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 09:50:58

Project Information:

Assessed By: () **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 73.48m²
Site Reference : HO LA TW11 **Plot Reference:** Plot 2 - 1B2P WC
Address : Plot 2, 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)	18.62 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.86 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	45.6 kWh/m²	
		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	0.13 (max. 0.25)	0.13 (max. 0.70)	**OK**
Roof	(no roof)		
Openings	1.18 (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	6.3m²
Windows facing: South	0.97m²
Windows facing: North	0.97m²
Windows facing: West	5.08m²
Windows facing: West	3.15m²
Ventilation rate:	3.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours

10 Key features

Doors U-value	1 W/m²K
Party Walls U-value	0 W/m²K
Photovoltaic array	

SAP Input

Property Details: Plot 2 - 1B2P WC

Address:	Plot 2, 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 250.59
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 m²	2.8 m

Living area:	36.06 m² (fraction 0.491)
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	
Terrace	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Kitchen	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	3.15	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
Terrace	16mm or more	0.7	0.63	1.2	5.08	1
Kitchen	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	1.5	2.1
Living bay		Main wall	South	0.46	2.1
Living bay N		Main wall	North	0.46	2.1
Terrace		Main wall	West	2.42	2.1
Kitchen		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:
External Elements							
Main wall	53.872	16.47	37.4	0.18	0	False	60
Corridor	5.404	2.04	3.36	0.18	0.43	False	60

SAP Input

Ground floor	73.48	0.13	110
Internal Elements			
Internal	108.248		9
Party Elements			
Party	42.784		110
Party	73.48		30

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0992

	Length	Psi-value		
[Approved]	8.81	0.3	E2	Other lintels (including other steel lintels)
[Approved]	7.84	0.04	E3	Sill
[Approved]	29.4	0.05	E4	Jamb
[Approved]	21.17	0.16	E5	Ground floor (normal)
[Approved]	21.17	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
	15.28	0.16	P1	Ground floor
	15.28	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:	Photovoltaic 1 Installed Peak power: 0.714 Tilt of collector: 30° Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

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 2 - 1B2P WC

Address : Plot 2, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
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		m³ 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)

			Air changes per hour	
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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.57	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			3.15	x	1/[1/(1.2)+ 0.04]	=	3.61			(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			5.08	x	1/[1/(1.2)+ 0.04]	=	5.82			(27)
Windows Type 5			3.15	x	1/[1/(1.2)+ 0.04]	=	3.61			(27)
Floor			73.48	x	0.13	=	9.5524	110	8082.8	(28)
Walls Type1	53.87	16.47	37.4	x	0.18	=	6.73	60	2244.12	(29)
Walls Type2	5.4	2.04	3.36	x	0.17	=	0.56	60	201.84	(29)
Total area of elements, m²			132.76							(31)
Party wall			42.78	x	0	=	0	110	4706.24	(32)
Party ceiling			73.48					30	2204.4	(32b)
Internal wall **			108.25					9	974.232	(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) = 37.75 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 18413.63 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 250.59 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 13.17 (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) = 50.91 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	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=	89.67	89.48	89.3	88.44	88.28	87.53	87.53	87.39	87.82	88.28	88.6	88.94	

Average = Sum(39)$_{1...12}$ /12= 88.44 (39)

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

(40)m=	1.22	1.22	1.22	1.2	1.2	1.19	1.19	1.19	1.2	1.2	1.21	1.21	

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.48 (43)

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

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

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

Total = Sum(44)$_{1...12}$ = 1073.76 (44)

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

(45)m=	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)$_{1...12}$ = 1407.86 (45)

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)

SAP WorkSheet: New dwelling design stage

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

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

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

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

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

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

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

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

(61)m=	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 × (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	

Output from water heater (annual)$_{1,12}$ 1572.89 (64)

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

(65)m=	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=	45.75	40.63	33.04	25.02	18.7	15.79	17.06	22.17	29.76	37.79	44.11	47.02	(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=	522.95	518.94	499.04	468.1	436.46	407.97	391.18	398.93	416.6	447.74	482.42	508.64	(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 m²		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	3.15	x	46.75	x	0.63	x	0.7	=	90.01	(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	3.15	x	76.57	x	0.63	x	0.7	=	147.42	(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	3.15	x	97.53	x	0.63	x	0.7	=	187.79	(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	3.15	x	110.23	x	0.63	x	0.7	=	212.24	(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	3.15	x	114.87	x	0.63	x	0.7	=	221.17	(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	3.15	x	110.55	x	0.63	x	0.7	=	212.84	(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	3.15	x	108.01	x	0.63	x	0.7	=	207.96	(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	3.15	x	104.89	x	0.63	x	0.7	=	201.96	(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	3.15	x	101.89	x	0.63	x	0.7	=	196.17	(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	3.15	x	82.59	x	0.63	x	0.7	=	159.01	(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	3.15	x	55.42	x	0.63	x	0.7	=	106.7	(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	3.15	x	40.4	x	0.63	x	0.7	=	77.78	(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	5.08	x	19.64	x	0.63	x	0.7	=	30.49	(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	5.08	x	38.42	x	0.63	x	0.7	=	59.65	(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	5.08	x	63.27	x	0.63	x	0.7	=	98.23	(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	5.08	x	92.28	x	0.63	x	0.7	=	143.27	(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	5.08	x	113.09	x	0.63	x	0.7	=	175.58	(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	5.08	x	115.77	x	0.63	x	0.7	=	179.74	(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	5.08	x	110.22	x	0.63	x	0.7	=	171.12	(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	5.08	x	94.68	x	0.63	x	0.7	=	146.99	(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	5.08	x	73.59	x	0.63	x	0.7	=	114.25	(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	5.08	x	45.59	x	0.63	x	0.7	=	70.78	(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	5.08	x	24.49	x	0.63	x	0.7	=	38.02	(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	5.08	x	16.15	x	0.63	x	0.7	=	25.07	(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=	156.43	272.78	386.08	493.46	561.82	560.51	539.34	488.75	423.77	305.33	188.61	133.01	(83)

