

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.25  
Printed on 11 June 2020 at 13:36:07

## Project Information:

**Assessed By:** Sean Mills (STRO034864)

**Building Type:** Flat

## Dwelling Details:

### NEW DWELLING DESIGN STAGE

Total Floor Area: 57m<sup>2</sup>

**Site Reference :** Garages to the South of 27a West End Lane, London, NW6 4QJ

**Plot Reference:** Flat 4

**Address :** New dwelling at:, Garages to the South of 27a West End Lane, London, NW6 4QJ

## Client Details:

**Name:**

**Address :**

**This report covers items included within the SAP calculations.**

**It is not a complete report of regulations compliance.**

## 1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 17.88 kg/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 17.52 kg/m<sup>2</sup>

OK

## 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 42.7 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 41.7 kWh/m<sup>2</sup>

OK

## 2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.20 (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:	Boiler systems with radiators or underfloor heating - mains gas Data from manufacturer Combi boiler Efficiency 89.5 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

## 5 Cylinder insulation

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

## 6 Controls

Space heating controls	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 West	14.4m <sup>2</sup>	
Windows facing: North West	14.4m <sup>2</sup>	
Ventilation rate:	8.00	

## 10 Key features

Party Walls U-value	0 W/m <sup>2</sup> K
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# SAP WorkSheet: New dwelling design stage

## User Details:

**Assessor Name:** Sean Mills **Stroma Number:** STRO034864  
**Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.25

## Property Address: Flat 4

**Address :** New dwelling at:, Garages to the South of 27a West End Lane, London, NW6 4QJ

### 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )	Av. Height(m)	Volume(m <sup>3</sup> )
Ground floor	57 (1a)	2.6 (2a)	148.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	57 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	148.2 (5)

### 2. Ventilation rate:

	main heating	secondary heating	other	total	m <sup>3</sup> per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

### Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (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
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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# SAP WorkSheet: New dwelling design stage

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

0.38	0.37	0.37	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.34	0.35
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

## 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			4.8	$\times 1/[1/(1.2) + 0.04] =$	5.5		(27)
Windows Type 2			4.8	$\times 1/[1/(1.2) + 0.04] =$	5.5		(27)
Walls	61.23	28.8	32.43	$\times 0.18 =$	5.84		(29)
Total area of elements, m²			61.23				(31)
Party wall			35.78	$\times 0 =$	0		(32)

\* for windows and roof windows, use effective window U-value calculated using formula  $1/[(1/U\text{-value})+0.04]$  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) = 38.81 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (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 9.52 (36)

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

Total fabric heat loss (33) + (36) = 48.33 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	27.99	27.85	27.72	27.09	26.97	26.42	26.42	26.32	26.63	26.97	27.21	27.46

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

(39)m= 76.32 76.18 76.05 75.42 75.3 74.75 74.75 74.65 74.96 75.3 75.54 75.79  
Average = Sum(39)<sub>1...12</sub> /12= 75.42 (39)

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

(40)m= 1.34 1.34 1.33 1.32 1.32 1.31 1.31 1.31 1.32 1.32 1.33 1.33  
Average = Sum(40)<sub>1...12</sub> /12= 1.32 (40)

# SAP WorkSheet: New dwelling design stage

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 1.9 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day  $V_{d,average} = (25 \times N) + 36$  79.22 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	87.14	83.98	80.81	77.64	74.47	71.3	71.3	74.47	77.64	80.81	83.98	87.14	
Total = Sum(44) <sub>1...12</sub> =												950.67	(44)

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

(45)m=	129.23	113.03	116.63	101.68	97.57	84.19	78.02	89.53	90.6	105.58	115.25	125.15	
Total = Sum(45) <sub>1...12</sub> =												1246.47	(45)

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

(46)m=	19.38	16.95	17.5	15.25	14.64	12.63	11.7	13.43	13.59	15.84	17.29	18.77	(46)
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Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
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Combi loss calculated for each month  $(61)m = (60) \div 365 \times (41)m$

(61)m=	44.41	38.65	41.18	38.29	37.95	35.16	36.33	37.95	38.29	41.18	41.41	44.41	(61)
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# SAP WorkSheet: New dwelling design stage

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= 

173.64	151.68	157.81	139.97	135.52	119.36	114.35	127.48	128.88	146.76	156.66	169.56
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 (62)

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

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

(63)m= 

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

Output from water heater

(64)m= 

173.64	151.68	157.81	139.97	135.52	119.36	114.35	127.48	128.88	146.76	156.66	169.56
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Output from water heater (annual)<sub>1...12</sub>

1721.68
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 (64)

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

(65)m= 

54.07	47.24	49.08	43.38	41.93	36.79	35.02	39.26	39.7	45.4	48.67	52.72
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 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m= 

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
113.74	113.74	113.74	113.74	113.74	113.74	113.74	113.74	113.74	113.74	113.74	113.74

 (66)

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

(67)m= 

36.85	32.73	26.62	20.15	15.06	12.72	13.74	17.86	23.97	30.44	35.52	37.87
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 (67)

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

(68)m= 

246.75	249.31	242.86	229.12	211.78	195.49	184.6	182.04	188.49	202.23	219.57	235.86
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 (68)

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

(69)m= 

48.27	48.27	48.27	48.27	48.27	48.27	48.27	48.27	48.27	48.27	48.27	48.27
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 (69)

Pumps and fans gains (Table 5a)

(70)m= 

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

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

(71)m= 

-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83
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 (71)

Water heating gains (Table 5)

(72)m= 

72.68	70.3	65.96	60.25	56.36	51.09	47.08	52.76	55.13	61.02	67.6	70.85
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 (72)

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

(73)m= 

445.46	441.53	424.62	398.71	372.38	348.48	334.6	341.84	356.78	382.87	411.88	433.77
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 (73)

## 6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m <sup>2</sup>		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)								
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>195.34</td></tr></table>	195.34	(79)
0.77																			
4.8																			
36.79																			
0.76																			
0.7																			
195.34																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>62.67</td></tr></table>	62.67		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>332.73</td></tr></table>	332.73	(79)
0.77																			
4.8																			
62.67																			
0.76																			
0.7																			
332.73																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>85.75</td></tr></table>	85.75		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>455.25</td></tr></table>	455.25	(79)
0.77																			
4.8																			
85.75																			
0.76																			
0.7																			
455.25																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>106.25</td></tr></table>	106.25		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>564.08</td></tr></table>	564.08	(79)
0.77																			
4.8																			
106.25																			
0.76																			
0.7																			
564.08																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>119.01</td></tr></table>	119.01		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>631.82</td></tr></table>	631.82	(79)
0.77																			
4.8																			
119.01																			
0.76																			
0.7																			
631.82																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>118.15</td></tr></table>	118.15		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>627.25</td></tr></table>	627.25	(79)
0.77																			
4.8																			
118.15																			
0.76																			
0.7																			
627.25																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>113.91</td></tr></table>	113.91		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>604.74</td></tr></table>	604.74	(79)
0.77																			
4.8																			
113.91																			
0.76																			
0.7																			
604.74																			
Southwest	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>104.39</td></tr></table>	104.39		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>554.2</td></tr></table>	554.2	(79)
0.77																			
4.8																			
104.39																			
0.76																			
0.7																			
554.2																			

