.7	=	111.45	(80)
West	0.9x	0.77	x	2.21	x	110.22	x	0.63	x	0.7	=	148.88	(80)
West	0.9x	0.77	x	3.15	x	110.22	x	0.63	x	0.7	=	106.11	(80)
West	0.9x	0.77	x	2.21	x	94.68	x	0.63	x	0.7	=	127.89	(80)
West	0.9x	0.77	x	3.15	x	94.68	x	0.63	x	0.7	=	91.14	(80)
West	0.9x	0.77	x	2.21	x	73.59	x	0.63	x	0.7	=	99.41	(80)
West	0.9x	0.77	x	3.15	x	73.59	x	0.63	x	0.7	=	70.84	(80)
West	0.9x	0.77	x	2.21	x	45.59	x	0.63	x	0.7	=	61.58	(80)
West	0.9x	0.77	x	3.15	x	45.59	x	0.63	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	2.21	x	24.49	x	0.63	x	0.7	=	33.08	(80)
West	0.9x	0.77	x	3.15	x	24.49	x	0.63	x	0.7	=	23.58	(80)
West	0.9x	0.77	x	2.21	x	16.15	x	0.63	x	0.7	=	21.82	(80)
West	0.9x	0.77	x	3.15	x	16.15	x	0.63	x	0.7	=	15.55	(80)

Solar gains in watts, calculated for each month

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

(83)m=	125.6	221.04	317.28	411.52	473.01	473.65	455.05	409.38	350.39	248.68	151.83	106.54	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	649.18	740.53	816.77	879.96	909.72	881.83	846.46	808.62	767.4	696.94	634.86	615.82	(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	0.9	0.81	0.67	0.5	0.37	0.4	0.61	0.85	0.95	0.98	(86)

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

(87)m=	20.02	20.21	20.47	20.74	20.91	20.98	21	20.99	20.96	20.74	20.33	19.97	(87)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------

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

(88)m=	20.09	20.09	20.09	20.1	20.1	20.11	20.11	20.11	20.11	20.1	20.1	20.1	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	------	------

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

(89)m=	0.96	0.94	0.89	0.78	0.62	0.44	0.29	0.32	0.54	0.81	0.94	0.97	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.8	19.08	19.44	19.81	20.02	20.1	20.11	20.11	20.07	19.82	19.26	18.74	(90)
--------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.39 (91)

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

# SAP WorkSheet: New dwelling design stage

(92)m=	19.27	19.52	19.85	20.17	20.37	20.44	20.46	20.46	20.42	20.18	19.68	19.22	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.12	19.37	19.7	20.02	20.22	20.29	20.31	20.31	20.27	20.03	19.53	19.07	(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	0.88	0.78	0.63	0.45	0.31	0.34	0.55	0.81	0.93	0.96	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	620.85	687.35	715.82	683.98	573.4	397.68	262.1	275.26	423.89	561.76	588.61	593.26	(95)
--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1083.77	1055.42	959.81	799.63	610.71	404.01	262.99	276.62	439.56	675.97	895.51	1076.62	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	344.42	247.34	181.53	83.27	27.75	0	0	0	0	84.97	220.96	359.62	(98)
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) =  $Sum(98)_{1..5,9..12} =$  1549.87

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

(99)	21.09
------	-------

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

### Space heating:

Fraction of space heat from secondary/supplementary system

(201)	0
-------	---

Fraction of space heat from main system(s)

(202) =  $1 - (201) =$

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

Fraction of total heating from main system 1

(204) =  $(202) \times [1 - (203)] =$

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

Efficiency of main space heating system 1

(206)	90.5
-------	------

Efficiency of secondary/supplementary heating system, %

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

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

Space heating requirement (calculated above)

344.42	247.34	181.53	83.27	27.75	0	0	0	0	84.97	220.96	359.62
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

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

380.57	273.31	200.59	92.01	30.67	0	0	0	0	93.89	244.16	397.37
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) =  $Sum(211)_{1..5,10..12} =$  1712.56 (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	(215)
---------	---	---	---	---	---	---	---	---	---	---	---	---	-------

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

### Water heating

Output from water heater (calculated above)

160.07	140.38	145.78	128.41	124.18	108.59	102.05	115.08	115.86	133.27	143.78	155.45
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater 87.3 (216)

(217)m=	89.46	89.31	89.05	88.53	87.87	87.3	87.3	87.3	87.3	88.52	89.21	89.51	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating,  $kWh/month$

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

(219)m=	178.93	157.17	163.71	145.04	141.33	124.39	116.89	131.82	132.71	150.56	161.17	173.67	(219)
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Total =  $Sum(219a)_{1..12} =$  1777.39 (219)

# SAP WorkSheet: New dwelling design stage

## Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		1712.56
Water heating fuel used		1777.39
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		327.58 (232)
Electricity generated by PVs		-616.62 (233)

### 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	59.6 (240)
Space heating - main system 2	(213) x	0	0 (241)
Space heating - secondary	(215) x	13.19	0 (242)
Water heating cost (other fuel)	(219)	3.48	61.85 (247)
Pumps, fans and electric keep-hot	(231)	13.19	9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a)			
Energy for lighting	(232)	13.19	43.21 (250)
Additional standing charges (Table 12)			120 (251)
one of (233) to (235) x		13.19	0 (252)
Appendix Q items: repeat lines (253) and (254) as needed			
<b>Total energy cost</b>	(245)...(247) + (250)...(254) =		294.55 (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] =	1.04 (257)
<b>SAP rating (Section 12)</b>		85.43 (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	369.91 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	383.92 (264)
Space and water heating	(261) + (262) + (263) + (264) =		753.83 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	170.01 (268)

## SAP WorkSheet: New dwelling design stage

Energy saving/generation technologies				
Item 1	0.519	=	-320.03	(269)
Total CO2, kg/year	sum of (265)...(271) =			642.74 (272)
<b>CO2 emissions per m<sup>2</sup></b>	(272) ÷ (4) =			8.75 (273)
El rating (section 14)				93 (274)

### 13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x		1.22	=	2089.33 (261)
Space heating (secondary)	(215) x		3.07	=	0 (263)
Energy for water heating	(219) x		1.22	=	2168.41 (264)
Space and water heating	(261) + (262) + (263) + (264) =				4257.74 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	230.25 (267)
Electricity for lighting	(232) x		0	=	1005.67 (268)
Energy saving/generation technologies					
Item 1			3.07	=	-1893.04 (269)
'Total Primary Energy	sum of (265)...(271) =				3600.62 (272)
<b>Primary energy kWh/m<sup>2</sup>/year</b>	(272) ÷ (4) =				49 (273)

DRAFT

# TFEE WorkSheet: New dwelling design stage

User Details:

**Assessor Name:**

**Stroma Number:**

**Software Name:** Stroma FSAP 2012

**Software Version:**

Version: 1.0.4.26

Property Address: Plot 8 - 2B4P

**Address :** Plot 8, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	73.48	(1a) x	2.8	(2a) =	205.74
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.48	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.74

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
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							3	x 10 =	30
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

DRAFT

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 ÷ (5) = 0.15 (8)

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) 0.4 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.34 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m= 

5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m= 

1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
------	------	------	-----	------	------	------	------	---	------	------	------

# TFEE WorkSheet: New dwelling design stage

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

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4
------	------	------	------	------	------	------	------	------	------	------	-----

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) 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= 

0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58
------	------	------	------	------	------	------	------	------	------	------	------

 (24d)

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

(25)m= 

0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

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

ELEMENT	Gross area (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			2.04	x 1	= 2.04		(26)
Windows Type 1			2.21	x 1/[1/( 1.4 )+ 0.04]	= 2.93		(27)
Windows Type 2			0.97	x 1/[1/( 1.4 )+ 0.04]	= 1.29		(27)
Windows Type 3			0.97	x 1/[1/( 1.4 )+ 0.04]	= 1.29		(27)
Windows Type 4			2.21	x 1/[1/( 1.4 )+ 0.04]	= 2.93		(27)
Windows Type 5			3.15	x 1/[1/( 1.4 )+ 0.04]	= 4.18		(27)
Walls Type1	53.87	13.93	39.94	x 0.18	= 7.19		(29)
Walls Type2	5.4	2.04	3.36	x 0.18	= 0.61		(29)
Total area of elements, m <sup>2</sup>			59.28				(31)
Party wall			42.78	x 0	= 0		(32)
Party floor			73.48				(32a)
Party ceiling			73.48				(32b)
Internal wall **			130.65				(32c)

\* 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) = 28.3 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13624.03 (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 6.28 (36)



# TFEE WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 34.58 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.19	39.95	39.71	38.6	38.39	37.42	37.42	37.24	37.79	38.39	38.81	39.25	(38)

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

(39)m=	74.78	74.53	74.3	73.18	72.97	72	72	71.82	72.37	72.97	73.39	73.83	
Average = Sum(39) <sub>1...12</sub> / 12 =												73.18	(39)