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

(84)m=	679.38	791.72	885.12	961.57	998.28	968.48	930.52	887.68	840.37	753.07	671.03	641.65	(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	0.97	0.94	0.87	0.74	0.56	0.41	0.45	0.67	0.9	0.98	0.99	(86)

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

(87)m=	19.96	20.16	20.42	20.71	20.9	20.98	21	20.99	20.95	20.7	20.27	19.92	(87)

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

(88)m=	19.9	19.91	19.91	19.92	19.92	19.93	19.93	19.93	19.92	19.92	19.92	19.91	(88)

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

(89)m=	0.98	0.97	0.93	0.83	0.68	0.47	0.31	0.35	0.59	0.86	0.97	0.99	(89)

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

(90)m=	18.56	18.84	19.21	19.6	19.83	19.91	19.93	19.93	19.89	19.6	19.01	18.5	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

SAP WorkSheet: New dwelling design stage

(92)m=	19.24	19.49	19.8	20.14	20.35	20.44	20.45	20.45	20.41	20.14	19.63	19.19	(92)

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

(93)m=	19.09	19.34	19.65	19.99	20.2	20.29	20.3	20.3	20.26	19.99	19.48	19.04	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.92	0.84	0.69	0.5	0.35	0.38	0.61	0.87	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	665.77	760.84	816.02	805.22	693.22	488.27	322.75	338.93	516.68	652.59	645.56	631.42	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1326.57	1291.72	1174.68	980.98	750.49	497.75	323.96	340.87	540.91	828.78	1097.03	1320.37	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	491.64	356.75	266.84	126.55	42.61	0	0	0	0	131.08	325.06	512.58	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2253.11 (98)

Space heating requirement in kWh/m²/year 30.66 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 90.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	491.64	356.75	266.84	126.55	42.61	0	0	0	0	131.08	325.06	512.58	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	543.24	394.2	294.85	139.83	47.09	0	0	0	0	144.84	359.18	566.38	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2489.62 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

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=	89.69	89.57	89.34	88.86	88.1	87.3	87.3	87.3	87.3	88.86	89.49	89.73	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	178.46	156.72	163.17	144.5	140.96	124.39	116.89	131.82	132.71	149.98	160.66	173.23	

Total = Sum(219a)$_{1...12}$ = 1773.5 (219)

SAP WorkSheet: New dwelling design stage

Annual totals	kWh/year		kWh/year	
Space heating fuel used, main system 1			2489.62	
Water heating fuel used			1773.5	
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			323.17	(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	x 0.01 =	86.64	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		3.48	x 0.01 =	61.72	(247)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	9.89	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)		13.19	x 0.01 =	42.63	(250)
Additional standing charges (Table 12)					120	(251)
	one of (233) to (235) x)		13.19	x 0.01 =	0	(252)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =				320.88	(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] =	1.14	(257)
SAP rating (Section 12)	84.13	(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	=	537.76	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	383.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =				920.84	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	167.72	(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) =			807.46 (272)
CO2 emissions per m²	(272) ÷ (4) =			10.99 (273)
EI rating (section 14)				91 (274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year
Space heating (main system 1)	(211) x		1.22	=	3037.34 (261)
Space heating (secondary)	(215) x		3.07	=	0 (263)
Energy for water heating	(219) x		1.22	=	2163.67 (264)
Space and water heating	(261) + (262) + (263) + (264) =				5201.02 (265)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	230.25 (267)
Electricity for lighting	(232) x		0	=	992.13 (268)
Energy saving/generation technologies Item 1			3.07	=	-1893.04 (269)
'Total Primary Energy	sum of (265)…(271) =				4530.36 (272)
Primary energy kWh/m²/year	(272) ÷ (4) =				61.65 (273)

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 2 - 1B2P WC

Address : Plot 2, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
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		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15 (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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.59	0.59	0.58	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 (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			3.12	x	1/[1/(1.4)+ 0.04]	=	4.14			(27)
Windows Type 2			0.96	x	1/[1/(1.4)+ 0.04]	=	1.27			(27)
Windows Type 3			0.96	x	1/[1/(1.4)+ 0.04]	=	1.27			(27)
Windows Type 4			5.04	x	1/[1/(1.4)+ 0.04]	=	6.68			(27)
Windows Type 5			3.12	x	1/[1/(1.4)+ 0.04]	=	4.14			(27)
Floor			73.48	x	0.13	=	9.5524			(28)
Walls Type1	53.87	16.32	37.55	x	0.18	=	6.76			(29)
Walls Type2	5.4	2.04	3.36	x	0.18	=	0.61			(29)
Total area of elements, m²			132.76							(31)
Party wall			42.78	x	0	=	0			(32)
Party ceiling			73.48							(32b)
Internal wall **			108.25							(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) = 40.59 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 18422.63 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.32 (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) = 49.91 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	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=	90.11	89.86	89.63	88.51	88.3	87.33	87.33	87.15	87.7	88.3	88.72	89.16	

Average = Sum(39)$_{1...12}$ /12= 88.51 (39)

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

(40)m=	1.23	1.22	1.22	1.2	1.2	1.19	1.19	1.19	1.19	1.2	1.21	1.21	

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.48 (43)

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

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

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

Total = Sum(44)$_{1...12}$ = 1073.76 (44)

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

(45)m=	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)$_{1...12}$ = 1407.86 (45)

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

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

Water storage loss:

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

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

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

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

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

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

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

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

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

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

(62)m=	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	

Output from water heater (annual)$_{1,12}$ 1196.68 (64)