## SAP WorkSheet: New dwelling design stage

Southwest 0.9x	0.77	x	4.8	x	92.85	0.76	x	0.7	=	492.94	(79)
Southwest 0.9x	0.77	x	4.8	x	69.27	0.76	x	0.7	=	367.74	(79)
Southwest 0.9x	0.77	x	4.8	x	44.07	0.76	x	0.7	=	233.97	(79)
Southwest 0.9x	0.77	x	4.8	x	31.49	0.76	x	0.7	=	167.17	(79)
Northwest 0.9x	0.77	x	4.8	x	11.28	0.76	x	0.7	=	59.9	(81)
Northwest 0.9x	0.77	x	4.8	x	22.97	0.76	x	0.7	=	121.93	(81)
Northwest 0.9x	0.77	x	4.8	x	41.38	0.76	x	0.7	=	219.68	(81)
Northwest 0.9x	0.77	x	4.8	x	67.96	0.76	x	0.7	=	360.77	(81)
Northwest 0.9x	0.77	x	4.8	x	91.35	0.76	x	0.7	=	484.95	(81)
Northwest 0.9x	0.77	x	4.8	x	97.38	0.76	x	0.7	=	517.01	(81)
Northwest 0.9x	0.77	x	4.8	x	91.1	0.76	x	0.7	=	483.65	(81)
Northwest 0.9x	0.77	x	4.8	x	72.63	0.76	x	0.7	=	385.57	(81)
Northwest 0.9x	0.77	x	4.8	x	50.42	0.76	x	0.7	=	267.68	(81)
Northwest 0.9x	0.77	x	4.8	x	28.07	0.76	x	0.7	=	149.01	(81)
Northwest 0.9x	0.77	x	4.8	x	14.2	0.76	x	0.7	=	75.37	(81)
Northwest 0.9x	0.77	x	4.8	x	9.21	0.76	x	0.7	=	48.92	(81)

Solar gains in watts, calculated for each month

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

(83)m=	255.24	454.66	674.93	924.86	1116.77	1144.26	1088.39	939.77	760.62	516.74	309.34	216.08	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	700.69	896.18	1099.55	1323.56	1489.15	1492.73	1422.98	1281.62	1117.4	899.61	721.21	649.86	(84)
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### 7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.92	0.82	0.64	0.46	0.32	0.23	0.27	0.46	0.76	0.93	0.98	(86)

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

(87)m=	20.05	20.36	20.68	20.9	20.98	21	21	21	20.99	20.84	20.4	19.98	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.81	19.81	19.81	19.82	19.82	19.83	19.83	19.83	19.83	19.82	19.82	19.82	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.96	0.9	0.78	0.59	0.41	0.26	0.17	0.2	0.38	0.7	0.91	0.97	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.62	19.04	19.46	19.73	19.81	19.83	19.83	19.83	19.82	19.67	19.11	18.52	(90)
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fLA = Living area ÷ (4) =

0.42

(91)

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

(92)m=	19.22	19.6	19.97	20.22	20.3	20.32	20.32	20.32	20.31	20.16	19.66	19.14	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.22	19.6	19.97	20.22	20.3	20.32	20.32	20.32	20.31	20.16	19.66	19.14	(93)
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### 8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.95	0.89	0.79	0.61	0.43	0.29	0.2	0.23	0.41	0.72	0.91	0.96	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	667.39	802.08	865.51	807.62	639.02	426.61	278.18	292.63	460.38	645.43	656.32	625.69	(95)
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Monthly average external temperature from Table 8

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

(97)m=	1138.65	1119.59	1024.45	853.98	647.72	427.68	278.32	292.91	465.61	720.07	948.39	1131.96	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	350.62	213.37	118.25	33.38	6.47	0	0	0	0	55.53	210.29	376.66	
Total per year (kWh/year) = Sum(98) <sub>1...5,9...12</sub> =												1364.56	(98)

Space heating requirement in kWh/m²/year

23.94	(99)
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## 9a. Energy requirements – Individual heating systems including micro-CHP)

### Space heating:

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

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

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

Efficiency of main space heating system 1 89.5 (206)

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

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

350.62	213.37	118.25	33.38	6.47	0	0	0	0	55.53	210.29	376.66
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

391.75	238.4	132.12	37.3	7.23	0	0	0	0	62.04	234.96	420.85		
Total (kWh/year) =Sum(211) <sub>1...5,10...12</sub> =												1524.65	(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		
Total (kWh/year) =Sum(215) <sub>1...5,10...12</sub> =												0	(215)

### Water heating

Output from water heater (calculated above)

173.64	151.68	157.81	139.97	135.52	119.36	114.35	127.48	128.88	146.76	156.66	169.56
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Efficiency of water heater 89.5 (216)

(217)m= (217)

89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	194.01	169.47	176.33	156.39	151.42	133.36	127.77	142.43	144	163.98	175.04	189.46	
Total = Sum(219a) <sub>1...12</sub> =												1923.66	(219)

### Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1 1524.65

Water heating fuel used 1923.66

Electricity for pumps, fans and electric keep-hot



## SAP WorkSheet: New dwelling design stage

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		260.29	(232)

### 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 = 53.06 (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 = 66.94 (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 = 34.33 (250)
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
<b>Total energy cost</b>	(245)...(247) + (250)...(254) =		284.23 (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] =	1.17	(257)
<b>SAP rating (Section 12)</b>		83.67	(258)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 329.33 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 415.51 (264)
Space and water heating	(261) + (262) + (263) + (264) =		744.84 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 135.09 (268)
Total CO2, kg/year		sum of (265)...(271) =	918.85 (272)
<b>CO2 emissions per m²</b>		(272) ÷ (4) =	16.12 (273)
EI rating (section 14)			88 (274)

### 13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	= 1860.08 (261)

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Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2346.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4206.94	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	799.09	(268)
'Total Primary Energy	sum of (265)...(271) =			5236.28	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			91.86	(273)

# TFEE WorkSheet: New dwelling design stage

## User Details:

**Assessor Name:** Sean Mills      **Stroma Number:** STRO034864  
**Software Name:** Stroma FSAP 2012      **Software Version:** Version: 1.0.4.25