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

(40)m=	1.02	1.01	1.01	1	0.99	0.98	0.98	0.98	0.98	0.99	1	1	
Average = Sum(40) <sub>1...12</sub> / 12 =												1	(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 2.33 (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 Vd,average = (25 x N) + 36 89.48 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.43	94.85	91.27	87.69	84.11	80.53	80.53	84.11	87.69	91.27	94.85	98.43	
Total = Sum(44) <sub>1...12</sub> =												1073.76	(44)

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

(45)m=	145.97	127.66	131.74	114.85	110.2	95.1	88.12	101.12	102.33	119.25	130.17	141.36	
Total = Sum(45) <sub>1...12</sub> =												1407.86	(45)

*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)*

*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 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)

# TFEE WorkSheet: New dwelling design stage

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0	(58)
---	------

Primary circuit loss calculated for each month  $(59)m = (58) \div 365 \times (41)m$

(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  $(61)m = (60) \div 365 \times (41)m$

(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  $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	124.07	108.51	111.98	97.62	93.67	80.83	74.9	85.95	86.98	101.36	110.65	120.16	(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=	124.07	108.51	111.98	97.62	93.67	80.83	74.9	85.95	86.98	101.36	110.65	120.16	
												1196.68	

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

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=	31.02	27.13	27.99	24.41	23.42	20.21	18.73	21.49	21.74	25.34	27.66	30.04	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	(66)

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

(67)m=	18.55	16.47	13.4	10.14	7.58	6.4	6.92	8.99	12.07	15.32	17.88	19.06	(67)
--------	-------	-------	------	-------	------	-----	------	------	-------	-------	-------	-------	------

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

(68)m=	205.28	207.41	202.04	190.61	176.19	162.63	153.57	151.44	156.81	168.24	182.66	196.22	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	(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=	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	(71)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water heating gains (Table 5)

(72)m=	41.69	40.37	37.63	33.9	31.48	28.07	25.17	28.88	30.2	34.06	38.42	40.37	(72)
--------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	------

**Total internal gains =**

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

(73)m=	323.43	322.17	310.98	292.57	273.16	255.01	243.57	247.23	256.99	275.53	296.88	313.57	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

## 6. Solar gains:

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

# TFEE WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d	Area m <sup>2</sup>	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)							
North	0.9x	0.77	x	0.97	x	10.63	x	0.63	x	0.7	=	3.15	(74)
North	0.9x	0.77	x	0.97	x	20.32	x	0.63	x	0.7	=	6.02	(74)
North	0.9x	0.77	x	0.97	x	34.53	x	0.63	x	0.7	=	10.24	(74)
North	0.9x	0.77	x	0.97	x	55.46	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	0.97	x	74.72	x	0.63	x	0.7	=	22.15	(74)
North	0.9x	0.77	x	0.97	x	79.99	x	0.63	x	0.7	=	23.71	(74)
North	0.9x	0.77	x	0.97	x	74.68	x	0.63	x	0.7	=	22.14	(74)
North	0.9x	0.77	x	0.97	x	59.25	x	0.63	x	0.7	=	17.56	(74)
North	0.9x	0.77	x	0.97	x	41.52	x	0.63	x	0.7	=	12.31	(74)
North	0.9x	0.77	x	0.97	x	24.19	x	0.63	x	0.7	=	7.17	(74)
North	0.9x	0.77	x	0.97	x	13.12	x	0.63	x	0.7	=	3.89	(74)
North	0.9x	0.77	x	0.97	x	8.86	x	0.63	x	0.7	=	2.63	(74)
South	0.9x	0.77	x	2.21	x	46.75	x	0.63	x	0.7	=	63.15	(78)
South	0.9x	0.77	x	0.97	x	46.75	x	0.63	x	0.7	=	13.86	(78)
South	0.9x	0.77	x	2.21	x	76.57	x	0.63	x	0.7	=	103.43	(78)
South	0.9x	0.77	x	0.97	x	76.57	x	0.63	x	0.7	=	22.7	(78)
South	0.9x	0.77	x	2.21	x	97.53	x	0.63	x	0.7	=	131.75	(78)
South	0.9x	0.77	x	0.97	x	97.53	x	0.63	x	0.7	=	28.91	(78)
South	0.9x	0.77	x	2.21	x	110.23	x	0.63	x	0.7	=	148.91	(78)
South	0.9x	0.77	x	0.97	x	110.23	x	0.63	x	0.7	=	32.68	(78)
South	0.9x	0.77	x	2.21	x	114.87	x	0.63	x	0.7	=	155.17	(78)
South	0.9x	0.77	x	0.97	x	114.87	x	0.63	x	0.7	=	34.05	(78)
South	0.9x	0.77	x	2.21	x	110.55	x	0.63	x	0.7	=	149.33	(78)
South	0.9x	0.77	x	0.97	x	110.55	x	0.63	x	0.7	=	32.77	(78)
South	0.9x	0.77	x	2.21	x	108.01	x	0.63	x	0.7	=	145.9	(78)
South	0.9x	0.77	x	0.97	x	108.01	x	0.63	x	0.7	=	32.02	(78)
South	0.9x	0.77	x	2.21	x	104.89	x	0.63	x	0.7	=	141.69	(78)
South	0.9x	0.77	x	0.97	x	104.89	x	0.63	x	0.7	=	31.1	(78)
South	0.9x	0.77	x	2.21	x	101.89	x	0.63	x	0.7	=	137.63	(78)
South	0.9x	0.77	x	0.97	x	101.89	x	0.63	x	0.7	=	30.2	(78)
South	0.9x	0.77	x	2.21	x	82.59	x	0.63	x	0.7	=	111.56	(78)
South	0.9x	0.77	x	0.97	x	82.59	x	0.63	x	0.7	=	24.48	(78)
South	0.9x	0.77	x	2.21	x	55.42	x	0.63	x	0.7	=	74.86	(78)
South	0.9x	0.77	x	0.97	x	55.42	x	0.63	x	0.7	=	16.43	(78)
South	0.9x	0.77	x	2.21	x	40.4	x	0.63	x	0.7	=	54.57	(78)
South	0.9x	0.77	x	0.97	x	40.4	x	0.63	x	0.7	=	11.98	(78)
West	0.9x	0.77	x	2.21	x	19.64	x	0.63	x	0.7	=	26.53	(80)
West	0.9x	0.77	x	3.15	x	19.64	x	0.63	x	0.7	=	18.91	(80)
West	0.9x	0.77	x	2.21	x	38.42	x	0.63	x	0.7	=	51.9	(80)

## TFEE WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.15	x	38.42	x	0.63	x	0.7	=	36.99	(80)
West	0.9x	0.77	x	2.21	x	63.27	x	0.63	x	0.7	=	85.47	(80)
West	0.9x	0.77	x	3.15	x	63.27	x	0.63	x	0.7	=	60.91	(80)
West	0.9x	0.77	x	2.21	x	92.28	x	0.63	x	0.7	=	124.65	(80)
West	0.9x	0.77	x	3.15	x	92.28	x	0.63	x	0.7	=	88.84	(80)
West	0.9x	0.77	x	2.21	x	113.09	x	0.63	x	0.7	=	152.77	(80)
West	0.9x	0.77	x	3.15	x	113.09	x	0.63	x	0.7	=	108.87	(80)
West	0.9x	0.77	x	2.21	x	115.77	x	0.63	x	0.7	=	156.38	(80)
West	0.9x	0.77	x	3.15	x	115.77	x	0.63	x	0.7	=	111.45	(80)
West	0.9x	0.77	x	2.21	x	110.22	x	0.63	x	0.7	=	148.88	(80)
West	0.9x	0.77	x	3.15	x	110.22	x	0.63	x	0.7	=	106.11	(80)
West	0.9x	0.77	x	2.21	x	94.68	x	0.63	x	0.7	=	127.89	(80)
West	0.9x	0.77	x	3.15	x	94.68	x	0.63	x	0.7	=	91.14	(80)
West	0.9x	0.77	x	2.21	x	73.59	x	0.63	x	0.7	=	99.41	(80)
West	0.9x	0.77	x	3.15	x	73.59	x	0.63	x	0.7	=	70.84	(80)
West	0.9x	0.77	x	2.21	x	45.59	x	0.63	x	0.7	=	61.58	(80)
West	0.9x	0.77	x	3.15	x	45.59	x	0.63	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	2.21	x	24.49	x	0.63	x	0.7	=	33.08	(80)
West	0.9x	0.77	x	3.15	x	24.49	x	0.63	x	0.7	=	23.58	(80)
West	0.9x	0.77	x	2.21	x	16.15	x	0.63	x	0.7	=	21.82	(80)
West	0.9x	0.77	x	3.15	x	16.15	x	0.63	x	0.7	=	15.55	(80)

Solar gains in watts, calculated for each month

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

(83)m=	125.6	221.04	317.28	411.52	473.01	473.65	455.05	409.38	350.39	248.68	151.83	106.54	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	449.03	543.2	628.26	704.08	746.17	728.66	698.62	656.61	607.38	524.22	448.71	420.11	(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	0.81	0.61	0.45	0.5	0.76	0.96	0.99	1	(86)