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

(65)m=	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=	18.3	16.26	13.22	10.01	7.48	6.32	6.82	8.87	11.91	15.12	17.65	18.81	(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=	323.19	321.95	310.8	292.43	273.06	254.93	243.48	247.11	256.83	275.33	296.64	313.32	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	0.96	x	10.63	x	0.63	x	0.7	=	3.12	(74)
North	0.9x 0.77	x	0.96	x	20.32	x	0.63	x	0.7	=	5.96	(74)
North	0.9x 0.77	x	0.96	x	34.53	x	0.63	x	0.7	=	10.13	(74)
North	0.9x 0.77	x	0.96	x	55.46	x	0.63	x	0.7	=	16.27	(74)
North	0.9x 0.77	x	0.96	x	74.72	x	0.63	x	0.7	=	21.92	(74)
North	0.9x 0.77	x	0.96	x	79.99	x	0.63	x	0.7	=	23.47	(74)
North	0.9x 0.77	x	0.96	x	74.68	x	0.63	x	0.7	=	21.91	(74)
North	0.9x 0.77	x	0.96	x	59.25	x	0.63	x	0.7	=	17.38	(74)
North	0.9x 0.77	x	0.96	x	41.52	x	0.63	x	0.7	=	12.18	(74)
North	0.9x 0.77	x	0.96	x	24.19	x	0.63	x	0.7	=	7.1	(74)
North	0.9x 0.77	x	0.96	x	13.12	x	0.63	x	0.7	=	3.85	(74)
North	0.9x 0.77	x	0.96	x	8.86	x	0.63	x	0.7	=	2.6	(74)
South	0.9x 0.77	x	3.12	x	46.75	x	0.63	x	0.7	=	89.16	(78)
South	0.9x 0.77	x	0.96	x	46.75	x	0.63	x	0.7	=	13.72	(78)
South	0.9x 0.77	x	3.12	x	76.57	x	0.63	x	0.7	=	146.02	(78)
South	0.9x 0.77	x	0.96	x	76.57	x	0.63	x	0.7	=	22.46	(78)
South	0.9x 0.77	x	3.12	x	97.53	x	0.63	x	0.7	=	186	(78)
South	0.9x 0.77	x	0.96	x	97.53	x	0.63	x	0.7	=	28.62	(78)
South	0.9x 0.77	x	3.12	x	110.23	x	0.63	x	0.7	=	210.22	(78)
South	0.9x 0.77	x	0.96	x	110.23	x	0.63	x	0.7	=	32.34	(78)
South	0.9x 0.77	x	3.12	x	114.87	x	0.63	x	0.7	=	219.06	(78)
South	0.9x 0.77	x	0.96	x	114.87	x	0.63	x	0.7	=	33.7	(78)
South	0.9x 0.77	x	3.12	x	110.55	x	0.63	x	0.7	=	210.82	(78)
South	0.9x 0.77	x	0.96	x	110.55	x	0.63	x	0.7	=	32.43	(78)
South	0.9x 0.77	x	3.12	x	108.01	x	0.63	x	0.7	=	205.98	(78)
South	0.9x 0.77	x	0.96	x	108.01	x	0.63	x	0.7	=	31.69	(78)
South	0.9x 0.77	x	3.12	x	104.89	x	0.63	x	0.7	=	200.04	(78)
South	0.9x 0.77	x	0.96	x	104.89	x	0.63	x	0.7	=	30.77	(78)
South	0.9x 0.77	x	3.12	x	101.89	x	0.63	x	0.7	=	194.3	(78)
South	0.9x 0.77	x	0.96	x	101.89	x	0.63	x	0.7	=	29.89	(78)
South	0.9x 0.77	x	3.12	x	82.59	x	0.63	x	0.7	=	157.49	(78)
South	0.9x 0.77	x	0.96	x	82.59	x	0.63	x	0.7	=	24.23	(78)
South	0.9x 0.77	x	3.12	x	55.42	x	0.63	x	0.7	=	105.68	(78)
South	0.9x 0.77	x	0.96	x	55.42	x	0.63	x	0.7	=	16.26	(78)
South	0.9x 0.77	x	3.12	x	40.4	x	0.63	x	0.7	=	77.04	(78)
South	0.9x 0.77	x	0.96	x	40.4	x	0.63	x	0.7	=	11.85	(78)
West	0.9x 0.77	x	5.04	x	19.64	x	0.63	x	0.7	=	30.25	(80)
West	0.9x 0.77	x	3.12	x	19.64	x	0.63	x	0.7	=	18.73	(80)
West	0.9x 0.77	x	5.04	x	38.42	x	0.63	x	0.7	=	59.18	(80)