## Property Address: Flat 4

**Address :** New dwelling at:, Garages to the South of 27a West End Lane, London, NW6 4QJ

## 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )		Av. Height(m)		Volume(m <sup>3</sup> )
Ground floor	<input type="text" value="57"/>	(1a) x	<input type="text" value="2.6"/>	(2a) =	<input type="text" value="148.2"/>
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="57"/>	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			<input type="text" value="148.2"/>

## 2. Ventilation rate:

	main heating	secondary heating	other	total		m <sup>3</sup> per hour
Number of chimneys	<input type="text" value="0"/>	+	<input type="text" value="0"/>	+	<input type="text" value="0"/>	= <input type="text" value="0"/> x 40 = <input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	+	<input type="text" value="0"/>	+	<input type="text" value="0"/>	= <input type="text" value="0"/> x 20 = <input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="2"/>	x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents				<input type="text" value="0"/>	x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/>	x 40 =	<input type="text" value="0"/> (7c)

## Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="20"/>	÷ (5) =	<input type="text" value="0.13"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			<input type="text" value="0"/> (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="5"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			<input type="text" value="0.38"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="3"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="0.78"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.3"/> (21)

Infiltration rate modified for monthly wind speed

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

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

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

0.38	0.37	0.37	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.34	0.35
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

## 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	x1/[1/(1.4)+0.04] =	3.16		(27)
Windows Type 2			2.38	x1/[1/(1.4)+0.04] =	3.16		(27)
Walls	61.23	14.28	46.95	x 0.18 =	8.45		(29)
Total area of elements, m²			61.23				(31)
Party wall			35.78	x 0 =	0		(32)

\* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

\*\* include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 27.38 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (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 6.48 (36)

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

Total fabric heat loss (33) + (36) = 33.86 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	27.99	27.85	27.72	27.09	26.97	26.42	26.42	26.32	26.63	26.97	27.21	27.46

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

(39)m= 61.85 61.72 61.58 60.95 60.83 60.28 60.28 60.18 60.49 60.83 61.07 61.32  
Average = Sum(39)<sub>1...12</sub> /12= 60.95 (39)

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

(40)m= 1.09 1.08 1.08 1.07 1.07 1.06 1.06 1.06 1.06 1.07 1.07 1.08  
Average = Sum(40)<sub>1...12</sub> /12= 1.07 (40)

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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 1.9 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day  $V_{d,average} = (25 \times N) + 36$  79.22 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	87.14	83.98	80.81	77.64	74.47	71.3	71.3	74.47	77.64	80.81	83.98	87.14	
Total = Sum(44) <sub>1...12</sub> =												950.67	(44)

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

(45)m=	129.23	113.03	116.63	101.68	97.57	84.19	78.02	89.53	90.6	105.58	115.25	125.15	
Total = Sum(45) <sub>1...12</sub> =												1246.47	(45)

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

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

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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Primary circuit loss (annual) from Table 3 0 (58)

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

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

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
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Combi loss calculated for each month  $(61)m = (60) \div 365 \times (41)m$

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

# TFEE WorkSheet: New dwelling design stage

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=	109.85	96.07	99.14	86.43	82.93	71.57	66.32	76.1	77.01	89.74	97.96	106.38	(62)
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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=	109.85	96.07	99.14	86.43	82.93	71.57	66.32	76.1	77.01	89.74	97.96	106.38	
Output from water heater (annual) <sub>1...12</sub>												1059.5	(64)

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

(65)m=	27.46	24.02	24.78	21.61	20.73	17.89	16.58	19.02	19.25	22.44	24.49	26.6	(65)
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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=	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	(66)

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

(67)m=	14.74	13.09	10.65	8.06	6.02	5.09	5.5	7.14	9.59	12.17	14.21	15.15	(67)
--------	-------	-------	-------	------	------	------	-----	------	------	-------	-------	-------	------

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

(68)m=	165.32	167.04	162.72	153.51	141.89	130.98	123.68	121.97	126.29	135.49	147.11	158.03	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	(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=	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	(71)
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Water heating gains (Table 5)

(72)m=	36.91	35.74	33.31	30.01	27.87	24.85	22.28	25.57	26.74	30.16	34.01	35.75	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	268.41	267.31	258.11	243.02	227.22	212.35	202.9	206.12	214.05	229.26	246.77	260.36	(73)
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## 6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest0.9x	0.77	x	2.38	x	36.79		0.63	x	0.7	=	80.29	(79)
Southwest0.9x	0.77	x	2.38	x	62.67		0.63	x	0.7	=	136.76	(79)
Southwest0.9x	0.77	x	2.38	x	85.75		0.63	x	0.7	=	187.12	(79)
Southwest0.9x	0.77	x	2.38	x	106.25		0.63	x	0.7	=	231.85	(79)
Southwest0.9x	0.77	x	2.38	x	119.01		0.63	x	0.7	=	259.69	(79)
Southwest0.9x	0.77	x	2.38	x	118.15		0.63	x	0.7	=	257.81	(79)
Southwest0.9x	0.77	x	2.38	x	113.91		0.63	x	0.7	=	248.56	(79)
Southwest0.9x	0.77	x	2.38	x	104.39		0.63	x	0.7	=	227.79	(79)

## TFEE WorkSheet: New dwelling design stage

Southwest	0.9x	0.77	x	2.38	x	92.85	0.63	x	0.7	=	202.61	(79)
Southwest	0.9x	0.77	x	2.38	x	69.27	0.63	x	0.7	=	151.15	(79)
Southwest	0.9x	0.77	x	2.38	x	44.07	0.63	x	0.7	=	96.17	(79)
Southwest	0.9x	0.77	x	2.38	x	31.49	0.63	x	0.7	=	68.71	(79)
Northwest	0.9x	0.77	x	2.38	x	11.28	0.63	x	0.7	=	24.62	(81)
Northwest	0.9x	0.77	x	2.38	x	22.97	0.63	x	0.7	=	50.12	(81)
Northwest	0.9x	0.77	x	2.38	x	41.38	0.63	x	0.7	=	90.29	(81)
Northwest	0.9x	0.77	x	2.38	x	67.96	0.63	x	0.7	=	148.28	(81)
Northwest	0.9x	0.77	x	2.38	x	91.35	0.63	x	0.7	=	199.32	(81)
Northwest	0.9x	0.77	x	2.38	x	97.38	0.63	x	0.7	=	212.5	(81)
Northwest	0.9x	0.77	x	2.38	x	91.1	0.63	x	0.7	=	198.79	(81)
Northwest	0.9x	0.77	x	2.38	x	72.63	0.63	x	0.7	=	158.48	(81)
Northwest	0.9x	0.77	x	2.38	x	50.42	0.63	x	0.7	=	110.02	(81)
Northwest	0.9x	0.77	x	2.38	x	28.07	0.63	x	0.7	=	61.24	(81)
Northwest	0.9x	0.77	x	2.38	x	14.2	0.63	x	0.7	=	30.98	(81)
Northwest	0.9x	0.77	x	2.38	x	9.21	0.63	x	0.7	=	20.11	(81)