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

(87)m=	19.95	20.13	20.39	20.7	20.9	20.98	21	21	20.95	20.66	20.25	19.92	(87)
--------	-------	-------	-------	------	------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.07	20.07	20.07	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.08	20.08	(88)
--------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	------

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

(89)m=	1	0.99	0.97	0.91	0.75	0.54	0.36	0.4	0.68	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=	19.11	19.3	19.55	19.85	20.02	20.09	20.1	20.1	20.07	19.83	19.42	19.09	(90)
--------	-------	------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.39 (91)

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

## TFEE WorkSheet: New dwelling design stage

(92)m=	19.44	19.62	19.88	20.18	20.37	20.44	20.45	20.45	20.41	20.15	19.74	19.41	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.44	19.62	19.88	20.18	20.37	20.44	20.45	20.45	20.41	20.15	19.74	19.41	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

### 8. Space heating requirement

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

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

Utilisation factor for gains,  $h_m$ :

(94)m=	1	0.99	0.97	0.91	0.77	0.57	0.4	0.44	0.71	0.94	0.99	1	(94)
--------	---	------	------	------	------	------	-----	------	------	------	------	---	------

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

(95)m=	447.43	537.66	609.47	639.46	575.76	412.61	276.31	289.31	430.57	493.76	444.81	419.05	(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=	1131.97	1097.29	994.08	825.34	632.32	420.44	277.15	290.83	456.76	697.03	927.67	1123.36	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	509.3	376.07	286.15	133.84	42.08	0	0	0	0	151.24	347.66	524	
--------	-------	--------	--------	--------	-------	---	---	---	---	--------	--------	-----	--

Total per year (kWh/year) = Sum(98)<sub>...5,9...12</sub> = 2370.34 (98)

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

32.26 (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  $L_m$  (calculated using  $25^\circ C$  internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	676.77	532.78	545.81	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss  $h_m$

(101)m=	0	0	0	0	0	0.95	0.98	0.97	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

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

(102)m=	0	0	0	0	0	644.08	521.72	529.91	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	938.26	901.39	853.74	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	211.81	282.48	240.93	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = Sum(104) = 735.22 (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(104) = 0 (106)

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

(107)m=	0	0	0	0	0	52.95	70.62	60.23	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 183.8 (107)

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

(107)  $\div$  (4) = 2.5 (108)

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

Fabric Energy Efficiency (99) + (108) = 34.76 (109)

Target Fabric Energy Efficiency (TFEE) 39.97 (109)

**DRAFT**

# DFEE WorkSheet: New dwelling design stage

User Details:

**Assessor Name:**

**Stroma Number:**

**Software Name:** Stroma FSAP 2012

**Software Version:**

Version: 1.0.4.26

Property Address: Plot 8 - 2B4P

**Address :** Plot 8, 38-42 Hampton Road, Teddington, London, TW11 0JE

**1. Overall dwelling dimensions:**

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	73.48 (1a)	x	2.8 (2a)	=	205.74 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.48 (4)				
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =				205.74 (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)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 ÷ (5) = 0.15 (8)

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) 0.4 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.34 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m= 

5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m= 

1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
------	------	------	-----	------	------	------	------	---	------	------	------

# DFEE WorkSheet: New dwelling design stage

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

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4
------	------	------	------	------	------	------	------	------	------	------	-----

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) 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= 

0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58
------	------	------	------	------	------	------	------	------	------	------	------

 (24d)

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

(25)m= 

0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

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

ELEMENT	Gross area (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			2.04	x 1	= 2.04		(26)
Windows Type 1			2.21	x 1/[1/(1.2)+0.04]	= 2.53		(27)
Windows Type 2			0.97	x 1/[1/(1.2)+0.04]	= 1.11		(27)
Windows Type 3			0.97	x 1/[1/(1.2)+0.04]	= 1.11		(27)
Windows Type 4			2.21	x 1/[1/(1.2)+0.04]	= 2.53		(27)
Windows Type 5			3.15	x 1/[1/(1.2)+0.04]	= 3.61		(27)
Walls Type1	53.87	13.93	39.94	x 0.18	= 7.19	60	2396.52 (29)
Walls Type2	5.4	2.04	3.36	x 0.17	= 0.56	60	201.84 (29)
Total area of elements, m <sup>2</sup>			59.28				(31)
Party wall			42.78	x 0	= 0	110	4706.24 (32)
Party floor			73.48			40	2939.2 (32a)
Party ceiling			73.48			30	2204.4 (32b)
Internal wall **			130.65			9	1175.832 (32c)

\* 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) = 25.74 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13624.03 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m<sup>2</sup>K = (34) ÷ (4) = 185.41 (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 8.61 (36)



# DFEE WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 34.36 (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	
(38)m=	40.19	39.95	39.71	38.6	38.39	37.42	37.42	37.24	37.79	38.39	38.81	39.25	(38)

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

(39)m=	74.55	74.31	74.07	72.95	72.74	71.77	71.77	71.59	72.15	72.74	73.17	73.61	
Average = Sum(39) <sub>1...12</sub> / 12 =												72.95	(39)

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

(40)m=	1.01	1.01	1.01	0.99	0.99	0.98	0.98	0.97	0.98	0.99	1	1	
Average = Sum(40) <sub>1...12</sub> / 12 =												0.99	(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 2.33 (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 Vd,average = (25 x N) + 36 89.48 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.43	94.85	91.27	87.69	84.11	80.53	80.53	84.11	87.69	91.27	94.85	98.43	
Total = Sum(44) <sub>1...12</sub> =												1073.76	(44)

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

(45)m=	145.97	127.66	131.74	114.85	110.2	95.1	88.12	101.12	102.33	119.25	130.17	141.36	
Total = Sum(45) <sub>1...12</sub> =												1407.86	(45)

*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)*

*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 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)

# DFEE WorkSheet: New dwelling design stage

Water storage loss calculated for each month

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

<b>(56)m=</b>	0	0	0	0	0	0	0	0	0	0	0	0	<b>(56)</b>
---------------	---	---	---	---	---	---	---	---	---	---	---	---	-------------

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

<b>(57)m=</b>	0	0	0	0	0	0	0	0	0	0	0	0	<b>(57)</b>
---------------	---	---	---	---	---	---	---	---	---	---	---	---	-------------

Primary circuit loss (annual) from Table 3

0	<b>(58)</b>
---	-------------

Primary circuit loss calculated for each month  $(59)m = (58) \div 365 \times (41)m$

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

<b>(59)m=</b>	0	0	0	0	0	0	0	0	0	0	0	0	<b>(59)</b>
---------------	---	---	---	---	---	---	---	---	---	---	---	---	-------------

Combi loss calculated for each month  $(61)m = (60) \div 365 \times (41)m$

<b>(61)m=</b>	0	0	0	0	0	0	0	0	0	0	0	0	<b>(61)</b>
---------------	---	---	---	---	---	---	---	---	---	---	---	---	-------------

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

<b>(62)m=</b>	124.07	108.51	111.98	97.62	93.67	80.83	74.9	85.95	86.98	101.36	110.65	120.16	<b>(62)</b>
---------------	--------	--------	--------	-------	-------	-------	------	-------	-------	--------	--------	--------	-------------

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)

<b>(63)m=</b>	0	0	0	0	0	0	0	0	0	0	0	0	<b>(63)</b>
---------------	---	---	---	---	---	---	---	---	---	---	---	---	-------------

Output from water heater

<b>(64)m=</b>	124.07	108.51	111.98	97.62	93.67	80.83	74.9	85.95	86.98	101.36	110.65	120.16	
												<b>(64)</b>	

Output from water heater (annual)<sup>1...12</sup> 1196.68

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

<b>(65)m=</b>	31.02	27.13	27.99	24.41	23.42	20.21	18.73	21.49	21.74	25.34	27.66	30.04	<b>(65)</b>
---------------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
<b>(66)m=</b>	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	<b>(66)</b>

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

<b>(67)m=</b>	18.55	16.47	13.4	10.14	7.58	6.4	6.92	8.99	12.07	15.32	17.88	19.06	<b>(67)</b>
---------------	-------	-------	------	-------	------	-----	------	------	-------	-------	-------	-------	-------------

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

<b>(68)m=</b>	205.28	207.41	202.04	190.61	176.19	162.63	153.57	151.44	156.81	168.24	182.66	196.22	<b>(68)</b>
---------------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------------

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

<b>(69)m=</b>	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	<b>(69)</b>
---------------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------------

Pumps and fans gains (Table 5a)

<b>(70)m=</b>	0	0	0	0	0	0	0	0	0	0	0	0	<b>(70)</b>
---------------	---	---	---	---	---	---	---	---	---	---	---	---	-------------

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

<b>(71)m=</b>	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	<b>(71)</b>
---------------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------------

Water heating gains (Table 5)

<b>(72)m=</b>	41.69	40.37	37.63	33.9	31.48	28.07	25.17	28.88	30.2	34.06	38.42	40.37	<b>(72)</b>
---------------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	-------------