TFEE WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.12	x	38.42	x	0.63	x	0.7	=	36.63	(80)
West	0.9x	0.77	x	5.04	x	63.27	x	0.63	x	0.7	=	97.46	(80)
West	0.9x	0.77	x	3.12	x	63.27	x	0.63	x	0.7	=	60.33	(80)
West	0.9x	0.77	x	5.04	x	92.28	x	0.63	x	0.7	=	142.14	(80)
West	0.9x	0.77	x	3.12	x	92.28	x	0.63	x	0.7	=	87.99	(80)
West	0.9x	0.77	x	5.04	x	113.09	x	0.63	x	0.7	=	174.2	(80)
West	0.9x	0.77	x	3.12	x	113.09	x	0.63	x	0.7	=	107.84	(80)
West	0.9x	0.77	x	5.04	x	115.77	x	0.63	x	0.7	=	178.32	(80)
West	0.9x	0.77	x	3.12	x	115.77	x	0.63	x	0.7	=	110.39	(80)
West	0.9x	0.77	x	5.04	x	110.22	x	0.63	x	0.7	=	169.77	(80)
West	0.9x	0.77	x	3.12	x	110.22	x	0.63	x	0.7	=	105.09	(80)
West	0.9x	0.77	x	5.04	x	94.68	x	0.63	x	0.7	=	145.83	(80)
West	0.9x	0.77	x	3.12	x	94.68	x	0.63	x	0.7	=	90.27	(80)
West	0.9x	0.77	x	5.04	x	73.59	x	0.63	x	0.7	=	113.35	(80)
West	0.9x	0.77	x	3.12	x	73.59	x	0.63	x	0.7	=	70.17	(80)
West	0.9x	0.77	x	5.04	x	45.59	x	0.63	x	0.7	=	70.22	(80)
West	0.9x	0.77	x	3.12	x	45.59	x	0.63	x	0.7	=	43.47	(80)
West	0.9x	0.77	x	5.04	x	24.49	x	0.63	x	0.7	=	37.72	(80)
West	0.9x	0.77	x	3.12	x	24.49	x	0.63	x	0.7	=	23.35	(80)
West	0.9x	0.77	x	5.04	x	16.15	x	0.63	x	0.7	=	24.88	(80)
West	0.9x	0.77	x	3.12	x	16.15	x	0.63	x	0.7	=	15.4	(80)

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

(83)m=	154.97	270.26	382.54	488.96	556.72	555.43	534.44	484.3	419.89	302.51	186.86	131.77	(83)

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

(84)m=	478.16	592.2	693.34	781.39	829.77	810.35	777.92	731.41	676.72	577.84	483.5	445.09	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.65	0.49	0.53	0.78	0.96	0.99	1	(86)

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

(87)m=	19.7	19.92	20.21	20.56	20.83	20.96	20.99	20.99	20.9	20.54	20.05	19.67	(87)

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

(88)m=	19.9	19.9	19.9	19.92	19.92	19.93	19.93	19.93	19.93	19.92	19.91	19.91	(88)

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

(89)m=	1	0.99	0.97	0.91	0.77	0.56	0.37	0.42	0.7	0.94	0.99	1	(89)

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

(90)m=	18.73	18.94	19.24	19.58	19.81	19.91	19.93	19.93	19.88	19.56	19.08	18.7	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

TFEE WorkSheet: New dwelling design stage

(92)m=	19.21	19.42	19.72	20.06	20.31	20.43	20.45	20.45	20.38	20.04	19.56	19.18	(92)

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

(93)m=	19.21	19.42	19.72	20.06	20.31	20.43	20.45	20.45	20.38	20.04	19.56	19.18	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.91	0.79	0.6	0.43	0.48	0.73	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	475.93	584.75	670.26	711.09	656.22	488.06	333.03	347.58	497.27	543.93	478.46	443.59	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1343.2	1304.72	1184.47	987.98	760.08	508.78	336.2	352.77	550.71	833.72	1105.12	1335.28	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	645.24	483.82	382.58	199.36	77.27	0	0	0	0	215.6	451.19	663.41	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3118.48 (98)

Space heating requirement in kWh/m²/year 42.44 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	820.88	646.22	662.32	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.91	0.95	0.94	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	747.29	616.4	622.23	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1033.63	993.96	941	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	206.17	280.91	237.17	0	0	0	0	

Total = Sum(104) = 724.24 (104)

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

Intermittency factor (Table 10b)

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

Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	51.54	70.23	59.29	0	0	0	0	

Total = Sum(107) = 181.06 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 2.46 (108)

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

Fabric Energy Efficiency (99) + (108) = 44.9 (109)

Target Fabric Energy Efficiency (TFEE) 51.64 (109)

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 2 - 1B2P WC

Address : Plot 2, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
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		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.59	0.59	0.58	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 (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			3.15	x	1/[1/(1.2)+ 0.04]	=	3.61			(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			5.08	x	1/[1/(1.2)+ 0.04]	=	5.82			(27)
Windows Type 5			3.15	x	1/[1/(1.2)+ 0.04]	=	3.61			(27)
Floor			73.48	x	0.13	=	9.5524	110	8082.8	(28)
Walls Type1	53.87	16.47	37.4	x	0.18	=	6.73	60	2244.12	(29)
Walls Type2	5.4	2.04	3.36	x	0.17	=	0.56	60	201.84	(29)
Total area of elements, m²			132.76							(31)
Party wall			42.78	x	0	=	0	110	4706.24	(32)
Party ceiling			73.48					30	2204.4	(32b)
Internal wall **			108.25					9	974.232	(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) = 37.75 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 18413.63 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 250.59 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 13.17 (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) = 50.91 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	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=	91.11	90.87	90.63	89.51	89.3	88.33	88.33	88.15	88.7	89.3	89.73	90.17	

Average = Sum(39)$_{1...12}$ /12= 89.51 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 1.22 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.48 (43)

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

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

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

Total = Sum(44)$_{1...12}$ = 1073.76 (44)

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

(45)m=	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)$_{1...12}$ = 1407.86 (45)

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

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

Water storage loss:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

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

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

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

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

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

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

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

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

(62)m=	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	

Output from water heater (annual)$_{1,12}$ 1196.68 (64)

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

(65)m=	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=	18.3	16.25	13.22	10.01	7.48	6.32	6.82	8.87	11.9	15.12	17.64	18.81	(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=	323.18	321.95	310.8	292.43	273.06	254.93	243.48	247.11	256.83	275.33	296.64	313.32	(73)