Solar gains in watts, calculated for each month

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

(83)m=	104.91	186.87	277.41	380.13	459.01	470.31	447.35	386.27	312.63	212.39	127.14	88.82	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(84)m=	373.31	454.18	535.52	623.15	686.24	682.66	650.24	592.38	526.68	441.65	373.91	349.17	(84)
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### 7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.75	0.55	0.41	0.46	0.73	0.95	0.99	1	(86)

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

(87)m=	19.9	20.09	20.38	20.71	20.92	20.99	21	21	20.95	20.64	20.2	19.86	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.02	20.03	20.03	20.04	20.04	20.04	20.03	20.03	20.02	20.02	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.88	0.69	0.48	0.32	0.37	0.65	0.93	0.99	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.01	19.21	19.49	19.8	19.98	20.03	20.04	20.04	20.01	19.76	19.32	18.98	(90)
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fLA = Living area ÷ (4) =

0.42

(91)

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

(92)m=	19.39	19.58	19.86	20.18	20.37	20.43	20.44	20.44	20.4	20.13	19.69	19.35	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.39	19.58	19.86	20.18	20.37	20.43	20.44	20.44	20.4	20.13	19.69	19.35	(93)
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### 8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.96	0.88	0.71	0.51	0.36	0.41	0.68	0.93	0.99	1	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	371.51	448.17	514.82	548.66	490.59	346.72	230.93	241.94	359.87	411.68	369.73	347.96	(95)
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Monthly average external temperature from Table 8

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

(97)m=	933.09	906.04	822.93	687.81	527.52	351.6	231.51	243.13	381.2	579.68	769.08	929.14	(97)
--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	--------	--------	--------	------

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

(98)m=	417.82	307.68	229.23	100.18	27.48	0	0	0	0	124.99	287.53	432.4	(98)
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Total per year (kWh/year) = Sum(98)<sub>1...5,9...12</sub> = 1927.33 (98)

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

33.81 (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
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Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	566.63	446.07	457.35	0	0	0	0	(100)
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Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.96	0.98	0.97	0	0	0	0	(101)
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Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	545.47	438.6	445.26	0	0	0	0	(102)
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Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	868.95	829.68	763.13	0	0	0	0	(103)
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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 x (98)m

(104)m=	0	0	0	0	0	232.9	290.96	236.5	0	0	0	0	(104)
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Total = Sum(104) = 760.36 (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	(106)
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Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	58.23	72.74	59.12	0	0	0	0	(107)
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Total = Sum(107) = 190.09 (107)

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

(107) ÷ (4) = 3.33 (108)

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

Fabric Energy Efficiency (99) + (108) = 37.15 (109)

Target Fabric Energy Efficiency (TFEE) 42.72 (109)



# DFEE WorkSheet: New dwelling design stage

## User Details:

**Assessor Name:** Sean Mills **Stroma Number:** STRO034864  
**Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.25

## Property Address: Flat 4

**Address :** New dwelling at:, Garages to the South of 27a West End Lane, London, NW6 4QJ

### 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )	Av. Height(m)	Volume(m <sup>3</sup> )
Ground floor	57 (1a)	2.6 (2a)	148.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	57 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	148.2 (5)

### 2. Ventilation rate:

	main heating	secondary heating	other	total	m <sup>3</sup> per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

### Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (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
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Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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# DFEE WorkSheet: New dwelling design stage

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

0.38	0.37	0.37	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.34	0.35
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

## 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			4.8	$x1/[1/(1.2)+0.04] =$	5.5		(27)
Windows Type 2			4.8	$x1/[1/(1.2)+0.04] =$	5.5		(27)
Walls	61.23	28.8	32.43	x 0.18 =	5.84		(29)
Total area of elements, m²			61.23				(31)
Party wall			35.78	x 0 =	0		(32)

\* for windows and roof windows, use effective window U-value calculated using formula  $1/[(1/U\text{-value})+0.04]$  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) = 38.81 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (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 9.52 (36)

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

Total fabric heat loss (33) + (36) = 48.33 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	27.99	27.85	27.72	27.09	26.97	26.42	26.42	26.32	26.63	26.97	27.21	27.46

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

(39)m= 76.32 76.18 76.05 75.42 75.3 74.75 74.75 74.65 74.96 75.3 75.54 75.79  
Average = Sum(39)<sub>1...12</sub> /12= 75.42 (39)

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

(40)m= 1.34 1.34 1.33 1.32 1.32 1.31 1.31 1.31 1.32 1.32 1.33 1.33  
Average = Sum(40)<sub>1...12</sub> /12= 1.32 (40)

# DFEE WorkSheet: New dwelling design stage

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 1.9 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day  $V_{d,average} = (25 \times N) + 36$  79.22 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	87.14	83.98	80.81	77.64	74.47	71.3	71.3	74.47	77.64	80.81	83.98	87.14	
Total = Sum(44) <sub>1...12</sub> =												950.67	(44)

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

(45)m=	129.23	113.03	116.63	101.68	97.57	84.19	78.02	89.53	90.6	105.58	115.25	125.15	
Total = Sum(45) <sub>1...12</sub> =												1246.47	(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)

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

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

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

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

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

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

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

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

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

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

# DFEE WorkSheet: New dwelling design stage

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

(62)m= 

109.85	96.07	99.14	86.43	82.93	71.57	66.32	76.1	77.01	89.74	97.96	106.38
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	--------

 (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= 

109.85	96.07	99.14	86.43	82.93	71.57	66.32	76.1	77.01	89.74	97.96	106.38
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	--------

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

1059.5
--------

 (64)

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

(65)m= 

27.46	24.02	24.78	21.61	20.73	17.89	16.58	19.02	19.25	22.44	24.49	26.6
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m= 

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78

 (66)

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

(67)m= 

14.74	13.09	10.65	8.06	6.02	5.09	5.5	7.14	9.59	12.17	14.21	15.15
-------	-------	-------	------	------	------	-----	------	------	-------	-------	-------

 (67)

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

(68)m= 

165.32	167.04	162.72	153.51	141.89	130.98	123.68	121.97	126.29	135.49	147.11	158.03
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m= 

32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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= 

-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m= 

36.91	35.74	33.31	30.01	27.87	24.85	22.28	25.57	26.74	30.16	34.01	35.75
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m= 

268.41	267.31	258.11	243.02	227.22	212.35	202.9	206.12	214.05	229.26	246.77	260.36
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (73)