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

<b>(73)m=</b>	323.43	322.17	310.98	292.57	273.16	255.01	243.57	247.23	256.99	275.53	296.88	313.57	<b>(73)</b>
---------------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------------

## 6. Solar gains:

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

# DFEE WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d	Area m <sup>2</sup>	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)							
North	0.9x	0.77	x	0.97	x	10.63	x	0.63	x	0.7	=	3.15	(74)
North	0.9x	0.77	x	0.97	x	20.32	x	0.63	x	0.7	=	6.02	(74)
North	0.9x	0.77	x	0.97	x	34.53	x	0.63	x	0.7	=	10.24	(74)
North	0.9x	0.77	x	0.97	x	55.46	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	0.97	x	74.72	x	0.63	x	0.7	=	22.15	(74)
North	0.9x	0.77	x	0.97	x	79.99	x	0.63	x	0.7	=	23.71	(74)
North	0.9x	0.77	x	0.97	x	74.68	x	0.63	x	0.7	=	22.14	(74)
North	0.9x	0.77	x	0.97	x	59.25	x	0.63	x	0.7	=	17.56	(74)
North	0.9x	0.77	x	0.97	x	41.52	x	0.63	x	0.7	=	12.31	(74)
North	0.9x	0.77	x	0.97	x	24.19	x	0.63	x	0.7	=	7.17	(74)
North	0.9x	0.77	x	0.97	x	13.12	x	0.63	x	0.7	=	3.89	(74)
North	0.9x	0.77	x	0.97	x	8.86	x	0.63	x	0.7	=	2.63	(74)
South	0.9x	0.77	x	2.21	x	46.75	x	0.63	x	0.7	=	63.15	(78)
South	0.9x	0.77	x	0.97	x	46.75	x	0.63	x	0.7	=	13.86	(78)
South	0.9x	0.77	x	2.21	x	76.57	x	0.63	x	0.7	=	103.43	(78)
South	0.9x	0.77	x	0.97	x	76.57	x	0.63	x	0.7	=	22.7	(78)
South	0.9x	0.77	x	2.21	x	97.53	x	0.63	x	0.7	=	131.75	(78)
South	0.9x	0.77	x	0.97	x	97.53	x	0.63	x	0.7	=	28.91	(78)
South	0.9x	0.77	x	2.21	x	110.23	x	0.63	x	0.7	=	148.91	(78)
South	0.9x	0.77	x	0.97	x	110.23	x	0.63	x	0.7	=	32.68	(78)
South	0.9x	0.77	x	2.21	x	114.87	x	0.63	x	0.7	=	155.17	(78)
South	0.9x	0.77	x	0.97	x	114.87	x	0.63	x	0.7	=	34.05	(78)
South	0.9x	0.77	x	2.21	x	110.55	x	0.63	x	0.7	=	149.33	(78)
South	0.9x	0.77	x	0.97	x	110.55	x	0.63	x	0.7	=	32.77	(78)
South	0.9x	0.77	x	2.21	x	108.01	x	0.63	x	0.7	=	145.9	(78)
South	0.9x	0.77	x	0.97	x	108.01	x	0.63	x	0.7	=	32.02	(78)
South	0.9x	0.77	x	2.21	x	104.89	x	0.63	x	0.7	=	141.69	(78)
South	0.9x	0.77	x	0.97	x	104.89	x	0.63	x	0.7	=	31.1	(78)
South	0.9x	0.77	x	2.21	x	101.89	x	0.63	x	0.7	=	137.63	(78)
South	0.9x	0.77	x	0.97	x	101.89	x	0.63	x	0.7	=	30.2	(78)
South	0.9x	0.77	x	2.21	x	82.59	x	0.63	x	0.7	=	111.56	(78)
South	0.9x	0.77	x	0.97	x	82.59	x	0.63	x	0.7	=	24.48	(78)
South	0.9x	0.77	x	2.21	x	55.42	x	0.63	x	0.7	=	74.86	(78)
South	0.9x	0.77	x	0.97	x	55.42	x	0.63	x	0.7	=	16.43	(78)
South	0.9x	0.77	x	2.21	x	40.4	x	0.63	x	0.7	=	54.57	(78)
South	0.9x	0.77	x	0.97	x	40.4	x	0.63	x	0.7	=	11.98	(78)
West	0.9x	0.77	x	2.21	x	19.64	x	0.63	x	0.7	=	26.53	(80)
West	0.9x	0.77	x	3.15	x	19.64	x	0.63	x	0.7	=	18.91	(80)
West	0.9x	0.77	x	2.21	x	38.42	x	0.63	x	0.7	=	51.9	(80)

## DFEE WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.15	x	38.42	x	0.63	x	0.7	=	36.99	(80)
West	0.9x	0.77	x	2.21	x	63.27	x	0.63	x	0.7	=	85.47	(80)
West	0.9x	0.77	x	3.15	x	63.27	x	0.63	x	0.7	=	60.91	(80)
West	0.9x	0.77	x	2.21	x	92.28	x	0.63	x	0.7	=	124.65	(80)
West	0.9x	0.77	x	3.15	x	92.28	x	0.63	x	0.7	=	88.84	(80)
West	0.9x	0.77	x	2.21	x	113.09	x	0.63	x	0.7	=	152.77	(80)
West	0.9x	0.77	x	3.15	x	113.09	x	0.63	x	0.7	=	108.87	(80)
West	0.9x	0.77	x	2.21	x	115.77	x	0.63	x	0.7	=	156.38	(80)
West	0.9x	0.77	x	3.15	x	115.77	x	0.63	x	0.7	=	111.45	(80)
West	0.9x	0.77	x	2.21	x	110.22	x	0.63	x	0.7	=	148.88	(80)
West	0.9x	0.77	x	3.15	x	110.22	x	0.63	x	0.7	=	106.11	(80)
West	0.9x	0.77	x	2.21	x	94.68	x	0.63	x	0.7	=	127.89	(80)
West	0.9x	0.77	x	3.15	x	94.68	x	0.63	x	0.7	=	91.14	(80)
West	0.9x	0.77	x	2.21	x	73.59	x	0.63	x	0.7	=	99.41	(80)
West	0.9x	0.77	x	3.15	x	73.59	x	0.63	x	0.7	=	70.84	(80)
West	0.9x	0.77	x	2.21	x	45.59	x	0.63	x	0.7	=	61.58	(80)
West	0.9x	0.77	x	3.15	x	45.59	x	0.63	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	2.21	x	24.49	x	0.63	x	0.7	=	33.08	(80)
West	0.9x	0.77	x	3.15	x	24.49	x	0.63	x	0.7	=	23.58	(80)
West	0.9x	0.77	x	2.21	x	16.15	x	0.63	x	0.7	=	21.82	(80)
West	0.9x	0.77	x	3.15	x	16.15	x	0.63	x	0.7	=	15.55	(80)

Solar gains in watts, calculated for each month

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

(83)m=	125.6	221.04	317.28	411.52	473.01	473.65	455.05	409.38	350.39	248.68	151.83	106.54	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	449.03	543.2	628.26	704.08	746.17	728.66	698.62	656.61	607.38	524.22	448.71	420.11	(84)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.77	0.6	0.45	0.49	0.73	0.93	0.99	0.99	(86)

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

(87)m=	19.68	19.9	20.22	20.58	20.84	20.96	20.99	20.99	20.91	20.55	20.04	19.64	(87)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.07	20.07	20.08	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.09	20.08	(88)
--------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.95	0.87	0.73	0.53	0.36	0.4	0.66	0.91	0.98	0.99	(89)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

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

(90)m=	18.86	19.09	19.4	19.75	19.98	20.08	20.1	20.1	20.04	19.74	19.24	18.83	(90)
--------	-------	-------	------	-------	-------	-------	------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.39 (91)

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

## DFEE WorkSheet: New dwelling design stage

(92)m=	19.18	19.4	19.72	20.07	20.31	20.43	20.45	20.45	20.38	20.05	19.55	19.15	(92)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.18	19.4	19.72	20.07	20.31	20.43	20.45	20.45	20.38	20.05	19.55	19.15	(93)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

### 8. Space heating requirement

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

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

Utilisation factor for gains,  $h_m$ :

(94)m=	0.99	0.97	0.94	0.87	0.74	0.55	0.39	0.44	0.68	0.91	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	443.92	529.6	593.18	613.4	551.76	402.88	273.6	285.63	414.64	476.31	438.74	416.44	(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=	1109.12	1077.7	978.93	815.22	626.52	418.09	276.14	289.66	453.16	687.71	911.02	1100.17	(97)
--------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	494.91	368.32	286.99	145.31	55.62	0	0	0	0	157.29	340.04	508.7	
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	-------	--

Total per year (kWh/year) = Sum(98)<sub>1..5,9..12</sub> = 2357.17 (98)

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

32.08 (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  $L_m$  (calculated using  $25^\circ C$  internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	674.65	531.11	544.09	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss  $h_m$