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 m²		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	3.15	x	46.75	x	0.63	x	0.7	=	90.01	(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	3.15	x	76.57	x	0.63	x	0.7	=	147.42	(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	3.15	x	97.53	x	0.63	x	0.7	=	187.79	(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	3.15	x	110.23	x	0.63	x	0.7	=	212.24	(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	3.15	x	114.87	x	0.63	x	0.7	=	221.17	(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	3.15	x	110.55	x	0.63	x	0.7	=	212.84	(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	3.15	x	108.01	x	0.63	x	0.7	=	207.96	(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	3.15	x	104.89	x	0.63	x	0.7	=	201.96	(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	3.15	x	101.89	x	0.63	x	0.7	=	196.17	(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	3.15	x	82.59	x	0.63	x	0.7	=	159.01	(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	3.15	x	55.42	x	0.63	x	0.7	=	106.7	(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	3.15	x	40.4	x	0.63	x	0.7	=	77.78	(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	5.08	x	19.64	x	0.63	x	0.7	=	30.49	(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	5.08	x	38.42	x	0.63	x	0.7	=	59.65	(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	5.08	x	63.27	x	0.63	x	0.7	=	98.23	(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	5.08	x	92.28	x	0.63	x	0.7	=	143.27	(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	5.08	x	113.09	x	0.63	x	0.7	=	175.58	(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	5.08	x	115.77	x	0.63	x	0.7	=	179.74	(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	5.08	x	110.22	x	0.63	x	0.7	=	171.12	(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	5.08	x	94.68	x	0.63	x	0.7	=	146.99	(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	5.08	x	73.59	x	0.63	x	0.7	=	114.25	(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	5.08	x	45.59	x	0.63	x	0.7	=	70.78	(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	5.08	x	24.49	x	0.63	x	0.7	=	38.02	(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	5.08	x	16.15	x	0.63	x	0.7	=	25.07	(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=	156.43	272.78	386.08	493.46	561.82	560.51	539.34	488.75	423.77	305.33	188.61	133.01	(83)

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

(84)m=	479.61	594.72	696.88	785.9	834.88	815.44	782.82	735.85	680.6	580.65	485.25	446.33	(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	0.83	0.65	0.49	0.54	0.78	0.96	0.99	1	(86)

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

(87)m=	19.69	19.9	20.2	20.56	20.82	20.96	20.99	20.99	20.9	20.53	20.04	19.65	(87)

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

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

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

(89)m=	1	0.99	0.97	0.91	0.77	0.56	0.37	0.42	0.7	0.94	0.99	1	(89)

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

(90)m=	18.71	18.92	19.22	19.56	19.79	19.9	19.92	19.92	19.86	19.55	19.06	18.68	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

DFEE WorkSheet: New dwelling design stage

(92)m=	19.19	19.4	19.7	20.05	20.3	20.42	20.44	20.44	20.37	20.03	19.54	19.16	(92)

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

(93)m=	19.19	19.4	19.7	20.05	20.3	20.42	20.44	20.44	20.37	20.03	19.54	19.16	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.91	0.79	0.6	0.43	0.48	0.74	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	477.36	587.21	673.67	715.37	661.03	492.42	336.2	350.84	501.06	546.69	480.18	444.81	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1356.49	1317.73	1196.36	998.07	767.89	514.03	339.54	356.3	556.31	842.1	1116.19	1348.63	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	654.07	490.91	388.89	203.54	79.51	0	0	0	0	219.79	457.93	672.44	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3167.07 (98)

Space heating requirement in kWh/m²/year 43.1 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	830.3	653.64	669.94	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.91	0.95	0.94	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	753.74	622.36	627.98	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1039.58	999.68	946.2	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	205.8	280.73	236.75	0	0	0	0	

Total = Sum(104) = 723.29 (104)

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

Intermittency factor (Table 10b)													
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	

Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	51.45	70.18	59.19	0	0	0	0	

Total = Sum(107) = 180.82 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 2.46 (108)

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

Fabric Energy Efficiency (99) + (108) = 45.56 (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 2 - 1B2P WC

Address : Plot 2, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
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		m³ 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)

		Air changes per hour	
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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.57	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			3.15	x	1/[1/(1.2)+ 0.04]	=	3.61			(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			5.08	x	1/[1/(1.2)+ 0.04]	=	5.82			(27)
Windows Type 5			3.15	x	1/[1/(1.2)+ 0.04]	=	3.61			(27)
Floor			73.48	x	0.13	=	9.5524	110	8082.8	(28)
Walls Type1	53.87	16.47	37.4	x	0.18	=	6.73	60	2244.12	(29)
Walls Type2	5.4	2.04	3.36	x	0.17	=	0.56	60	201.84	(29)
Total area of elements, m²			132.76							(31)
Party wall			42.78	x	0	=	0	110	4706.24	(32)
Party ceiling			73.48					30	2204.4	(32b)
Internal wall **			108.25					9	974.232	(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) = 37.75 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 18413.63 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 250.59 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 13.17 (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) = 50.91 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	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=	89.67	89.48	89.3	88.44	88.28	87.53	87.53	87.39	87.82	88.28	88.6	88.94	

Average = Sum(39)$_{1...12}$ /12= 88.44 (39)

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

(40)m=	1.22	1.22	1.22	1.2	1.2	1.19	1.19	1.19	1.2	1.2	1.21	1.21	

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.48 (43)

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

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

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

Total = Sum(44)$_{1...12}$ = 1073.76 (44)

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

(45)m=	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)$_{1...12}$ = 1407.86 (45)

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) × (41)m

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

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

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

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

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

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

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

(61)m=	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 × (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	

Output from water heater (annual)$_{1,12}$ 1572.89 (64)