## 6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m <sup>2</sup>		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)			
Southwest	0.9x		0.77	x	4.8	x	36.79		0.76	x	0.7	=	195.34	(79)
Southwest	0.9x		0.77	x	4.8	x	62.67		0.76	x	0.7	=	332.73	(79)
Southwest	0.9x		0.77	x	4.8	x	85.75		0.76	x	0.7	=	455.25	(79)
Southwest	0.9x		0.77	x	4.8	x	106.25		0.76	x	0.7	=	564.08	(79)
Southwest	0.9x		0.77	x	4.8	x	119.01		0.76	x	0.7	=	631.82	(79)
Southwest	0.9x		0.77	x	4.8	x	118.15		0.76	x	0.7	=	627.25	(79)
Southwest	0.9x		0.77	x	4.8	x	113.91		0.76	x	0.7	=	604.74	(79)
Southwest	0.9x		0.77	x	4.8	x	104.39		0.76	x	0.7	=	554.2	(79)

## DFEE WorkSheet: New dwelling design stage

Southwest 0.9x	0.77	x	4.8	x	92.85	0.76	x	0.7	=	492.94	(79)
Southwest 0.9x	0.77	x	4.8	x	69.27	0.76	x	0.7	=	367.74	(79)
Southwest 0.9x	0.77	x	4.8	x	44.07	0.76	x	0.7	=	233.97	(79)
Southwest 0.9x	0.77	x	4.8	x	31.49	0.76	x	0.7	=	167.17	(79)
Northwest 0.9x	0.77	x	4.8	x	11.28	0.76	x	0.7	=	59.9	(81)
Northwest 0.9x	0.77	x	4.8	x	22.97	0.76	x	0.7	=	121.93	(81)
Northwest 0.9x	0.77	x	4.8	x	41.38	0.76	x	0.7	=	219.68	(81)
Northwest 0.9x	0.77	x	4.8	x	67.96	0.76	x	0.7	=	360.77	(81)
Northwest 0.9x	0.77	x	4.8	x	91.35	0.76	x	0.7	=	484.95	(81)
Northwest 0.9x	0.77	x	4.8	x	97.38	0.76	x	0.7	=	517.01	(81)
Northwest 0.9x	0.77	x	4.8	x	91.1	0.76	x	0.7	=	483.65	(81)
Northwest 0.9x	0.77	x	4.8	x	72.63	0.76	x	0.7	=	385.57	(81)
Northwest 0.9x	0.77	x	4.8	x	50.42	0.76	x	0.7	=	267.68	(81)
Northwest 0.9x	0.77	x	4.8	x	28.07	0.76	x	0.7	=	149.01	(81)
Northwest 0.9x	0.77	x	4.8	x	14.2	0.76	x	0.7	=	75.37	(81)
Northwest 0.9x	0.77	x	4.8	x	9.21	0.76	x	0.7	=	48.92	(81)

Solar gains in watts, calculated for each month

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

(83)m=	255.24	454.66	674.93	924.86	1116.77	1144.26	1088.39	939.77	760.62	516.74	309.34	216.08	(83)
--------	--------	--------	--------	--------	---------	---------	---------	--------	--------	--------	--------	--------	------

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

(84)m=	523.64	721.96	933.04	1167.87	1343.99	1356.6	1291.28	1145.89	974.68	746	556.11	476.44	(84)
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### 7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.96	0.88	0.71	0.51	0.35	0.25	0.3	0.52	0.84	0.97	0.99	(86)

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

(87)m=	19.79	20.15	20.55	20.86	20.97	21	21	21	20.98	20.75	20.19	19.72	(87)
--------	-------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

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

(88)m=	19.81	19.81	19.81	19.82	19.82	19.83	19.83	19.83	19.83	19.82	19.82	19.82	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.95	0.85	0.65	0.45	0.29	0.19	0.22	0.43	0.79	0.96	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.75	19.09	19.46	19.73	19.81	19.83	19.83	19.83	19.82	19.65	19.14	18.68	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.42

(91)

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

(92)m=	19.19	19.54	19.92	20.2	20.3	20.32	20.32	20.32	20.31	20.11	19.58	19.12	(92)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.19	19.54	19.92	20.2	20.3	20.32	20.32	20.32	20.31	20.11	19.58	19.12	(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
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

## DFEE WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	0.98	0.94	0.85	0.67	0.47	0.31	0.22	0.26	0.47	0.8	0.96	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	-----	------	------	------

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

(95)m=	514.58	681.66	794.79	784.64	634.7	426.06	278.1	292.44	456.53	597.84	533.59	470.66	(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=	1136.26	1115.1	1020.58	852.53	647.42	427.63	278.31	292.89	465.27	716.4	942.81	1130.77	(97)
--------	---------	--------	---------	--------	--------	--------	--------	--------	--------	-------	--------	---------	------

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

(98)m=	462.53	291.28	167.99	48.88	9.47	0	0	0	0	88.21	294.64	491.12	(98)
--------	--------	--------	--------	-------	------	---	---	---	---	-------	--------	--------	------

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

1854.12

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

32.53

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

(100)m=	0	0	0	0	0	702.63	553.13	567.31	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.99	0.99	0.99	0	0	0	0	(101)
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Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	694.25	550.02	561.82	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	1656.68	1578.95	1410.09	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 x (98)m

(104)m=	0	0	0	0	0	692.95	765.52	631.11	0	0	0	0	(104)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Total = Sum(104) =

2089.58

Cooled fraction

f C = cooled area ÷ (4) =

1

Intermittency factor (Table 10b)

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

Total = Sum(104) =

0

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

(107)m=	0	0	0	0	0	173.24	191.38	157.78	0	0	0	0	(107)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Total = Sum(107) =

522.4

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

(107) ÷ (4) =

9.16

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

Fabric Energy Efficiency (99) + (108) =

41.69

# DER WorkSheet: New dwelling design stage

## User Details:

**Assessor Name:** Sean Mills **Stroma Number:** STRO034864  
**Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.25

## Property Address: Flat 4

**Address :** New dwelling at:, Garages to the South of 27a West End Lane, London, NW6 4QJ

### 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )	Av. Height(m)	Volume(m <sup>3</sup> )
Ground floor	57 (1a)	2.6 (2a)	148.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	57 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	148.2 (5)

### 2. Ventilation rate:

	main heating	secondary heating	other	total	m <sup>3</sup> per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

### Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (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	0.37	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.34	0.35
------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

## 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			4.8	$\times 1/[1/(1.2) + 0.04] =$	5.5		(27)
Windows Type 2			4.8	$\times 1/[1/(1.2) + 0.04] =$	5.5		(27)
Walls	61.23	28.8	32.43	$\times 0.18 =$	5.84		(29)
Total area of elements, m²			61.23				(31)
Party wall			35.78	$\times 0 =$	0		(32)

\* for windows and roof windows, use effective window U-value calculated using formula  $1/[1/(U\text{-value}) + 0.04]$  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) = 38.81 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (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 9.52 (36)