(101)m=	0	0	0	0	0	0.92	0.96	0.95	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

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

(102)m=	0	0	0	0	0	623.63	509.94	516.06	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	938.26	901.39	853.74	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	226.53	291.24	251.23	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = Sum(104) = 769.01 (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(104) = 0 (106)

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

(107)m=	0	0	0	0	0	56.63	72.81	62.81	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 192.25 (107)

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

(107)  $\div$  (4) = 2.62 (108)

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

Fabric Energy Efficiency (99) + (108) = 34.7 (109)

# DER WorkSheet: New dwelling design stage

User Details:

**Assessor Name:**

**Stroma Number:**

**Software Name:** Stroma FSAP 2012

**Software Version:**

Version: 1.0.4.26

Property Address: Plot 8 - 2B4P

**Address :** Plot 8, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	73.48	(1a) x	2.8	(2a) =	205.74 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.48	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.74 (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							2	x 10 =	20 (7a)
Number of passive vents							0	x 10 =	0 (7b)
Number of flueless gas fires							0	x 40 =	0 (7c)

DRAFT

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 ÷ (5) = 0.1 (8)

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) 0.35 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.3 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m= 

5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m= 

1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
------	------	------	-----	------	------	------	------	---	------	------	------

# DER WorkSheet: New dwelling design stage

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

0.38	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.3	0.32	0.33	0.35
------	------	------	------	------	------	------	------	-----	------	------	------

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= 

0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (24d)

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

(25)m= 

0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

## 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.04	x 1	= 2.04		(26)
Windows Type 1			2.21	x 1/[1/(1.2)+0.04]	= 2.53		(27)
Windows Type 2			0.97	x 1/[1/(1.2)+0.04]	= 1.11		(27)
Windows Type 3			0.97	x 1/[1/(1.2)+0.04]	= 1.11		(27)
Windows Type 4			2.21	x 1/[1/(1.2)+0.04]	= 2.53		(27)
Windows Type 5			3.15	x 1/[1/(1.2)+0.04]	= 3.61		(27)
Walls Type1	53.87	13.93	39.94	x 0.18	= 7.19	60	2396.52 (29)
Walls Type2	5.4	2.04	3.36	x 0.17	= 0.56	60	201.84 (29)
Total area of elements, m²			59.28				(31)
Party wall			42.78	x 0	= 0	110	4706.24 (32)
Party floor			73.48			40	2939.2 (32a)
Party ceiling			73.48			30	2204.4 (32b)
Internal wall **			130.65			9	1175.832 (32c)

\* 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) = 25.74 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13624.03 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 185.41 (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 8.61 (36)

# DER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 34.36 (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	
(38)m=	38.75	38.57	38.38	37.53	37.36	36.62	36.62	36.48	36.9	37.36	37.69	38.03	(38)

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

(39)m=	73.11	72.92	72.74	71.88	71.72	70.97	70.97	70.83	71.26	71.72	72.05	72.39	
Average = Sum(39) <sub>1...12</sub> / 12 =												71.88	(39)

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

(40)m=	0.99	0.99	0.99	0.98	0.98	0.97	0.97	0.96	0.97	0.98	0.98	0.99	
Average = Sum(40) <sub>1...12</sub> / 12 =												0.98	(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 2.33 (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 Vd,average = (25 x N) + 36 89.48 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.43	94.85	91.27	87.69	84.11	80.53	80.53	84.11	87.69	91.27	94.85	98.43	
Total = Sum(44) <sub>1...12</sub> =												1073.76	(44)

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

(45)m=	145.97	127.66	131.74	114.85	110.2	95.1	88.12	101.12	102.33	119.25	130.17	141.36	
Total = Sum(45) <sub>1...12</sub> =												1407.86	(45)

*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)*

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

(46)m=	21.89	19.15	19.76	17.23	16.53	14.26	13.22	15.17	15.35	17.89	19.53	21.2	(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)



# DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

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

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

If cylinder contains dedicated solar storage,  $(57)_m = (56)_m \times [(50) - (H11)] \div (50)$ , else  $(57)_m = (56)_m$  where (H11) is from Appendix H

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

Primary circuit loss (annual) from Table 3

0
---

(58)

Primary circuit loss calculated for each month  $(59)_m = (58) \div 365 \times (41)_m$

(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  $(61)_m = (60) \div 365 \times (41)_m$

(61)m=	14.1	12.72	14.05	13.55	13.98	13.5	13.93	13.96	13.53	14.02	13.61	14.09	(61)
--------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

Total heat required for water heating calculated for each month  $(62)_m = 0.85 \times (45)_m + (46)_m + (57)_m + (59)_m + (61)_m$

(62)m=	160.07	140.38	145.78	128.41	124.18	108.59	102.05	115.08	115.86	133.27	143.78	155.45	(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=	160.07	140.38	145.78	128.41	124.18	108.59	102.05	115.08	115.86	133.27	143.78	155.45	(64)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

1572.89

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=	52.06	45.63	47.31	41.58	40.14	34.99	32.78	37.11	37.41	43.16	46.68	50.52	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	(66)

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

(67)m=	18.55	16.47	13.4	10.14	7.58	6.4	6.92	8.99	12.07	15.32	17.88	19.06	(67)
--------	-------	-------	------	-------	------	-----	------	------	-------	-------	-------	-------	------

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

(68)m=	205.28	207.41	202.04	190.61	176.19	162.63	153.57	151.44	156.81	168.24	182.66	196.22	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	(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=	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	(71)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water heating gains (Table 5)

(72)m=	69.97	67.9	63.59	57.75	53.95	48.6	44.06	49.88	51.95	58.01	64.84	67.91	(72)
--------	-------	------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

**Total internal gains =**

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

(73)m=	354.71	352.69	339.95	319.42	298.63	278.55	265.46	271.23	281.74	302.48	326.3	344.11	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

## 6. Solar gains:

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

## DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d	Area m <sup>2</sup>	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)							
North	0.9x	0.77	x	0.97	x	10.63	x	0.63	x	0.7	=	3.15	(74)
North	0.9x	0.77	x	0.97	x	20.32	x	0.63	x	0.7	=	6.02	(74)
North	0.9x	0.77	x	0.97	x	34.53	x	0.63	x	0.7	=	10.24	(74)
North	0.9x	0.77	x	0.97	x	55.46	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	0.97	x	74.72	x	0.63	x	0.7	=	22.15	(74)
North	0.9x	0.77	x	0.97	x	79.99	x	0.63	x	0.7	=	23.71	(74)
North	0.9x	0.77	x	0.97	x	74.68	x	0.63	x	0.7	=	22.14	(74)
North	0.9x	0.77	x	0.97	x	59.25	x	0.63	x	0.7	=	17.56	(74)
North	0.9x	0.77	x	0.97	x	41.52	x	0.63	x	0.7	=	12.31	(74)
North	0.9x	0.77	x	0.97	x	24.19	x	0.63	x	0.7	=	7.17	(74)
North	0.9x	0.77	x	0.97	x	13.12	x	0.63	x	0.7	=	3.89	(74)
North	0.9x	0.77	x	0.97	x	8.86	x	0.63	x	0.7	=	2.63	(74)
South	0.9x	0.77	x	2.21	x	46.75	x	0.63	x	0.7	=	63.15	(78)
South	0.9x	0.77	x	0.97	x	46.75	x	0.63	x	0.7	=	13.86	(78)
South	0.9x	0.77	x	2.21	x	76.57	x	0.63	x	0.7	=	103.43	(78)
South	0.9x	0.77	x	0.97	x	76.57	x	0.63	x	0.7	=	22.7	(78)
South	0.9x	0.77	x	2.21	x	97.53	x	0.63	x	0.7	=	131.75	(78)
South	0.9x	0.77	x	0.97	x	97.53	x	0.63	x	0.7	=	28.91	(78)
South	0.9x	0.77	x	2.21	x	110.23	x	0.63	x	0.7	=	148.91	(78)
South	0.9x	0.77	x	0.97	x	110.23	x	0.63	x	0.7	=	32.68	(78)
South	0.9x	0.77	x	2.21	x	114.87	x	0.63	x	0.7	=	155.17	(78)
South	0.9x	0.77	x	0.97	x	114.87	x	0.63	x	0.7	=	34.05	(78)
South	0.9x	0.77	x	2.21	x	110.55	x	0.63	x	0.7	=	149.33	(78)
South	0.9x	0.77	x	0.97	x	110.55	x	0.63	x	0.7	=	32.77	(78)
South	0.9x	0.77	x	2.21	x	108.01	x	0.63	x	0.7	=	145.9	(78)
South	0.9x	0.77	x	0.97	x	108.01	x	0.63	x	0.7	=	32.02	(78)
South	0.9x	0.77	x	2.21	x	104.89	x	0.63	x	0.7	=	141.69	(78)
South	0.9x	0.77	x	0.97	x	104.89	x	0.63	x	0.7	=	31.1	(78)
South	0.9x	0.77	x	2.21	x	101.89	x	0.63	x	0.7	=	137.63	(78)
South	0.9x	0.77	x	0.97	x	101.89	x	0.63	x	0.7	=	30.2	(78)
South	0.9x	0.77	x	2.21	x	82.59	x	0.63	x	0.7	=	111.56	(78)
South	0.9x	0.77	x	0.97	x	82.59	x	0.63	x	0.7	=	24.48	(78)
South	0.9x	0.77	x	2.21	x	55.42	x	0.63	x	0.7	=	74.86	(78)
South	0.9x	0.77	x	0.97	x	55.42	x	0.63	x	0.7	=	16.43	(78)
South	0.9x	0.77	x	2.21	x	40.4	x	0.63	x	0.7	=	54.57	(78)
South	0.9x	0.77	x	0.97	x	40.4	x	0.63	x	0.7	=	11.98	(78)
West	0.9x	0.77	x	2.21	x	19.64	x	0.63	x	0.7	=	26.53	(80)
West	0.9x	0.77	x	3.15	x	19.64	x	0.63	x	0.7	=	18.91	(80)
West	0.9x	0.77	x	2.21	x	38.42	x	0.63	x	0.7	=	51.9	(80)

## DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.15	x	38.42	x	0.63	x	0.7	=	36.99	(80)
West	0.9x	0.77	x	2.21	x	63.27	x	0.63	x	0.7	=	85.47	(80)
West	0.9x	0.77	x	3.15	x	63.27	x	0.63	x	0.7	=	60.91	(80)
West	0.9x	0.77	x	2.21	x	92.28	x	0.63	x	0.7	=	124.65	(80)
West	0.9x	0.77	x	3.15	x	92.28	x	0.63	x	0.7	=	88.84	(80)
West	0.9x	0.77	x	2.21	x	113.09	x	0.63	x	0.7	=	152.77	(80)
West	0.9x	0.77	x	3.15	x	113.09	x	0.63	x	0.7	=	108.87	(80)
West	0.9x	0.77	x	2.21	x	115.77	x	0.63	x	0.7	=	156.38	(80)
West	0.9x	0.77	x	3.15	x	115.77	x	0.63	x	0.7	=	111.45	(80)
West	0.9x	0.77	x	2.21	x	110.22	x	0.63	x	0.7	=	148.88	(80)
West	0.9x	0.77	x	3.15	x	110.22	x	0.63	x	0.7	=	106.11	(80)
West	0.9x	0.77	x	2.21	x	94.68	x	0.63	x	0.7	=	127.89	(80)
West	0.9x	0.77	x	3.15	x	94.68	x	0.63	x	0.7	=	91.14	(80)
West	0.9x	0.77	x	2.21	x	73.59	x	0.63	x	0.7	=	99.41	(80)
West	0.9x	0.77	x	3.15	x	73.59	x	0.63	x	0.7	=	70.84	(80)
West	0.9x	0.77	x	2.21	x	45.59	x	0.63	x	0.7	=	61.58	(80)
West	0.9x	0.77	x	3.15	x	45.59	x	0.63	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	2.21	x	24.49	x	0.63	x	0.7	=	33.08	(80)
West	0.9x	0.77	x	3.15	x	24.49	x	0.63	x	0.7	=	23.58	(80)
West	0.9x	0.77	x	2.21	x	16.15	x	0.63	x	0.7	=	21.82	(80)
West	0.9x	0.77	x	3.15	x	16.15	x	0.63	x	0.7	=	15.55	(80)

Solar gains in watts, calculated for each month

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

(83)m=	125.6	221.04	317.28	411.52	473.01	473.65	455.05	409.38	350.39	248.68	151.83	106.54	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	480.32	573.73	657.23	730.93	771.64	752.19	720.51	680.61	632.13	551.16	478.13	450.65	(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	0.88	0.75	0.58	0.43	0.47	0.7	0.92	0.98	0.99	(86)

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

(87)m=	19.76	19.98	20.28	20.62	20.86	20.97	20.99	20.99	20.92	20.6	20.11	19.72	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(88)m=	20.09	20.09	20.09	20.1	20.1	20.11	20.11	20.11	20.11	20.1	20.1	20.1	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	------	------

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

(89)m=	0.99	0.97	0.94	0.86	0.71	0.51	0.34	0.38	0.64	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=	18.43	18.75	19.19	19.66	19.96	20.09	20.11	20.11	20.04	19.64	18.95	18.37	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.39 (91)

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

## DER WorkSheet: New dwelling design stage

(92)m=	18.95	19.23	19.61	20.04	20.31	20.43	20.45	20.45	20.39	20.01	19.4	18.9	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	------

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

(93)m=	18.8	19.08	19.46	19.89	20.16	20.28	20.3	20.3	20.24	19.86	19.25	18.75	(93)
--------	------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

### 8. Space heating requirement

Set  $T_{i,m}$  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=	0.98	0.97	0.93	0.85	0.71	0.52	0.36	0.4	0.65	0.89	0.97	0.99	(94)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

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

(95)m=	472.46	554.49	611.14	620.32	547.21	391.89	261.14	273.67	408.18	488.39	463.35	444.87	(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=	1059.93	1033.96	942.94	789.71	606.8	403.16	262.84	276.38	437.23	664.4	875.47	1053.03	(97)
--------	---------	---------	--------	--------	-------	--------	--------	--------	--------	-------	--------	---------	------

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

(98)m=	437.08	322.2	246.86	121.96	44.34	0	0	0	0	130.95	296.73	452.47	
--------	--------	-------	--------	--------	-------	---	---	---	---	--------	--------	--------	--

Total per year (kWh/year) = Sum(98)<sub>1...5,9...12</sub> = 2052.59 (98)

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

27.93 (99)

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

#### Space heating:

Fraction of space heat from secondary/supplementary system

	<span style="border: 1px solid black; padding: 2px;">0</span>	(201)
--	---	-------

Fraction of space heat from main system(s)

(202) = 1 - (201) =

	<span style="border: 1px solid black; padding: 2px;">1</span>	(202)
--	---	-------

Fraction of total heating from main system 1

(204) = (202) × [1 - (203)] =

	<span style="border: 1px solid black; padding: 2px;">1</span>	(204)
--	---	-------

Efficiency of main space heating system 1

	<span style="border: 1px solid black; padding: 2px;">90.5</span>	(206)
--	--	-------

Efficiency of secondary/supplementary heating system, %

	<span style="border: 1px solid black; padding: 2px;">0</span>	(208)
--	---	-------

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

kWh/year

Space heating requirement (calculated above)

437.08	322.2	246.86	121.96	44.34	0	0	0	0	130.95	296.73	452.47
--------	-------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

482.96	356.03	272.77	134.76	48.99	0	0	0	0	144.7	327.87	499.97
--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) = Sum(211)<sub>1...5,10...12</sub> = 2268.06 (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)<sub>1...5,10...12</sub> = 0 (215)

#### Water heating

Output from water heater (calculated above)

160.07	140.38	145.78	128.41	124.18	108.59	102.05	115.08	115.86	133.27	143.78	155.45
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

	<span style="border: 1px solid black; padding: 2px;">87.3</span>	(216)
--	--	-------

(217)m=  $\{[(98)m \times (204)]\} \times 100 \div (206)$  (217)

89.62	89.5	89.28	88.83	88.12	87.3	87.3	87.3	87.3	88.86	89.43	89.66
-------	------	-------	-------	-------	------	------	------	------	-------	-------	-------

Fuel for water heating,  $kWh/month$

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

(219)m=	178.61	156.84	163.28	144.55	140.92	124.39	116.89	131.82	132.71	149.98	160.78	173.38
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)<sub>1...12</sub> = 1774.15 (219)

## DER WorkSheet: New dwelling design stage

**Annual totals**

	kWh/year	kWh/year
Space heating fuel used, main system 1		2268.06
Water heating fuel used		1774.15
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		327.58 (232)
Electricity generated by PVs		-616.62 (233)

**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	=	489.9 (261)
Space heating (secondary)	(215) x		0.519	=	0 (263)
Water heating	(219) x		0.216	=	383.22 (264)
Space and water heating	(261) + (262) + (263) + (264) =				873.12 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93 (267)
Electricity for lighting	(232) x		0.519	=	170.01 (268)
Energy saving/generation technologies Item 1			0.519	=	-320.03 (269)
Total CO2, kg/year		sum of (265)...(271) =			762.03 (272)
<b>Dwelling CO2 Emission Rate</b>		(272) ÷ (4) =			10.37 (273)
El rating (section 14)					91 (274)

## TER WorkSheet: New dwelling design stage

User Details:

**Assessor Name:**

**Stroma Number:**

**Software Name:** Stroma FSAP 2012

**Software Version:**

Version: 1.0.4.26

Property Address: Plot 8 - 2B4P

**Address :** Plot 8, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	73.48	(1a) x	2.8	(2a) =	205.74 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.48	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.74 (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)

DRAFT

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 ÷ (5) = 0.15 (8)

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

Number of storeys in the dwelling (ns) 0 (9)

Additional infiltration [(9)-1]x0.1 = 0 (10)

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)

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

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 0 (12)

If no draught lobby, enter 0.05, else enter 0 0 (13)

Percentage of windows and doors draught stripped 0 (14)

Window infiltration 0.25 - [0.2 x (14) ÷ 100] = 0 (15)

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 5 (17)

If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) 0.4 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.34 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m= 

5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m= 

1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
------	------	------	-----	------	------	------	------	---	------	------	------

# TER WorkSheet: New dwelling design stage

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

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4
------	------	------	------	------	------	------	------	------	------	------	-----

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) 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= 

0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58
------	------	------	------	------	------	------	------	------	------	------	------

 (24d)

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

(25)m= 

0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

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

ELEMENT	Gross area (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			2.04	x 1	= 2.04		(26)
Windows Type 1			2.21	x 1/[1/( 1.4 )+ 0.04]	= 2.93		(27)
Windows Type 2			0.97	x 1/[1/( 1.4 )+ 0.04]	= 1.29		(27)
Windows Type 3			0.97	x 1/[1/( 1.4 )+ 0.04]	= 1.29		(27)
Windows Type 4			2.21	x 1/[1/( 1.4 )+ 0.04]	= 2.93		(27)
Windows Type 5			3.15	x 1/[1/( 1.4 )+ 0.04]	= 4.18		(27)
Walls Type1	53.87	13.93	39.94	x 0.18	= 7.19		(29)
Walls Type2	5.4	2.04	3.36	x 0.18	= 0.61		(29)
Total area of elements, m <sup>2</sup>			59.28				(31)
Party wall			42.78	x 0	= 0		(32)
Party floor			73.48				(32a)
Party ceiling			73.48				(32b)
Internal wall **			130.65				(32c)

\* 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) = 28.3 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 13624.03 (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 6.28 (36)

# TER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 34.58 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.19	39.95	39.71	38.6	38.39	37.42	37.42	37.24	37.79	38.39	38.81	39.25	(38)

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

(39)m=	74.78	74.53	74.3	73.18	72.97	72	72	71.82	72.37	72.97	73.39	73.83	
Average = Sum(39) <sub>1...12</sub> / 12 =												73.18	(39)

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

(40)m=	1.02	1.01	1.01	1	0.99	0.98	0.98	0.98	0.98	0.99	1	1	
Average = Sum(40) <sub>1...12</sub> / 12 =												1	(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 2.33 (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 Vd,average = (25 x N) + 36 89.48 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	98.43	94.85	91.27	87.69	84.11	80.53	80.53	84.11	87.69	91.27	94.85	98.43	
Total = Sum(44) <sub>1...12</sub> =												1073.76	(44)

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

(45)m=	145.97	127.66	131.74	114.85	110.2	95.1	88.12	101.12	102.33	119.25	130.17	141.36	
Total = Sum(45) <sub>1...12</sub> =												1407.86	(45)

*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)*

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

(46)m=	21.89	19.15	19.76	17.23	16.53	14.26	13.22	15.17	15.35	17.89	19.53	21.2	(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)



# TER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0
---

(58)

Primary circuit loss calculated for each month  $(59)m = (58) \div 365 \times (41)m$

(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  $(61)m = (60) \div 365 \times (41)m$

(61)m=	50.16	43.66	46.51	43.24	42.86	39.71	41.04	42.86	43.24	46.51	46.77	50.16	(61)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(62)m=	196.12	171.32	178.25	158.09	153.06	134.81	129.16	143.98	145.57	165.76	176.95	191.52	(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=	196.12	171.32	178.25	158.09	153.06	134.81	129.16	143.98	145.57	165.76	176.95	191.52	(64)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

1944.59
---------

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=	61.07	53.36	55.43	49	47.36	41.55	39.56	44.34	44.83	51.28	54.98	59.54	(65)
--------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	116.38	(66)

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

(67)m=	18.55	16.47	13.4	10.14	7.58	6.4	6.92	8.99	12.07	15.32	17.88	19.06	(67)
--------	-------	-------	------	-------	------	-----	------	------	-------	-------	-------	-------	------

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

(68)m=	205.28	207.41	202.04	190.61	176.19	162.63	153.57	151.44	156.81	168.24	182.66	196.22	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	34.64	(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=	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	-93.1	(71)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water heating gains (Table 5)

(72)m=	82.09	79.41	74.5	68.05	63.65	57.71	53.17	59.59	62.27	68.92	76.36	80.03	(72)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

**Total internal gains =**

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

(73)m=	366.83	364.21	350.86	329.72	308.34	287.65	274.57	280.94	292.06	313.4	337.82	356.23	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

## 6. Solar gains:

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

## TER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d	Area m <sup>2</sup>	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)							
North	0.9x	0.77	x	0.97	x	10.63	x	0.63	x	0.7	=	3.15	(74)
North	0.9x	0.77	x	0.97	x	20.32	x	0.63	x	0.7	=	6.02	(74)
North	0.9x	0.77	x	0.97	x	34.53	x	0.63	x	0.7	=	10.24	(74)
North	0.9x	0.77	x	0.97	x	55.46	x	0.63	x	0.7	=	16.44	(74)
North	0.9x	0.77	x	0.97	x	74.72	x	0.63	x	0.7	=	22.15	(74)
North	0.9x	0.77	x	0.97	x	79.99	x	0.63	x	0.7	=	23.71	(74)
North	0.9x	0.77	x	0.97	x	74.68	x	0.63	x	0.7	=	22.14	(74)
North	0.9x	0.77	x	0.97	x	59.25	x	0.63	x	0.7	=	17.56	(74)
North	0.9x	0.77	x	0.97	x	41.52	x	0.63	x	0.7	=	12.31	(74)
North	0.9x	0.77	x	0.97	x	24.19	x	0.63	x	0.7	=	7.17	(74)
North	0.9x	0.77	x	0.97	x	13.12	x	0.63	x	0.7	=	3.89	(74)
North	0.9x	0.77	x	0.97	x	8.86	x	0.63	x	0.7	=	2.63	(74)
South	0.9x	0.77	x	2.21	x	46.75	x	0.63	x	0.7	=	63.15	(78)
South	0.9x	0.77	x	0.97	x	46.75	x	0.63	x	0.7	=	13.86	(78)
South	0.9x	0.77	x	2.21	x	76.57	x	0.63	x	0.7	=	103.43	(78)
South	0.9x	0.77	x	0.97	x	76.57	x	0.63	x	0.7	=	22.7	(78)
South	0.9x	0.77	x	2.21	x	97.53	x	0.63	x	0.7	=	131.75	(78)
South	0.9x	0.77	x	0.97	x	97.53	x	0.63	x	0.7	=	28.91	(78)
South	0.9x	0.77	x	2.21	x	110.23	x	0.63	x	0.7	=	148.91	(78)
South	0.9x	0.77	x	0.97	x	110.23	x	0.63	x	0.7	=	32.68	(78)
South	0.9x	0.77	x	2.21	x	114.87	x	0.63	x	0.7	=	155.17	(78)
South	0.9x	0.77	x	0.97	x	114.87	x	0.63	x	0.7	=	34.05	(78)
South	0.9x	0.77	x	2.21	x	110.55	x	0.63	x	0.7	=	149.33	(78)
South	0.9x	0.77	x	0.97	x	110.55	x	0.63	x	0.7	=	32.77	(78)
South	0.9x	0.77	x	2.21	x	108.01	x	0.63	x	0.7	=	145.9	(78)
South	0.9x	0.77	x	0.97	x	108.01	x	0.63	x	0.7	=	32.02	(78)
South	0.9x	0.77	x	2.21	x	104.89	x	0.63	x	0.7	=	141.69	(78)
South	0.9x	0.77	x	0.97	x	104.89	x	0.63	x	0.7	=	31.1	(78)
South	0.9x	0.77	x	2.21	x	101.89	x	0.63	x	0.7	=	137.63	(78)
South	0.9x	0.77	x	0.97	x	101.89	x	0.63	x	0.7	=	30.2	(78)
South	0.9x	0.77	x	2.21	x	82.59	x	0.63	x	0.7	=	111.56	(78)
South	0.9x	0.77	x	0.97	x	82.59	x	0.63	x	0.7	=	24.48	(78)
South	0.9x	0.77	x	2.21	x	55.42	x	0.63	x	0.7	=	74.86	(78)
South	0.9x	0.77	x	0.97	x	55.42	x	0.63	x	0.7	=	16.43	(78)
South	0.9x	0.77	x	2.21	x	40.4	x	0.63	x	0.7	=	54.57	(78)
South	0.9x	0.77	x	0.97	x	40.4	x	0.63	x	0.7	=	11.98	(78)
West	0.9x	0.77	x	2.21	x	19.64	x	0.63	x	0.7	=	26.53	(80)
West	0.9x	0.77	x	3.15	x	19.64	x	0.63	x	0.7	=	18.91	(80)
West	0.9x	0.77	x	2.21	x	38.42	x	0.63	x	0.7	=	51.9	(80)

## TER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.15	x	38.42	x	0.63	x	0.7	=	36.99	(80)
West	0.9x	0.77	x	2.21	x	63.27	x	0.63	x	0.7	=	85.47	(80)
West	0.9x	0.77	x	3.15	x	63.27	x	0.63	x	0.7	=	60.91	(80)
West	0.9x	0.77	x	2.21	x	92.28	x	0.63	x	0.7	=	124.65	(80)
West	0.9x	0.77	x	3.15	x	92.28	x	0.63	x	0.7	=	88.84	(80)
West	0.9x	0.77	x	2.21	x	113.09	x	0.63	x	0.7	=	152.77	(80)
West	0.9x	0.77	x	3.15	x	113.09	x	0.63	x	0.7	=	108.87	(80)
West	0.9x	0.77	x	2.21	x	115.77	x	0.63	x	0.7	=	156.38	(80)
West	0.9x	0.77	x	3.15	x	115.77	x	0.63	x	0.7	=	111.45	(80)
West	0.9x	0.77	x	2.21	x	110.22	x	0.63	x	0.7	=	148.88	(80)
West	0.9x	0.77	x	3.15	x	110.22	x	0.63	x	0.7	=	106.11	(80)
West	0.9x	0.77	x	2.21	x	94.68	x	0.63	x	0.7	=	127.89	(80)
West	0.9x	0.77	x	3.15	x	94.68	x	0.63	x	0.7	=	91.14	(80)
West	0.9x	0.77	x	2.21	x	73.59	x	0.63	x	0.7	=	99.41	(80)
West	0.9x	0.77	x	3.15	x	73.59	x	0.63	x	0.7	=	70.84	(80)
West	0.9x	0.77	x	2.21	x	45.59	x	0.63	x	0.7	=	61.58	(80)
West	0.9x	0.77	x	3.15	x	45.59	x	0.63	x	0.7	=	43.89	(80)
West	0.9x	0.77	x	2.21	x	24.49	x	0.63	x	0.7	=	33.08	(80)
West	0.9x	0.77	x	3.15	x	24.49	x	0.63	x	0.7	=	23.58	(80)
West	0.9x	0.77	x	2.21	x	16.15	x	0.63	x	0.7	=	21.82	(80)
West	0.9x	0.77	x	3.15	x	16.15	x	0.63	x	0.7	=	15.55	(80)

Solar gains in watts, calculated for each month

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

(83)m=	125.6	221.04	317.28	411.52	473.01	473.65	455.05	409.38	350.39	248.68	151.83	106.54	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	492.43	585.24	668.14	741.24	781.35	761.3	729.62	690.32	642.45	562.08	489.65	462.77	(84)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	------

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.78	0.59	0.43	0.47	0.73	0.95	0.99	1	(86)

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

(87)m=	20.01	20.19	20.44	20.73	20.91	20.99	21	21	20.96	20.7	20.3	19.98	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	------	------	-------	------

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

(88)m=	20.07	20.07	20.07	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.08	20.08	(88)
--------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	------

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

(89)m=	1	0.99	0.96	0.89	0.73	0.51	0.34	0.38	0.65	0.92	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(90)m=	18.75	19.01	19.37	19.78	20.01	20.09	20.1	20.1	20.06	19.75	19.18	18.71	(90)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.39 (91)

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

## TER WorkSheet: New dwelling design stage

(92)m=	19.24	19.47	19.79	20.15	20.36	20.44	20.45	20.45	20.41	20.12	19.62	19.2	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(93)m=	19.24	19.47	19.79	20.15	20.36	20.44	20.45	20.45	20.41	20.12	19.62	19.2	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

### 8. Space heating requirement

Set  $T_{i,m}$  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	0.89	0.75	0.54	0.38	0.42	0.68	0.92	0.99	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	489.49	576.43	641.65	659.92	583.98	414.05	276.48	289.67	435.8	519.36	482.95	460.75	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1117	1085.86	987.3	823.09	632.02	420.46	277.16	290.85	456.84	694.9	918.6	1107.88	(97)
--------	------	---------	-------	--------	--------	--------	--------	--------	--------	-------	-------	---------	------

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

(98)m=	466.87	342.33	257.16	117.49	35.74	0	0	0	0	130.6	313.67	481.47	
--------	--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------	--

Total per year (kWh/year) = Sum(98)<sub>1...5,9...12</sub> = 2145.34 (98)

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

29.2 (99)

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

#### Space heating:

Fraction of space heat from secondary/supplementary system

0	(201)
---	-------

Fraction of space heat from main system(s)

(202) = 1 - (201) =

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

Fraction of total heating from main system 1

(204) = (202) × [1 - (203)] =

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

Efficiency of main space heating system 1

93.4	(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)

466.87	342.33	257.16	117.49	35.74	0	0	0	0	130.6	313.67	481.47
--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------

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

499.86	366.52	275.34	125.79	38.27	0	0	0	0	139.83	335.84	515.49
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)<sub>1...5,10...12</sub> = 2296.94 (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	
---------	---	---	---	---	---	---	---	---	---	---	---	---	--

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

#### Water heating

Output from water heater (calculated above)

196.12	171.32	178.25	158.09	153.06	134.81	129.16	143.98	145.57	165.76	176.95	191.52
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

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

(217)m=	87.16	86.76	85.97	84.32	82.04	80.3	80.3	80.3	80.3	84.46	86.48	87.28	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating,  $kWh/month$

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

(219)m=	225.02	197.46	207.33	187.5	186.58	167.88	160.84	179.3	181.28	196.26	204.62	219.44	
---------	--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--

Total = Sum(219a)<sub>1...12</sub> = 2313.53 (219)

# TER WorkSheet: New dwelling design stage

**Annual totals**

	kWh/year	kWh/year
Space heating fuel used, main system 1		2296.94
Water heating fuel used		2313.53
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		327.58 (232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year
Space heating (main system 1)	(211) x		0.216	=	496.14 (261)
Space heating (secondary)	(215) x		0.519	=	0 (263)
Water heating	(219) x		0.216	=	499.72 (264)
Space and water heating	(261) + (262) + (263) + (264) =				995.86 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93 (267)
Electricity for lighting	(232) x		0.519	=	170.01 (268)
Total CO2, kg/year		sum of (265)...(271) =			1204.8 (272)
<b>TER =</b>					16.4 (273)

DRAFT

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 30 June 2020

## Property Details: Plot 8 - 2B4P

<b>Dwelling type:</b>	Flat
<b>Located in:</b>	England
<b>Region:</b>	Thames valley
<b>Cross ventilation possible:</b>	Yes
<b>Number of storeys:</b>	1
<b>Front of dwelling faces:</b>	North
<b>Overshading:</b>	Average or unknown
<b>Overhangs:</b>	None
<b>Thermal mass parameter:</b>	Calculated 185.41
<b>Night ventilation:</b>	False
<b>Blinds, curtains, shutters:</b>	Dark-coloured curtain or roller blind
<b>Ventilation rate during hot weather (ach):</b>	6 ( Windows fully open)

## Overheating Details:

<b>Summer ventilation heat loss coefficient:</b>	407.37	(P1)
<b>Transmission heat loss coefficient:</b>	34.4	
<b>Summer heat loss coefficient:</b>	441.73	(P2)

## Overhangs:

Orientation:	Ratio:	Z_overhangs:
South (Bedroom)	0	1
South (Living bay)	0	1
North (Living bay N)	0	1
West (Living)	0	1
West (Bedroom 2)	0	1

## Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South (Bedroom)	0.85	0.9	1	0.76	(P8)
South (Living bay)	0.85	0.9	1	0.76	(P8)
North (Living bay N)	0.85	0.9	1	0.76	(P8)
West (Living)	0.85	0.9	1	0.76	(P8)
West (Bedroom 2)	0.85	0.9	1	0.76	(P8)

## Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains
South (Bedroom)	0.9 x	4.42	112.21	0.63	0.7	0.76	150.58
South (Living bay)	0.9 x	0.97	112.21	0.63	0.7	0.76	33.05
North (Living bay N)	0.9 x	0.97	81.19	0.63	0.7	0.76	23.91
West (Living)	0.9 x	4.42	117.51	0.63	0.7	0.76	157.7
West (Bedroom 2)	0.9 x	3.15	117.51	0.63	0.7	0.76	112.39
						<b>Total</b>	<b>477.63 (P3/P4)</b>

## Internal gains:

	June	July	August
Internal gains	405.18	388.41	396.24
Total summer gains	908.1	866.04	834.47 (P5)
Summer gain/loss ratio	2.06	1.96	1.89 (P6)
Mean summer external temperature (Thames valley)	16	17.9	17.8

# SAP 2012 Overheating Assessment

Thermal mass temperature increment	0.7	0.7	0.7
Threshold temperature	18.76	20.56	20.39 (P7)
<b>Likelihood of high internal temperature</b>	<b>Not significant</b>	<b>Slight</b>	<b>Not significant</b>
<b>Assessment of likelihood of high internal temperature:</b>	<u>Slight</u>		

DRAFT