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

(65)m=	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=	18.3	16.25	13.22	10.01	7.48	6.32	6.82	8.87	11.9	15.12	17.64	18.81	(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=	354.46	352.47	339.77	319.28	298.53	278.46	265.37	271.11	281.58	302.27	326.06	343.85	(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 m²		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	3.15	x	46.75	x	0.63	x	0.7	=	90.01	(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	3.15	x	76.57	x	0.63	x	0.7	=	147.42	(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	3.15	x	97.53	x	0.63	x	0.7	=	187.79	(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	3.15	x	110.23	x	0.63	x	0.7	=	212.24	(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	3.15	x	114.87	x	0.63	x	0.7	=	221.17	(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	3.15	x	110.55	x	0.63	x	0.7	=	212.84	(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	3.15	x	108.01	x	0.63	x	0.7	=	207.96	(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	3.15	x	104.89	x	0.63	x	0.7	=	201.96	(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	3.15	x	101.89	x	0.63	x	0.7	=	196.17	(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	3.15	x	82.59	x	0.63	x	0.7	=	159.01	(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	3.15	x	55.42	x	0.63	x	0.7	=	106.7	(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	3.15	x	40.4	x	0.63	x	0.7	=	77.78	(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	5.08	x	19.64	x	0.63	x	0.7	=	30.49	(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	5.08	x	38.42	x	0.63	x	0.7	=	59.65	(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	5.08	x	63.27	x	0.63	x	0.7	=	98.23	(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	5.08	x	92.28	x	0.63	x	0.7	=	143.27	(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	5.08	x	113.09	x	0.63	x	0.7	=	175.58	(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	5.08	x	115.77	x	0.63	x	0.7	=	179.74	(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	5.08	x	110.22	x	0.63	x	0.7	=	171.12	(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	5.08	x	94.68	x	0.63	x	0.7	=	146.99	(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	5.08	x	73.59	x	0.63	x	0.7	=	114.25	(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	5.08	x	45.59	x	0.63	x	0.7	=	70.78	(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	5.08	x	24.49	x	0.63	x	0.7	=	38.02	(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	5.08	x	16.15	x	0.63	x	0.7	=	25.07	(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=	156.43	272.78	386.08	493.46	561.82	560.51	539.34	488.75	423.77	305.33	188.61	133.01	(83)

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

(84)m=	510.89	625.25	725.85	812.74	860.35	838.97	804.71	759.86	705.35	607.6	514.67	476.86	(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	0.92	0.81	0.63	0.47	0.52	0.76	0.95	0.99	1	(86)

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

(87)m=	19.75	19.96	20.26	20.59	20.84	20.96	20.99	20.99	20.91	20.57	20.09	19.71	(87)

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

(88)m=	19.9	19.91	19.91	19.92	19.92	19.93	19.93	19.93	19.92	19.92	19.92	19.91	(88)

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

(89)m=	0.99	0.99	0.96	0.89	0.75	0.54	0.36	0.4	0.68	0.93	0.99	1	(89)

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

(90)m=	18.26	18.57	18.99	19.46	19.77	19.9	19.92	19.92	19.86	19.44	18.76	18.21	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

DER WorkSheet: New dwelling design stage

(92)m=	18.99	19.25	19.61	20.02	20.3	20.42	20.45	20.45	20.38	19.99	19.41	18.95	(92)

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

(93)m=	18.84	19.1	19.46	19.87	20.15	20.27	20.3	20.3	20.23	19.84	19.26	18.8	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.89	0.77	0.57	0.4	0.44	0.7	0.93	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	507.42	614.61	695.24	726.17	658.42	480.39	321.52	336.85	495.34	562.64	507.09	474.47	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1304.11	1270.83	1157.35	969.86	745.79	496.7	323.77	340.56	538.04	816.05	1077.43	1298.3	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	592.74	440.98	343.8	175.46	65	0	0	0	0	188.54	410.64	612.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2830.1 (98)

Space heating requirement in kWh/m²/year 38.52 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 90.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	592.74	440.98	343.8	175.46	65	0	0	0	0	188.54	410.64	612.93	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	654.96	487.27	379.89	193.88	71.83	0	0	0	0	208.33	453.75	677.27	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3127.18 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

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=	89.8	89.71	89.52	89.12	88.37	87.3	87.3	87.3	87.3	89.15	89.65	89.83	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	178.25	156.49	162.84	144.08	140.52	124.39	116.89	131.82	132.71	149.5	160.39	173.04	

Total = Sum(219a)$_{1...12}$ = 1770.91 (219)

DER WorkSheet: New dwelling design stage

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3127.18	
Water heating fuel used		1770.91	
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		323.17	(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	=	675.47	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	382.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1057.99	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	167.72	(268)
Energy saving/generation technologies Item 1			0.519	=	-320.03	(269)
Total CO2, kg/year	sum of (265)…(271) =				944.61	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =				12.86	(273)
EI rating (section 14)					89	(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 2 - 1B2P WC

Address : Plot 2, 38-42 Hampton Road, Teddington, London, TW11 0JE

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
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		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15 (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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.59	0.59	0.58	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 (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			3.12	x	1/[1/(1.4)+ 0.04]	=	4.14			(27)
Windows Type 2			0.96	x	1/[1/(1.4)+ 0.04]	=	1.27			(27)
Windows Type 3			0.96	x	1/[1/(1.4)+ 0.04]	=	1.27			(27)
Windows Type 4			5.04	x	1/[1/(1.4)+ 0.04]	=	6.68			(27)
Windows Type 5			3.12	x	1/[1/(1.4)+ 0.04]	=	4.14			(27)
Floor			73.48	x	0.13	=	9.5524			(28)
Walls Type1	53.87	16.32	37.55	x	0.18	=	6.76			(29)
Walls Type2	5.4	2.04	3.36	x	0.18	=	0.61			(29)
Total area of elements, m²			132.76							(31)
Party wall			42.78	x	0	=	0			(32)
Party ceiling			73.48							(32b)
Internal wall **			108.25							(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) = 40.59 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 18422.63 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.32 (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) = 49.91 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	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=	90.11	89.86	89.63	88.51	88.3	87.33	87.33	87.15	87.7	88.3	88.72	89.16	