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

Total fabric heat loss (33) + (36) = 48.33 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	27.99	27.85	27.72	27.09	26.97	26.42	26.42	26.32	26.63	26.97	27.21	27.46

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

(39)m= 76.32 76.18 76.05 75.42 75.3 74.75 74.75 74.65 74.96 75.3 75.54 75.79  
Average = Sum(39)<sub>1...12</sub> /12= 75.42 (39)

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

(40)m= 1.34 1.34 1.33 1.32 1.32 1.31 1.31 1.31 1.32 1.32 1.33 1.33  
Average = Sum(40)<sub>1...12</sub> /12= 1.32 (40)



# DER WorkSheet: New dwelling design stage

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 1.9 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day  $V_{d,average} = (25 \times N) + 36$  79.22 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	87.14	83.98	80.81	77.64	74.47	71.3	71.3	74.47	77.64	80.81	83.98	87.14	
Total = Sum(44) <sub>1...12</sub> =												950.67	(44)

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

(45)m=	129.23	113.03	116.63	101.68	97.57	84.19	78.02	89.53	90.6	105.58	115.25	125.15	
Total = Sum(45) <sub>1...12</sub> =												1246.47	(45)

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

(46)m=	19.38	16.95	17.5	15.25	14.64	12.63	11.7	13.43	13.59	15.84	17.29	18.77	(46)
--------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	44.41	38.65	41.18	38.29	37.95	35.16	36.33	37.95	38.29	41.18	41.41	44.41	(61)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

## DER WorkSheet: New dwelling design stage

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

(62)m= 

173.64	151.68	157.81	139.97	135.52	119.36	114.35	127.48	128.88	146.76	156.66	169.56
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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= 

173.64	151.68	157.81	139.97	135.52	119.36	114.35	127.48	128.88	146.76	156.66	169.56
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

1721.68
---------

 (64)

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

(65)m= 

54.07	47.24	49.08	43.38	41.93	36.79	35.02	39.26	39.7	45.4	48.67	52.72
-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m= 

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78

 (66)

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

(67)m= 

14.74	13.09	10.65	8.06	6.02	5.09	5.5	7.14	9.59	12.17	14.21	15.15
-------	-------	-------	------	------	------	-----	------	------	-------	-------	-------

 (67)

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

(68)m= 

165.32	167.04	162.72	153.51	141.89	130.98	123.68	121.97	126.29	135.49	147.11	158.03
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m= 

32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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= 

-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m= 

72.68	70.3	65.96	60.25	56.36	51.09	47.08	52.76	55.13	61.02	67.6	70.85
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

 (72)

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

(73)m= 

307.17	304.87	293.76	276.26	258.71	241.59	230.69	236.31	245.44	263.12	283.36	298.47
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

### 6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m <sup>2</sup>		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
Southwest0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>36.79</td></tr></table>	36.79		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>195.34</td></tr></table>	195.34	(79)
0.77																		
4.8																		
36.79																		
0.76																		
0.7																		
195.34																		
Southwest0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>62.67</td></tr></table>	62.67		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>332.73</td></tr></table>	332.73	(79)
0.77																		
4.8																		
62.67																		
0.76																		
0.7																		
332.73																		
Southwest0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>85.75</td></tr></table>	85.75		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>455.25</td></tr></table>	455.25	(79)
0.77																		
4.8																		
85.75																		
0.76																		
0.7																		
455.25																		
Southwest0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>106.25</td></tr></table>	106.25		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>564.08</td></tr></table>	564.08	(79)
0.77																		
4.8																		
106.25																		
0.76																		
0.7																		
564.08																		
Southwest0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>119.01</td></tr></table>	119.01		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>631.82</td></tr></table>	631.82	(79)
0.77																		
4.8																		
119.01																		
0.76																		
0.7																		
631.82																		
Southwest0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>118.15</td></tr></table>	118.15		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>627.25</td></tr></table>	627.25	(79)
0.77																		
4.8																		
118.15																		
0.76																		
0.7																		
627.25																		
Southwest0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>113.91</td></tr></table>	113.91		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>604.74</td></tr></table>	604.74	(79)
0.77																		
4.8																		
113.91																		
0.76																		
0.7																		
604.74																		
Southwest0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>4.8</td></tr></table>	4.8	x	<table><tr><td>104.39</td></tr></table>	104.39		<table><tr><td>0.76</td></tr></table>	0.76	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>554.2</td></tr></table>	554.2	(79)
0.77																		
4.8																		
104.39																		
0.76																		
0.7																		
554.2																		

## DER WorkSheet: New dwelling design stage

Southwest 0.9x	0.77	x	4.8	x	92.85	0.76	x	0.7	=	492.94	(79)
Southwest 0.9x	0.77	x	4.8	x	69.27	0.76	x	0.7	=	367.74	(79)
Southwest 0.9x	0.77	x	4.8	x	44.07	0.76	x	0.7	=	233.97	(79)
Southwest 0.9x	0.77	x	4.8	x	31.49	0.76	x	0.7	=	167.17	(79)
Northwest 0.9x	0.77	x	4.8	x	11.28	0.76	x	0.7	=	59.9	(81)
Northwest 0.9x	0.77	x	4.8	x	22.97	0.76	x	0.7	=	121.93	(81)
Northwest 0.9x	0.77	x	4.8	x	41.38	0.76	x	0.7	=	219.68	(81)
Northwest 0.9x	0.77	x	4.8	x	67.96	0.76	x	0.7	=	360.77	(81)
Northwest 0.9x	0.77	x	4.8	x	91.35	0.76	x	0.7	=	484.95	(81)
Northwest 0.9x	0.77	x	4.8	x	97.38	0.76	x	0.7	=	517.01	(81)
Northwest 0.9x	0.77	x	4.8	x	91.1	0.76	x	0.7	=	483.65	(81)
Northwest 0.9x	0.77	x	4.8	x	72.63	0.76	x	0.7	=	385.57	(81)
Northwest 0.9x	0.77	x	4.8	x	50.42	0.76	x	0.7	=	267.68	(81)
Northwest 0.9x	0.77	x	4.8	x	28.07	0.76	x	0.7	=	149.01	(81)
Northwest 0.9x	0.77	x	4.8	x	14.2	0.76	x	0.7	=	75.37	(81)
Northwest 0.9x	0.77	x	4.8	x	9.21	0.76	x	0.7	=	48.92	(81)

Solar gains in watts, calculated for each month

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

(83)m=	255.24	454.66	674.93	924.86	1116.77	1144.26	1088.39	939.77	760.62	516.74	309.34	216.08	(83)
--------	--------	--------	--------	--------	---------	---------	---------	--------	--------	--------	--------	--------	------

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

(84)m=	562.41	759.53	968.69	1201.12	1375.48	1385.85	1319.07	1176.08	1006.07	779.87	592.69	514.55	(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	0.95	0.87	0.69	0.5	0.34	0.25	0.29	0.5	0.82	0.97	0.99	(86)

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

(87)m=	19.85	20.2	20.58	20.87	20.97	21	21	21	20.98	20.77	20.24	19.78	(87)
--------	-------	------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

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

(88)m=	19.81	19.81	19.81	19.82	19.82	19.83	19.83	19.83	19.83	19.82	19.82	19.82	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.98	0.94	0.83	0.64	0.44	0.28	0.18	0.22	0.42	0.77	0.95	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.34	18.82	19.34	19.7	19.8	19.83	19.83	19.83	19.82	19.6	18.89	18.24	(90)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =

0.42

(91)

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

(92)m=	18.97	19.4	19.86	20.19	20.3	20.32	20.32	20.32	20.31	20.09	19.46	18.89	(92)
--------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.97	19.4	19.86	20.19	20.3	20.32	20.32	20.32	20.31	20.09	19.46	18.89	(93)
--------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

### 8. Space heating requirement

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

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

# DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	0.98	0.93	0.84	0.66	0.46	0.31	0.21	0.25	0.45	0.78	0.95	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	549.11	708.36	809.96	789.38	635.59	426.18	278.12	292.48	457.46	609.08	562.08	505.71	(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=	1119.96	1104.84	1016.07	851.46	647.26	427.62	278.31	292.89	465.22	714.82	933.64	1113.15	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	424.71	266.43	153.35	44.7	8.68	0	0	0	0	78.68	267.52	451.93	(98)
--------	--------	--------	--------	------	------	---	---	---	---	-------	--------	--------	------

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

1696	(98)
------	------

Space heating requirement in kWh/m²/year

29.75	(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) x [1 – (203)] =

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

Efficiency of main space heating system 1

89.5	(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)

424.71	266.43	153.35	44.7	8.68	0	0	0	0	78.68	267.52	451.93
--------	--------	--------	------	------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206)

474.54	297.69	171.34	49.94	9.7	0	0	0	0	87.91	298.91	504.95
--------	--------	--------	-------	-----	---	---	---	---	-------	--------	--------

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

1894.97	(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	(215)
---------	---	---	---	---	---	---	---	---	---	---	---	---	-------

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

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

### Water heating

Output from water heater (calculated above)

173.64	151.68	157.81	139.97	135.52	119.36	114.35	127.48	128.88	146.76	156.66	169.56
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

89.5	(216)
------	-------

(217)m=	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	(217)
---------	------	------	------	------	------	------	------	------	------	------	------	------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	194.01	169.47	176.33	156.39	151.42	133.36	127.77	142.43	144	163.98	175.04	189.46
---------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------

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

1923.66	(219)
---------	-------

### Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

1894.97
---------

Water heating fuel used

1923.66
---------

Electricity for pumps, fans and electric keep-hot

## DER WorkSheet: New dwelling design stage

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		260.29	(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	=	409.31	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	415.51	(264)
Space and water heating	(261) + (262) + (263) + (264) =			824.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	135.09	(268)
Total CO2, kg/year		sum of (265)...(271) =		998.84	(272)
<b>Dwelling CO2 Emission Rate</b>		(272) ÷ (4) =		17.52	(273)
El rating (section 14)				87	(274)

# TER WorkSheet: New dwelling design stage

## User Details:

**Assessor Name:** Sean Mills **Stroma Number:** STRO034864  
**Software Name:** Stroma FSAP 2012 **Software Version:** Version: 1.0.4.25

## Property Address: Flat 4

**Address :** New dwelling at:, Garages to the South of 27a West End Lane, London, NW6 4QJ

### 1. Overall dwelling dimensions:

	Area(m <sup>2</sup> )	Av. Height(m)	Volume(m <sup>3</sup> )
Ground floor	57 (1a)	2.6 (2a)	148.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	57 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	148.2 (5)

### 2. Ventilation rate:

	main heating	secondary heating	other	total	m <sup>3</sup> per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

### Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (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
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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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# TER WorkSheet: New dwelling design stage

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

0.38	0.37	0.37	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.34	0.35
------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

## 3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Windows Type 2			2.38	$\times 1/[1/(1.4) + 0.04] =$	3.16		(27)
Walls	61.23	14.28	46.95	$\times 0.18 =$	8.45		(29)
Total area of elements, m²			61.23				(31)
Party wall			35.78	$\times 0 =$	0		(32)

\* for windows and roof windows, use effective window U-value calculated using formula  $1/[(1/U\text{-value})+0.04]$  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) = 27.38 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (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 6.48 (36)

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

Total fabric heat loss (33) + (36) = 33.86 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	27.99	27.85	27.72	27.09	26.97	26.42	26.42	26.32	26.63	26.97	27.21	27.46

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

(39)m= 61.85 61.72 61.58 60.95 60.83 60.28 60.28 60.18 60.49 60.83 61.07 61.32  
Average = Sum(39)<sub>1...12</sub> /12= 60.95 (39)

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

(40)m= 1.09 1.08 1.08 1.07 1.07 1.06 1.06 1.06 1.06 1.07 1.07 1.08  
Average = Sum(40)<sub>1...12</sub> /12= 1.07 (40)

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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 1.9 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day  $V_{d,average} = (25 \times N) + 36$  79.22 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	87.14	83.98	80.81	77.64	74.47	71.3	71.3	74.47	77.64	80.81	83.98	87.14	
Total = Sum(44) <sub>1...12</sub> =												950.67	(44)

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

(45)m=	129.23	113.03	116.63	101.68	97.57	84.19	78.02	89.53	90.6	105.58	115.25	125.15	
Total = Sum(45) <sub>1...12</sub> =												1246.47	(45)

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

(46)m=	19.38	16.95	17.5	15.25	14.64	12.63	11.7	13.43	13.59	15.84	17.29	18.77	(46)
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Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	44.41	38.65	41.18	38.29	37.95	35.16	36.33	37.95	38.29	41.18	41.41	44.41	(61)
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# TER WorkSheet: New dwelling design stage

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= 

173.64	151.68	157.81	139.97	135.52	119.36	114.35	127.48	128.88	146.76	156.66	169.56
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 (62)

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

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

(63)m= 

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

 (63)

Output from water heater

(64)m= 

173.64	151.68	157.81	139.97	135.52	119.36	114.35	127.48	128.88	146.76	156.66	169.56
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Output from water heater (annual)<sub>1...12</sub>

1721.68
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 (64)

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

(65)m= 

54.07	47.24	49.08	43.38	41.93	36.79	35.02	39.26	39.7	45.4	48.67	52.72
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 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m= 

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78	94.78

 (66)

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

(67)m= 

14.74	13.09	10.65	8.06	6.02	5.09	5.5	7.14	9.59	12.17	14.21	15.15
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 (67)

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

(68)m= 

165.32	167.04	162.72	153.51	141.89	130.98	123.68	121.97	126.29	135.49	147.11	158.03
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m= 

32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48	32.48
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m= 

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

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

(71)m= 

-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83	-75.83
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m= 

72.68	70.3	65.96	60.25	56.36	51.09	47.08	52.76	55.13	61.02	67.6	70.85
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

 (72)

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

(73)m= 

307.17	304.87	293.76	276.26	258.71	241.59	230.69	236.31	245.44	263.12	283.36	298.47
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

## 6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m <sup>2</sup>		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)			
Southwest	0.9x		0.77	x	2.38	x	36.79		0.63	x	0.7	=	80.29	(79)
Southwest	0.9x		0.77	x	2.38	x	62.67		0.63	x	0.7	=	136.76	(79)
Southwest	0.9x		0.77	x	2.38	x	85.75		0.63	x	0.7	=	187.12	(79)
Southwest	0.9x		0.77	x	2.38	x	106.25		0.63	x	0.7	=	231.85	(79)
Southwest	0.9x		0.77	x	2.38	x	119.01		0.63	x	0.7	=	259.69	(79)
Southwest	0.9x		0.77	x	2.38	x	118.15		0.63	x	0.7	=	257.81	(79)
Southwest	0.9x		0.77	x	2.38	x	113.91		0.63	x	0.7	=	248.56	(79)
Southwest	0.9x		0.77	x	2.38	x	104.39		0.63	x	0.7	=	227.79	(79)

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Southwest 0.9x	0.77	x	2.38	x	92.85	0.63	x	0.7	=	202.61	(79)
Southwest 0.9x	0.77	x	2.38	x	69.27	0.63	x	0.7	=	151.15	(79)
Southwest 0.9x	0.77	x	2.38	x	44.07	0.63	x	0.7	=	96.17	(79)
Southwest 0.9x	0.77	x	2.38	x	31.49	0.63	x	0.7	=	68.71	(79)
Northwest 0.9x	0.77	x	2.38	x	11.28	0.63	x	0.7	=	24.62	(81)
Northwest 0.9x	0.77	x	2.38	x	22.97	0.63	x	0.7	=	50.12	(81)
Northwest 0.9x	0.77	x	2.38	x	41.38	0.63	x	0.7	=	90.29	(81)
Northwest 0.9x	0.77	x	2.38	x	67.96	0.63	x	0.7	=	148.28	(81)
Northwest 0.9x	0.77	x	2.38	x	91.35	0.63	x	0.7	=	199.32	(81)
Northwest 0.9x	0.77	x	2.38	x	97.38	0.63	x	0.7	=	212.5	(81)
Northwest 0.9x	0.77	x	2.38	x	91.1	0.63	x	0.7	=	198.79	(81)
Northwest 0.9x	0.77	x	2.38	x	72.63	0.63	x	0.7	=	158.48	(81)
Northwest 0.9x	0.77	x	2.38	x	50.42	0.63	x	0.7	=	110.02	(81)
Northwest 0.9x	0.77	x	2.38	x	28.07	0.63	x	0.7	=	61.24	(81)
Northwest 0.9x	0.77	x	2.38	x	14.2	0.63	x	0.7	=	30.98	(81)
Northwest 0.9x	0.77	x	2.38	x	9.21	0.63	x	0.7	=	20.11	(81)

Solar gains in watts, calculated for each month

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

(83)m=	104.91	186.87	277.41	380.13	459.01	470.31	447.35	386.27	312.63	212.39	127.14	88.82	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	412.08	491.74	571.17	656.39	717.72	711.9	678.04	622.57	558.08	475.52	410.5	387.28	(84)
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### 7. Mean internal temperature (heating season)

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

21 (85)

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

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	0.99	0.96	0.89	0.73	0.53	0.39	0.44	0.7	0.94	0.99	1	

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

(87)m=	19.96	20.15	20.43	20.74	20.93	20.99	21	21	20.96	20.69	20.26	19.92	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.02	20.03	20.03	20.04	20.04	20.04	20.03	20.03	20.02	20.02	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.95	0.86	0.67	0.46	0.31	0.35	0.62	0.91	0.98	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.64	18.92	19.31	19.74	19.96	20.03	20.04	20.04	20	19.68	19.08	18.59	(90)
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fLA = Living area ÷ (4) =

0.42 (91)

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

(92)m=	19.2	19.44	19.78	20.16	20.37	20.43	20.44	20.44	20.4	20.1	19.58	19.15	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	------

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

(93)m=	19.2	19.44	19.78	20.16	20.37	20.43	20.44	20.44	20.4	20.1	19.58	19.15	(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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

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Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.86	0.69	0.49	0.34	0.39	0.65	0.91	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	408.77	482.21	542.32	564.62	495.93	347.57	231.04	242.21	364.11	433.65	403.31	384.96	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

(97)m=	921.38	897.21	817.95	686.36	527.39	351.62	231.51	243.15	381.3	578.18	762.02	916.86	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	381.38	278.88	205.07	87.65	23.41	0	0	0	0	107.53	258.27	395.74	(98)
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Total per year (kWh/year) = Sum(98)<sub>1...5,9...12</sub> =

1737.93

Space heating requirement in kWh/m²/year

30.49

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

### Space heating:

Fraction of space heat from secondary/supplementary system

0

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

1

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

1

Efficiency of main space heating system 1

93.4

Efficiency of secondary/supplementary heating system, %

0

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

Space heating requirement (calculated above)

381.38	278.88	205.07	87.65	23.41	0	0	0	0	107.53	258.27	395.74
--------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206)

408.34	298.58	219.56	93.85	25.06	0	0	0	0	115.13	276.52	423.7
--------	--------	--------	-------	-------	---	---	---	---	--------	--------	-------

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

1860.74

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

0

### Water heating

Output from water heater (calculated above)

173.64	151.68	157.81	139.97	135.52	119.36	114.35	127.48	128.88	146.76	156.66	169.56
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Efficiency of water heater

80.3

(217)m=

86.98	86.56	85.71	83.91	81.64	80.3	80.3	80.3	80.3	84.28	86.3	87.11
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	199.64	175.22	184.12	166.81	165.99	148.64	142.41	158.75	160.5	174.13	181.53	194.65	(219)
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Total = Sum(219a)<sub>1...12</sub> =

2052.38

### Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

1860.74

Water heating fuel used

2052.38

Electricity for pumps, fans and electric keep-hot

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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		260.29	(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	=	401.92	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	443.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =				845.23	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	135.09	(268)
Total CO2, kg/year		sum of (265)...(271) =			1019.25	(272)
<b>TER =</b>					17.88	(273)