Average = Sum(39)$_{1...12}$ /12= 88.51 (39)

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

(40)m=	1.23	1.22	1.22	1.2	1.2	1.19	1.19	1.19	1.19	1.2	1.21	1.21	

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.48 (43)

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

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

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

Total = Sum(44)$_{1...12}$ = 1073.76 (44)

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

(45)m=	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)$_{1...12}$ = 1407.86 (45)

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) × (41)m

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

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

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

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

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

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

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

(61)m=	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 × (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	

Output from water heater (annual)$_{1,12}$ 1944.59 (64)

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

(65)m=	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=	18.3	16.26	13.22	10.01	7.48	6.32	6.82	8.87	11.91	15.12	17.65	18.81	(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=	366.58	363.99	350.68	329.59	308.24	287.57	274.48	280.82	291.9	313.19	337.58	355.98	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	0.96	x	10.63	x	0.63	x	0.7	=	3.12	(74)
North	0.9x 0.77	x	0.96	x	20.32	x	0.63	x	0.7	=	5.96	(74)
North	0.9x 0.77	x	0.96	x	34.53	x	0.63	x	0.7	=	10.13	(74)
North	0.9x 0.77	x	0.96	x	55.46	x	0.63	x	0.7	=	16.27	(74)
North	0.9x 0.77	x	0.96	x	74.72	x	0.63	x	0.7	=	21.92	(74)
North	0.9x 0.77	x	0.96	x	79.99	x	0.63	x	0.7	=	23.47	(74)
North	0.9x 0.77	x	0.96	x	74.68	x	0.63	x	0.7	=	21.91	(74)
North	0.9x 0.77	x	0.96	x	59.25	x	0.63	x	0.7	=	17.38	(74)
North	0.9x 0.77	x	0.96	x	41.52	x	0.63	x	0.7	=	12.18	(74)
North	0.9x 0.77	x	0.96	x	24.19	x	0.63	x	0.7	=	7.1	(74)
North	0.9x 0.77	x	0.96	x	13.12	x	0.63	x	0.7	=	3.85	(74)
North	0.9x 0.77	x	0.96	x	8.86	x	0.63	x	0.7	=	2.6	(74)
South	0.9x 0.77	x	3.12	x	46.75	x	0.63	x	0.7	=	89.16	(78)
South	0.9x 0.77	x	0.96	x	46.75	x	0.63	x	0.7	=	13.72	(78)
South	0.9x 0.77	x	3.12	x	76.57	x	0.63	x	0.7	=	146.02	(78)
South	0.9x 0.77	x	0.96	x	76.57	x	0.63	x	0.7	=	22.46	(78)
South	0.9x 0.77	x	3.12	x	97.53	x	0.63	x	0.7	=	186	(78)
South	0.9x 0.77	x	0.96	x	97.53	x	0.63	x	0.7	=	28.62	(78)
South	0.9x 0.77	x	3.12	x	110.23	x	0.63	x	0.7	=	210.22	(78)
South	0.9x 0.77	x	0.96	x	110.23	x	0.63	x	0.7	=	32.34	(78)
South	0.9x 0.77	x	3.12	x	114.87	x	0.63	x	0.7	=	219.06	(78)
South	0.9x 0.77	x	0.96	x	114.87	x	0.63	x	0.7	=	33.7	(78)
South	0.9x 0.77	x	3.12	x	110.55	x	0.63	x	0.7	=	210.82	(78)
South	0.9x 0.77	x	0.96	x	110.55	x	0.63	x	0.7	=	32.43	(78)
South	0.9x 0.77	x	3.12	x	108.01	x	0.63	x	0.7	=	205.98	(78)
South	0.9x 0.77	x	0.96	x	108.01	x	0.63	x	0.7	=	31.69	(78)
South	0.9x 0.77	x	3.12	x	104.89	x	0.63	x	0.7	=	200.04	(78)
South	0.9x 0.77	x	0.96	x	104.89	x	0.63	x	0.7	=	30.77	(78)
South	0.9x 0.77	x	3.12	x	101.89	x	0.63	x	0.7	=	194.3	(78)
South	0.9x 0.77	x	0.96	x	101.89	x	0.63	x	0.7	=	29.89	(78)
South	0.9x 0.77	x	3.12	x	82.59	x	0.63	x	0.7	=	157.49	(78)
South	0.9x 0.77	x	0.96	x	82.59	x	0.63	x	0.7	=	24.23	(78)
South	0.9x 0.77	x	3.12	x	55.42	x	0.63	x	0.7	=	105.68	(78)
South	0.9x 0.77	x	0.96	x	55.42	x	0.63	x	0.7	=	16.26	(78)
South	0.9x 0.77	x	3.12	x	40.4	x	0.63	x	0.7	=	77.04	(78)
South	0.9x 0.77	x	0.96	x	40.4	x	0.63	x	0.7	=	11.85	(78)
West	0.9x 0.77	x	5.04	x	19.64	x	0.63	x	0.7	=	30.25	(80)
West	0.9x 0.77	x	3.12	x	19.64	x	0.63	x	0.7	=	18.73	(80)
West	0.9x 0.77	x	5.04	x	38.42	x	0.63	x	0.7	=	59.18	(80)

TER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	3.12	x	38.42	x	0.63	x	0.7	=	36.63	(80)
West	0.9x	0.77	x	5.04	x	63.27	x	0.63	x	0.7	=	97.46	(80)
West	0.9x	0.77	x	3.12	x	63.27	x	0.63	x	0.7	=	60.33	(80)
West	0.9x	0.77	x	5.04	x	92.28	x	0.63	x	0.7	=	142.14	(80)
West	0.9x	0.77	x	3.12	x	92.28	x	0.63	x	0.7	=	87.99	(80)
West	0.9x	0.77	x	5.04	x	113.09	x	0.63	x	0.7	=	174.2	(80)
West	0.9x	0.77	x	3.12	x	113.09	x	0.63	x	0.7	=	107.84	(80)
West	0.9x	0.77	x	5.04	x	115.77	x	0.63	x	0.7	=	178.32	(80)
West	0.9x	0.77	x	3.12	x	115.77	x	0.63	x	0.7	=	110.39	(80)
West	0.9x	0.77	x	5.04	x	110.22	x	0.63	x	0.7	=	169.77	(80)
West	0.9x	0.77	x	3.12	x	110.22	x	0.63	x	0.7	=	105.09	(80)
West	0.9x	0.77	x	5.04	x	94.68	x	0.63	x	0.7	=	145.83	(80)
West	0.9x	0.77	x	3.12	x	94.68	x	0.63	x	0.7	=	90.27	(80)
West	0.9x	0.77	x	5.04	x	73.59	x	0.63	x	0.7	=	113.35	(80)
West	0.9x	0.77	x	3.12	x	73.59	x	0.63	x	0.7	=	70.17	(80)
West	0.9x	0.77	x	5.04	x	45.59	x	0.63	x	0.7	=	70.22	(80)
West	0.9x	0.77	x	3.12	x	45.59	x	0.63	x	0.7	=	43.47	(80)
West	0.9x	0.77	x	5.04	x	24.49	x	0.63	x	0.7	=	37.72	(80)
West	0.9x	0.77	x	3.12	x	24.49	x	0.63	x	0.7	=	23.35	(80)
West	0.9x	0.77	x	5.04	x	16.15	x	0.63	x	0.7	=	24.88	(80)
West	0.9x	0.77	x	3.12	x	16.15	x	0.63	x	0.7	=	15.4	(80)

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

(83)m=	154.97	270.26	382.54	488.96	556.72	555.43	534.44	484.3	419.89	302.51	186.86	131.77	(83)

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

(84)m=	521.55	634.24	733.21	818.55	864.95	842.99	808.93	765.12	711.79	615.7	524.44	487.75	(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	0.92	0.81	0.63	0.47	0.51	0.76	0.95	0.99	1	(86)

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

(87)m=	19.76	19.97	20.26	20.6	20.84	20.96	20.99	20.99	20.92	20.58	20.1	19.72	(87)

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

(88)m=	19.9	19.9	19.9	19.92	19.92	19.93	19.93	19.93	19.93	19.92	19.91	19.91	(88)

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

(89)m=	0.99	0.99	0.96	0.89	0.75	0.54	0.36	0.4	0.67	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=	18.26	18.57	18.99	19.46	19.77	19.91	19.93	19.93	19.86	19.45	18.77	18.22	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

TER WorkSheet: New dwelling design stage

(92)m=	19	19.25	19.61	20.02	20.3	20.43	20.45	20.45	20.38	20	19.42	18.95	(92)

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

(93)m=	19	19.25	19.61	20.02	20.3	20.43	20.45	20.45	20.38	20	19.42	18.95	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.77	0.58	0.41	0.46	0.71	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	517.84	623.27	702.5	732.97	666.93	490.86	333.54	348.51	504.95	570.55	516.49	485.16	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1324.18	1289.82	1175.05	984.18	759.33	508.8	336.23	352.82	550.73	830.17	1093.04	1315.62	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	599.92	447.92	351.58	180.87	68.75	0	0	0	0	193.16	415.11	617.86	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2875.17 (98)

Space heating requirement in kWh/m²/year 39.13 (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)													
	599.92	447.92	351.58	180.87	68.75	0	0	0	0	193.16	415.11	617.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	642.31	479.57	376.42	193.65	73.61	0	0	0	0	206.81	444.45	661.53	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3078.34 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

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=	87.68	87.36	86.73	85.39	83.18	80.3	80.3	80.3	80.3	85.44	87.12	87.79	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	223.67	196.11	205.52	185.14	184.01	167.88	160.84	179.3	181.28	194.02	203.1	218.16	

Total = Sum(219a)$_{1...12}$ = 2299.04 (219)

TER WorkSheet: New dwelling design stage

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3078.34	
Water heating fuel used		2299.04	
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		323.22	(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	=	664.92	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	496.59	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1161.52	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	167.75	(268)
Total CO2, kg/year		sum of (265)…(271) =			1368.19	(272)
TER =					18.62	(273)

SAP 2012 Overheating Assessment

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

Property Details: Plot 2 - 1B2P WC

Dwelling type:	Flat
Located in:	England
Region:	Thames valley
Cross ventilation possible:	Yes
Number of storeys:	1
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Calculated 250.59
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	3 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	203.69	**(P1)**
Transmission heat loss coefficient:	50.9	
Summer heat loss coefficient:	254.6	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South (Bedroom)	0	1
South (Living bay)	0	1
North (Living bay N)	0	1
West (Terrace)	0	1
West (Kitchen)	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 (Terrace)	0.85	0.9	1	0.76	**(P8)**
West (Kitchen)	0.85	0.9	1	0.76	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South (Bedroom)	0.9 x	6.3	112.21	0.63	0.7	0.76	214.63	
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 (Terrace)	0.9 x	5.08	117.51	0.63	0.7	0.76	181.25	
West (Kitchen)	0.9 x	3.15	117.51	0.63	0.7	0.76	112.39	
						Total	565.23	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	404.97	388.18	395.93	
Total summer gains	999.28	953.4	918.08	**(P5)**
Summer gain/loss ratio	3.92	3.74	3.61	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	

SAP 2012 Overheating Assessment

Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	20.17	21.89	21.65	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight