

SAP WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 2b Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.14 (1a)	2.85 (2a)	219.85 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.14 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	219.85 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0	0 (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) =	0	÷ (5) =	0 (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			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.75 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.75 (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

0.96	0.94	0.92	0.82	0.81	0.71	0.71	0.69	0.75	0.81	0.84	0.88
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1.6	= 3.056		(26)
Windows Type 1			1.86	x 1/[1/(1.6)+0.04]	= 2.8		(27)
Windows Type 2			2.79	x 1/[1/(1.6)+0.04]	= 4.2		(27)
Walls	33.53	11.21	22.32	x 0.3	= 6.7		(29)
Roof	77.14	0	77.14	x 0.18	= 13.89		(30)
Total area of elements, m²			110.67				(31)
Party wall			75.81	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) = 37.62 (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 16.6 (36)

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

Total fabric heat loss (33) + (36) = 54.22 (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=	77.9	76.54	75.18	68.38	67.02	60.22	60.22	58.86	62.94	67.02	69.74	72.46

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

(39)m=	132.12	130.76	129.4	122.6	121.24	114.44	114.44	113.08	117.16	121.24	123.96	126.68
Average = Sum(39) _{1...12} /12=												122.26 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.71	1.7	1.68	1.59	1.57	1.48	1.48	1.47	1.52	1.57	1.61	1.64		
Average = Sum(40) _{1...12} /12=													1.58	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.41

(42)

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

if TFA ≤ 13.9, N = 1

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

91.35

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

(44)m=	100.49	96.83	93.18	89.52	85.87	82.22	82.22	85.87	89.52	93.18	96.83	100.49		
Total = Sum(44) _{1...12} =													1096.21	(44)

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

(45)m=	149.02	130.33	134.49	117.25	112.51	97.08	89.96	103.23	104.47	121.75	132.9	144.32		
Total = Sum(45) _{1...12} =													1437.31	(45)

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

(46)m=	22.35	19.55	20.17	17.59	16.88	14.56	13.49	15.49	15.67	18.26	19.93	21.65		(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

0

(58)

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

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

(59)m=	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) ÷ 365 × (41)m

(61)m=	50.96	44.57	47.48	44.15	43.76	40.54	41.9	43.76	44.15	47.48	47.75	50.96	(61)
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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=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	(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)
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Output from water heater

(64)m=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	
Output from water heater (annual) _{1...12}												1984.77	(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=	62.29	54.48	56.59	50.02	48.35	42.42	40.39	45.26	45.77	52.35	56.13	60.72	(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=	144.38	144.38	144.38	144.38	144.38	144.38	144.38	144.38	144.38	144.38	144.38	144.38	(66)

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

(67)m=	52.73	46.83	38.09	28.83	21.55	18.2	19.66	25.56	34.3	43.56	50.84	54.19	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	318.45	321.75	313.42	295.7	273.32	252.29	238.24	234.93	243.26	260.99	283.36	304.4	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	51.84	51.84	51.84	51.84	51.84	51.84	51.84	51.84	51.84	51.84	51.84	51.84	(69)
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Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	(71)
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Water heating gains (Table 5)

(72)m=	83.72	81.07	76.06	69.48	64.98	58.91	54.28	60.84	63.57	70.36	77.95	81.62	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	557.87	552.62	530.54	496.98	462.83	432.37	415.15	424.3	444.11	477.88	515.12	543.18	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.4	x	0.7	=	39.84	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.4	x	0.7	=	67.86	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.4	x	0.7	=	92.85	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.4	x	0.7	=	115.04	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.4	x	0.7	=	128.86	(77)

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Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.4	x	0.7	=	127.93	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.4	x	0.7	=	123.33	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.4	x	0.7	=	113.03	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.4	x	0.7	=	100.53	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.4	x	0.7	=	75	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.4	x	0.7	=	47.72	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.4	x	0.7	=	34.09	(77)
Northwest 0.9x	0.77	x	1.86	x	11.28	x	0.4	x	0.7	=	8.14	(81)
Northwest 0.9x	0.77	x	1.86	x	22.97	x	0.4	x	0.7	=	16.58	(81)
Northwest 0.9x	0.77	x	1.86	x	41.38	x	0.4	x	0.7	=	29.87	(81)
Northwest 0.9x	0.77	x	1.86	x	67.96	x	0.4	x	0.7	=	49.05	(81)
Northwest 0.9x	0.77	x	1.86	x	91.35	x	0.4	x	0.7	=	65.94	(81)
Northwest 0.9x	0.77	x	1.86	x	97.38	x	0.4	x	0.7	=	70.29	(81)
Northwest 0.9x	0.77	x	1.86	x	91.1	x	0.4	x	0.7	=	65.76	(81)
Northwest 0.9x	0.77	x	1.86	x	72.63	x	0.4	x	0.7	=	52.42	(81)
Northwest 0.9x	0.77	x	1.86	x	50.42	x	0.4	x	0.7	=	36.4	(81)
Northwest 0.9x	0.77	x	1.86	x	28.07	x	0.4	x	0.7	=	20.26	(81)
Northwest 0.9x	0.77	x	1.86	x	14.2	x	0.4	x	0.7	=	10.25	(81)
Northwest 0.9x	0.77	x	1.86	x	9.21	x	0.4	x	0.7	=	6.65	(81)

Solar gains in watts, calculated for each month

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

(83)m=	47.98	84.44	122.72	164.1	194.79	198.22	189.09	165.45	136.93	95.26	57.96	40.74	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	605.85	637.06	653.26	661.08	657.62	630.59	604.25	589.75	581.04	573.14	573.09	583.92	(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)
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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	0.99	0.99	0.98	0.95	0.86	0.73	0.75	0.91	0.98	0.99	0.99	(86)

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

(87)m=	19.23	19.37	19.63	20.06	20.43	20.78	20.93	20.91	20.68	20.21	19.7	19.27	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.53	19.54	19.56	19.62	19.63	19.7	19.7	19.71	19.67	19.63	19.61	19.58	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.97	0.92	0.77	0.56	0.6	0.85	0.96	0.99	0.99	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.25	17.46	17.85	18.5	19.04	19.54	19.67	19.67	19.4	18.73	17.99	17.34	(90)
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fLA = Living area ÷ (4) =

0.48 (91)

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

(92)m=	18.2	18.38	18.71	19.25	19.71	20.14	20.28	20.27	20.02	19.44	18.81	18.27	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.2	18.38	18.71	19.25	19.71	20.14	20.28	20.27	20.02	19.44	18.81	18.27	(93)
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8. Space heating requirement

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

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

(94)m=	0.99	0.99	0.98	0.96	0.92	0.81	0.64	0.67	0.87	0.96	0.98	0.99	(94)
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Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	599.14	627.86	639.21	635.36	604.28	508.74	386.64	396.22	503.13	549.54	563.59	578.37	(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, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1837.16	1762.91	1580.3	1269.34	971.22	633.82	420.74	437.87	693.61	1072.32	1452.2	1782.93	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	921.09	762.75	700.17	456.46	273.01	0	0	0	0	388.95	639.8	896.19	
Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$												5038.41	(98)

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

65.32	(99)
-------	------

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

Space heating:

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

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

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

Efficiency of main space heating system 1 90.3 (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)

921.09	762.75	700.17	456.46	273.01	0	0	0	0	388.95	639.8	896.19
--------	--------	--------	--------	--------	---	---	---	---	--------	-------	--------

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

1020.03	844.69	775.38	505.49	302.33	0	0	0	0	430.73	708.53	992.46
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Total ($kWh/year$) = $Sum(211)_{1..5,10..12} =$ 5579.63 (211)

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

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

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

Water heating

Output from water heater (calculated above)

199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27
--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater 81 (216)

(217)m= 88.49 88.41 88.21 87.67 86.68 81 81 81 81 87.26 88.07 88.48 (217)

Fuel for water heating, $kWh/month$

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

(219)m=	225.99	197.84	206.29	184.1	180.28	169.91	162.79	181.47	183.48	193.93	205.11	220.69	
Total = $Sum(219a)_{1..12} =$												2311.89	(219)

Annual totals

Space heating fuel used, main system 1

$kWh/year$ $kWh/year$

5579.63

SAP WorkSheet: New dwelling created by change of use

Water heating fuel used		2311.89	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.39		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	316.39	(231)
Electricity for lighting		372.47	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		8580.4	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	194.17 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	80.45 (247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	41.73 (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 =	49.13 (250)
Additional standing charges (Table 12)				120 (251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =			485.49 (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] =	1.67	(257)
SAP rating (Section 12)		76.71	(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	=	1205.2 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	499.37 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1704.57 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	164.21 (267)
Electricity for lighting	(232) x	0.519	=	193.31 (268)
Total CO2, kg/year		sum of (265)...(271) =		2062.09 (272)
CO2 emissions per m²		(272) ÷ (4) =		26.73 (273)

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El rating (section 14)

77

(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	6807.15	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2820.51	(264)
Space and water heating	(261) + (262) + (263) + (264) =			9627.66	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	971.33	(267)
Electricity for lighting	(232) x	0	=	1143.5	(268)
'Total Primary Energy		sum of (265)...(271) =		11742.49	(272)
Primary energy kWh/m ² /year		(272) ÷ (4) =		152.22	(273)

TFEE WorkSheet: New dwelling created by change of use

User Details:

Assessor Name:	Sean Mills	Stroma Number:	STRO034864
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.5.60

Property Address: Flat 2b Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	77.14	(1a) ×	2.85	(2a) =	219.85 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.14	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			219.85 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (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]×0.1 =	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 × (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)			0.39 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 × (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.39 (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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TFEE WorkSheet: New dwelling created by change of use

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

0.49	0.48	0.47	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.43	0.45
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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= 0.62 0.62 0.61 0.59 0.59 0.57 0.57 0.56 0.57 0.59 0.59 0.6 (24d)

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

(25)m= 0.62 0.62 0.61 0.59 0.59 0.57 0.57 0.56 0.57 0.59 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1	= 1.91		(26)
Windows Type 1			1.86	x 1/[1/(1.4)+0.04]	= 2.47		(27)
Windows Type 2			2.79	x 1/[1/(1.4)+0.04]	= 3.7		(27)
Walls	33.53	11.21	22.32	x 0.18	= 4.02		(29)
Roof	77.14	0	77.14	x 0.13	= 10.03		(30)
Total area of elements, m²			110.67				(31)
Party wall			75.81	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) = 28.29 (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 5.53 (36)

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

Total fabric heat loss (33) + (36) = 33.82 (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=	45.08	44.74	44.4	42.83	42.54	41.16	41.16	40.91	41.69	42.54	43.13	43.75

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

(39)m=	78.9	78.56	78.22	76.65	76.35	74.98	74.98	74.73	75.51	76.35	76.95	77.57
Average = Sum(39) _{1...12} /12=												76.65 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.02	1.02	1.01	0.99	0.99	0.97	0.97	0.97	0.98	0.99	1	1.01		
													Average = Sum(40) _{1...12} /12=	0.99 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.41

(42)

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

if TFA ≤ 13.9, N = 1

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

91.35

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

(44)m=	100.49	96.83	93.18	89.52	85.87	82.22	82.22	85.87	89.52	93.18	96.83	100.49		
													Total = Sum(44) _{1...12} =	1096.21 (44)

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

(45)m=	149.02	130.33	134.49	117.25	112.51	97.08	89.96	103.23	104.47	121.75	132.9	144.32		
													Total = Sum(45) _{1...12} =	1437.31 (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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

0

(58)

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

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

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

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

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

(62)m=	126.67	110.78	114.32	99.66	95.63	82.52	76.47	87.75	88.8	103.48	112.96	122.67	(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	(63)
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Output from water heater

(64)m=	126.67	110.78	114.32	99.66	95.63	82.52	76.47	87.75	88.8	103.48	112.96	122.67	
Output from water heater (annual) _{1...12}												1221.71	(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=	31.67	27.7	28.58	24.92	23.91	20.63	19.12	21.94	22.2	25.87	28.24	30.67	(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=	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	(66)

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

(67)m=	21.09	18.73	15.23	11.53	8.62	7.28	7.86	10.22	13.72	17.42	20.33	21.68	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	213.36	215.57	209.99	198.12	183.12	169.03	159.62	157.4	162.98	174.86	189.85	203.95	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	42.56	41.21	38.41	34.61	32.13	28.65	25.7	29.49	30.83	34.77	39.22	41.22	(72)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(73)m=	336.11	334.62	322.74	303.35	282.97	264.06	252.27	256.21	266.63	286.15	308.51	325.94	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.63	x	0.7	=	62.75	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.63	x	0.7	=	106.88	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.63	x	0.7	=	146.24	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.63	x	0.7	=	181.19	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.63	x	0.7	=	202.95	(77)

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Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.63	x	0.7	=	201.48	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.63	x	0.7	=	194.25	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.63	x	0.7	=	178.02	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.63	x	0.7	=	158.34	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.63	x	0.7	=	118.12	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.63	x	0.7	=	75.15	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.63	x	0.7	=	53.7	(77)
Northwest 0.9x	0.77	x	1.86	x	11.28	x	0.63	x	0.7	=	12.83	(81)
Northwest 0.9x	0.77	x	1.86	x	22.97	x	0.63	x	0.7	=	26.11	(81)
Northwest 0.9x	0.77	x	1.86	x	41.38	x	0.63	x	0.7	=	47.04	(81)
Northwest 0.9x	0.77	x	1.86	x	67.96	x	0.63	x	0.7	=	77.26	(81)
Northwest 0.9x	0.77	x	1.86	x	91.35	x	0.63	x	0.7	=	103.85	(81)
Northwest 0.9x	0.77	x	1.86	x	97.38	x	0.63	x	0.7	=	110.71	(81)
Northwest 0.9x	0.77	x	1.86	x	91.1	x	0.63	x	0.7	=	103.57	(81)
Northwest 0.9x	0.77	x	1.86	x	72.63	x	0.63	x	0.7	=	82.57	(81)
Northwest 0.9x	0.77	x	1.86	x	50.42	x	0.63	x	0.7	=	57.32	(81)
Northwest 0.9x	0.77	x	1.86	x	28.07	x	0.63	x	0.7	=	31.91	(81)
Northwest 0.9x	0.77	x	1.86	x	14.2	x	0.63	x	0.7	=	16.14	(81)
Northwest 0.9x	0.77	x	1.86	x	9.21	x	0.63	x	0.7	=	10.48	(81)

Solar gains in watts, calculated for each month

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

(83)m=	75.57	132.99	193.28	258.45	306.8	312.2	297.82	260.59	215.66	150.03	91.29	64.17	(83)
--------	-------	--------	--------	--------	-------	-------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	411.68	467.6	516.02	561.8	589.78	576.26	550.1	516.8	482.3	436.18	399.8	390.11	(84)
--------	--------	-------	--------	-------	--------	--------	-------	-------	-------	--------	-------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.92	0.76	0.59	0.64	0.88	0.98	1	1	(86)

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

(87)m=	19.87	20	20.22	20.52	20.79	20.95	20.99	20.99	20.88	20.54	20.16	19.86	(87)
--------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.06	20.07	20.07	20.09	20.09	20.11	20.11	20.11	20.1	20.09	20.09	20.08	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.97	0.88	0.68	0.47	0.53	0.82	0.98	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	19.03	19.16	19.38	19.69	19.94	20.08	20.1	20.1	20.03	19.72	19.33	19.03	(90)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.48

(91)

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

(92)m=	19.43	19.57	19.79	20.1	20.35	20.5	20.53	20.53	20.44	20.12	19.73	19.43	(92)
--------	-------	-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	------

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

TFEE WorkSheet: New dwelling created by change of use

(93)m=	19.43	19.57	19.79	20.1	20.35	20.5	20.53	20.53	20.44	20.12	19.73	19.43	(93)
--------	-------	-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	1	1	0.99	0.97	0.89	0.72	0.53	0.58	0.85	0.98	1	1	(94)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(95)m=	410.93	465.73	510.69	543.04	527.19	415.59	291.06	302.13	409.13	426.23	398.23	389.58	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1194.09	1152.4	1039.59	858.13	660.48	442.54	294.88	308.65	478.81	726.59	972.08	1181.27	(97)
--------	---------	--------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	582.67	461.44	393.5	226.87	99.17	0	0	0	0	223.47	413.17	589.01	
--------	--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 2989.29 (98)

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

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

(100)m=	0	0	0	0	0	704.84	554.88	567.94	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss h_m

(101)m=	0	0	0	0	0	0.88	0.94	0.92	0	0	0	0	(101)
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Useful loss, $h_m L_m$ (Watts) = $(100)m \times (101)m$

(102)m=	0	0	0	0	0	623.21	522.68	524.47	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	764.02	731.67	694.53	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

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

(104)m=	0	0	0	0	0	101.38	155.49	126.52	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = $Sum(104) =$ 383.39 (104)

Cooled fraction

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

Intermittency factor (Table 10b)

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

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

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

(107)m=	0	0	0	0	0	25.34	38.87	31.63	0	0	0	0	
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Total = $Sum(107) =$ 95.85 (107)

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

$(107) \div (4) =$ 1.24 (108)

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

Fabric Energy Efficiency $(99) + (108) =$ 39.99 (109)

Target Fabric Energy Efficiency (TFEE) 45.99 (109)

DFEE WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 2b Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.14 (1a)	2.85 (2a)	219.85 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.14 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	219.85 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				3	30 (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) =	30	÷ (5) =	0.14 (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			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.89 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.89 (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 created by change of use

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

1.13	1.11	1.09	0.98	0.95	0.84	0.84	0.82	0.89	0.95	1	1.04
------	------	------	------	------	------	------	------	------	------	---	------

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= 1.13 1.11 1.09 0.98 0.95 0.85 0.85 0.84 0.89 0.95 1 1.04 (24d)

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

(25)m= 1.13 1.11 1.09 0.98 0.95 0.85 0.85 0.84 0.89 0.95 1 1.04 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1.6	= 3.056		(26)
Windows Type 1			1.86	x 1/[1/(1.6)+0.04]	= 2.8		(27)
Windows Type 2			2.79	x 1/[1/(1.6)+0.04]	= 4.2		(27)
Walls	33.53	11.21	22.32	x 0.3	= 6.7		(29)
Roof	77.14	0	77.14	x 0.18	= 13.89		(30)
Total area of elements, m²			110.67				(31)
Party wall			75.81	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) = 37.62 (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 16.6 (36)

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

Total fabric heat loss (33) + (36) = 54.22 (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=	82	80.39	78.78	70.77	69.22	62	62	60.66	64.78	69.22	72.35	75.57

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

(39)m=	136.22	134.61	133.01	124.99	123.44	116.22	116.22	114.89	119	123.44	126.57	129.79
Average = Sum(39) _{1...12} /12=												124.87 (39)

DFEE WorkSheet: New dwelling created by change of use

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.77	1.75	1.72	1.62	1.6	1.51	1.51	1.49	1.54	1.6	1.64	1.68		
Average = Sum(40) _{1...12} /12=													1.62	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.41

(42)

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

if TFA ≤ 13.9, N = 1

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

91.35

(43)

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

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

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

(44)m=	100.49	96.83	93.18	89.52	85.87	82.22	82.22	85.87	89.52	93.18	96.83	100.49		
Total = Sum(44) _{1...12} =													1096.21	(44)

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

(45)m=	149.02	130.33	134.49	117.25	112.51	97.08	89.96	103.23	104.47	121.75	132.9	144.32		
Total = Sum(45) _{1...12} =													1437.31	(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

DFEE WorkSheet: New dwelling created by change of use

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

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)
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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=	126.67	110.78	114.32	99.66	95.63	82.52	76.47	87.75	88.8	103.48	112.96	122.67	(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	(63)
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Output from water heater

(64)m=	126.67	110.78	114.32	99.66	95.63	82.52	76.47	87.75	88.8	103.48	112.96	122.67	
Output from water heater (annual) _{1...12}												1221.71	(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=	31.67	27.7	28.58	24.92	23.91	20.63	19.12	21.94	22.2	25.87	28.24	30.67	(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=	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	(66)

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

(67)m=	21.09	18.73	15.23	11.53	8.62	7.28	7.86	10.22	13.72	17.42	20.33	21.68	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	213.36	215.57	209.99	198.12	183.12	169.03	159.62	157.4	162.98	174.86	189.85	203.95	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	(71)
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Water heating gains (Table 5)

(72)m=	42.56	41.21	38.41	34.61	32.13	28.65	25.7	29.49	30.83	34.77	39.22	41.22	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	336.11	334.62	322.74	303.35	282.97	264.06	252.27	256.21	266.63	286.15	308.51	325.94	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.4	x	0.7	=	39.84	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.4	x	0.7	=	67.86	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.4	x	0.7	=	92.85	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.4	x	0.7	=	115.04	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.4	x	0.7	=	128.86	(77)

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Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.4	x	0.7	=	127.93	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.4	x	0.7	=	123.33	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.4	x	0.7	=	113.03	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.4	x	0.7	=	100.53	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.4	x	0.7	=	75	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.4	x	0.7	=	47.72	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.4	x	0.7	=	34.09	(77)
Northwest 0.9x	0.77	x	1.86	x	11.28	x	0.4	x	0.7	=	8.14	(81)
Northwest 0.9x	0.77	x	1.86	x	22.97	x	0.4	x	0.7	=	16.58	(81)
Northwest 0.9x	0.77	x	1.86	x	41.38	x	0.4	x	0.7	=	29.87	(81)
Northwest 0.9x	0.77	x	1.86	x	67.96	x	0.4	x	0.7	=	49.05	(81)
Northwest 0.9x	0.77	x	1.86	x	91.35	x	0.4	x	0.7	=	65.94	(81)
Northwest 0.9x	0.77	x	1.86	x	97.38	x	0.4	x	0.7	=	70.29	(81)
Northwest 0.9x	0.77	x	1.86	x	91.1	x	0.4	x	0.7	=	65.76	(81)
Northwest 0.9x	0.77	x	1.86	x	72.63	x	0.4	x	0.7	=	52.42	(81)
Northwest 0.9x	0.77	x	1.86	x	50.42	x	0.4	x	0.7	=	36.4	(81)
Northwest 0.9x	0.77	x	1.86	x	28.07	x	0.4	x	0.7	=	20.26	(81)
Northwest 0.9x	0.77	x	1.86	x	14.2	x	0.4	x	0.7	=	10.25	(81)
Northwest 0.9x	0.77	x	1.86	x	9.21	x	0.4	x	0.7	=	6.65	(81)

Solar gains in watts, calculated for each month

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

(83)m=	47.98	84.44	122.72	164.1	194.79	198.22	189.09	165.45	136.93	95.26	57.96	40.74	(83)
--------	-------	-------	--------	-------	--------	--------	--------	--------	--------	-------	-------	-------	------

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

(84)m=	384.09	419.05	445.45	467.45	477.77	462.28	441.37	421.66	403.56	381.41	366.47	366.68	(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)
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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	1	1	0.99	0.98	0.94	0.86	0.88	0.97	0.99	1	1	(86)

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

(87)m=	18.93	19.08	19.36	19.82	20.24	20.65	20.85	20.82	20.51	19.98	19.44	18.99	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.49	19.51	19.52	19.6	19.61	19.68	19.68	19.7	19.66	19.61	19.58	19.55	(88)
--------	-------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(89)m=	1	1	1	0.99	0.97	0.89	0.71	0.76	0.94	0.99	1	1	(89)
--------	---	---	---	------	------	------	------	------	------	------	---	---	------

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

(90)m=	17.65	17.81	18.1	18.62	19.03	19.48	19.63	19.63	19.34	18.79	18.23	17.75	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.48 (91)

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

(92)m=	18.27	18.42	18.71	19.2	19.61	20.04	20.22	20.2	19.9	19.36	18.81	18.35	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.27	18.42	18.71	19.2	19.61	20.04	20.22	20.2	19.9	19.36	18.81	18.35	(93)
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8. Space heating requirement

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

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

(94)m=	1	1	0.99	0.99	0.97	0.91	0.78	0.82	0.95	0.99	1	1	(94)
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Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	383.16	417.54	442.7	461.42	462.23	418.68	345.64	345.09	382.59	377.12	365.15	365.98	(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, L_m , $W = [(39)m \times ((93)m - (96)m)]$

(97)m=	1902.61	1820.19	1624.24	1287.42	976.94	632.43	420.65	437.08	690.67	1081.79	1482.65	1836.06	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	1130.47	942.58	879.07	594.72	382.95	0	0	0	0	524.27	804.6	1093.73	
Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$												6352.39	(98)

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

82.35	(99)
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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 L_m (calculated using $25^\circ C$ internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	1092.5	860.06	873.15	0	0	0	0	(100)
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Utilisation factor for loss h_m

(101)m=	0	0	0	0	0	0.55	0.64	0.62	0	0	0	0	(101)
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Useful loss, $h_m L_m$ (Watts) = $(100)m \times (101)m$

(102)m=	0	0	0	0	0	600.46	553.25	541.02	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	630.8	604.58	583.33	0	0	0	0	(103)
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Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set $(104)m$ to zero if $(104)m < 3 \times (98)m$

(104)m=	0	0	0	0	0	21.84	38.19	31.48	0	0	0	0	
Total = $Sum(104) =$												91.51	(104)
Cooled fraction $f_C = \text{cooled area} \div (4) =$												1	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = $Sum(106) =$												0	(106)

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

(107)m=	0	0	0	0	0	5.46	9.55	7.87	0	0	0	0	
Total = $Sum(107) =$												22.88	(107)

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

$(107) \div (4) =$

0.3	(108)
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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency $(99) + (108) =$

82.65	(109)
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DER WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 2b Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.14 (1a)	2.85 (2a)	219.85 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.14 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	219.85 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0	0 (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) =	0	÷ (5) =	0 (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			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.75 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.75 (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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DER WorkSheet: New dwelling created by change of use

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

0.96	0.94	0.92	0.82	0.81	0.71	0.71	0.69	0.75	0.81	0.84	0.88
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1.6	= 3.056		(26)
Windows Type 1			1.86	x 1/[1/(1.6)+0.04]	= 2.8		(27)
Windows Type 2			2.79	x 1/[1/(1.6)+0.04]	= 4.2		(27)
Walls	33.53	11.21	22.32	x 0.3	= 6.7		(29)
Roof	77.14	0	77.14	x 0.18	= 13.89		(30)
Total area of elements, m²			110.67				(31)
Party wall			75.81	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) = 37.62 (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 16.6 (36)

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

Total fabric heat loss (33) + (36) = 54.22 (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=	77.9	76.54	75.18	68.38	67.02	60.22	60.22	58.86	62.94	67.02	69.74	72.46

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

(39)m=	132.12	130.76	129.4	122.6	121.24	114.44	114.44	113.08	117.16	121.24	123.96	126.68
Average = Sum(39) _{1...12} /12=												122.26

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.71	1.7	1.68	1.59	1.57	1.48	1.48	1.47	1.52	1.57	1.61	1.64		
	Average = Sum(40) _{1...12} /12=												1.58	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.41

(42)

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

if TFA ≤ 13.9, N = 1

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

91.35

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

(44)m=	100.49	96.83	93.18	89.52	85.87	82.22	82.22	85.87	89.52	93.18	96.83	100.49		
	Total = Sum(44) _{1...12} =												1096.21	(44)

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

(45)m=	149.02	130.33	134.49	117.25	112.51	97.08	89.96	103.23	104.47	121.75	132.9	144.32		
	Total = Sum(45) _{1...12} =												1437.31	(45)

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

(46)m=	22.35	19.55	20.17	17.59	16.88	14.56	13.49	15.49	15.67	18.26	19.93	21.65		(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

0

(58)

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

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

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
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DER WorkSheet: New dwelling created by change of use

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

(61)m=	50.96	44.57	47.48	44.15	43.76	40.54	41.9	43.76	44.15	47.48	47.75	50.96	(61)
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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=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	(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)
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Output from water heater

(64)m=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	
Output from water heater (annual) _{1...12}												1984.77	(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=	62.29	54.48	56.59	50.02	48.35	42.42	40.39	45.26	45.77	52.35	56.13	60.72	(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=	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	(66)

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

(67)m=	21.09	18.73	15.23	11.53	8.62	7.28	7.86	10.22	13.72	17.42	20.33	21.68	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	213.36	215.57	209.99	198.12	183.12	169.03	159.62	157.4	162.98	174.86	189.85	203.95	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	(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=	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	83.72	81.07	76.06	69.48	64.98	58.91	54.28	60.84	63.57	70.36	77.95	81.62	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	380.27	377.47	363.38	341.22	318.82	297.32	283.86	290.56	302.37	324.74	350.24	369.34	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.4	x	0.7	=	39.84	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.4	x	0.7	=	67.86	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.4	x	0.7	=	92.85	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.4	x	0.7	=	115.04	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.4	x	0.7	=	128.86	(77)

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Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.4	x	0.7	=	127.93	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.4	x	0.7	=	123.33	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.4	x	0.7	=	113.03	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.4	x	0.7	=	100.53	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.4	x	0.7	=	75	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.4	x	0.7	=	47.72	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.4	x	0.7	=	34.09	(77)
Northwest 0.9x	0.77	x	1.86	x	11.28	x	0.4	x	0.7	=	8.14	(81)
Northwest 0.9x	0.77	x	1.86	x	22.97	x	0.4	x	0.7	=	16.58	(81)
Northwest 0.9x	0.77	x	1.86	x	41.38	x	0.4	x	0.7	=	29.87	(81)
Northwest 0.9x	0.77	x	1.86	x	67.96	x	0.4	x	0.7	=	49.05	(81)
Northwest 0.9x	0.77	x	1.86	x	91.35	x	0.4	x	0.7	=	65.94	(81)
Northwest 0.9x	0.77	x	1.86	x	97.38	x	0.4	x	0.7	=	70.29	(81)
Northwest 0.9x	0.77	x	1.86	x	91.1	x	0.4	x	0.7	=	65.76	(81)
Northwest 0.9x	0.77	x	1.86	x	72.63	x	0.4	x	0.7	=	52.42	(81)
Northwest 0.9x	0.77	x	1.86	x	50.42	x	0.4	x	0.7	=	36.4	(81)
Northwest 0.9x	0.77	x	1.86	x	28.07	x	0.4	x	0.7	=	20.26	(81)
Northwest 0.9x	0.77	x	1.86	x	14.2	x	0.4	x	0.7	=	10.25	(81)
Northwest 0.9x	0.77	x	1.86	x	9.21	x	0.4	x	0.7	=	6.65	(81)

Solar gains in watts, calculated for each month

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

(83)m=	47.98	84.44	122.72	164.1	194.79	198.22	189.09	165.45	136.93	95.26	57.96	40.74	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	428.25	461.91	486.1	505.32	513.62	495.54	472.96	456.01	439.3	420	408.2	410.08	(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)
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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	1	1	0.99	0.98	0.93	0.83	0.86	0.96	0.99	1	1	(86)

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

(87)m=	19.04	19.18	19.45	19.89	20.29	20.69	20.87	20.85	20.56	20.05	19.52	19.08	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.53	19.54	19.56	19.62	19.63	19.7	19.7	19.71	19.67	19.63	19.61	19.58	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.99	0.96	0.86	0.68	0.72	0.92	0.99	1	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.97	17.18	17.59	18.27	18.86	19.44	19.64	19.64	19.26	18.51	17.72	17.06	(90)
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fLA = Living area ÷ (4) =

0.48 (91)

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

(92)m=	17.97	18.15	18.49	19.05	19.55	20.04	20.24	20.22	19.89	19.25	18.59	18.04	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	17.97	18.15	18.49	19.05	19.55	20.04	20.24	20.22	19.89	19.25	18.59	18.04	(93)
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8. Space heating requirement

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

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

(94)m=	1	0.99	0.99	0.98	0.96	0.88	0.75	0.78	0.93	0.98	0.99	1	(94)
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Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	426.66	459.46	481.84	496.4	491.85	438.28	354.72	357.48	409.25	413.12	405.92	408.86	(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, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1805.66	1732.31	1551.8	1245	951.71	622.67	416.05	432.18	678.07	1048.66	1424.62	1752.92	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	1025.97	855.35	796.05	538.99	342.14	0	0	0	0	472.85	733.46	999.99	
Total per year (kWh/year) = Sum(98) _{1..5,9..12} =												5764.8	(98)

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

74.73	(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 90.3 (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)

1025.97	855.35	796.05	538.99	342.14	0	0	0	0	472.85	733.46	999.99
---------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

1136.18	947.24	881.56	596.89	378.89	0	0	0	0	523.64	812.25	1107.4
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Total (kWh/year) = Sum(211)_{1..5,10..12} = 6384.06 (211)

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

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

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

Water heating

Output from water heater (calculated above)

199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27
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Efficiency of water heater 81 (216)

(217)m= (217)

88.64	88.57	88.41	87.97	87.16	81	81	81	81	87.65	88.3	88.64
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Fuel for water heating, $kWh/month$

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

(219)m=	225.61	197.46	205.83	183.47	179.28	169.91	162.79	181.47	183.48	193.08	204.59	220.31	
Total = Sum(219a) _{1..12} =												2307.27	(219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

6384.06

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Water heating fuel used		2307.27	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.39		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =		316.39 (231)
Electricity for lighting		372.47	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		9380.2	(338)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1378.96	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	498.37	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1877.33	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	164.21	(267)
Electricity for lighting	(232) x	0.519	=	193.31	(268)
Total CO2, kg/year	sum of (265)...(271) =			2234.85	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			28.97	(273)
El rating (section 14)				75	(274)

TER WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 2b Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.14 (1a)	2.85 (2a)	219.85 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.14 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	219.85 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				3	30 (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) =	30	÷ (5) =	0.14 (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)			0.39 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.39 (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

0.49	0.48	0.47	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.43	0.45
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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= 0.62 0.62 0.61 0.59 0.59 0.57 0.57 0.56 0.57 0.59 0.59 0.6 (24d)

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

(25)m= 0.62 0.62 0.61 0.59 0.59 0.57 0.57 0.56 0.57 0.59 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1	= 1.91		(26)
Windows Type 1			1.86	x 1/[1/(1.4)+0.04]	= 2.47		(27)
Windows Type 2			2.79	x 1/[1/(1.4)+0.04]	= 3.7		(27)
Walls	33.53	11.21	22.32	x 0.18	= 4.02		(29)
Roof	77.14	0	77.14	x 0.13	= 10.03		(30)
Total area of elements, m²			110.67				(31)
Party wall			75.81	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) = 28.29 (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 5.53 (36)

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

Total fabric heat loss (33) + (36) = 33.82 (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=	45.08	44.74	44.4	42.83	42.54	41.16	41.16	40.91	41.69	42.54	43.13	43.75

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

(39)m=	78.9	78.56	78.22	76.65	76.35	74.98	74.98	74.73	75.51	76.35	76.95	77.57
Average = Sum(39) _{1...12} /12=												76.65 (39)

TER WorkSheet: New dwelling created by change of use

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.02	1.02	1.01	0.99	0.99	0.97	0.97	0.97	0.98	0.99	1	1.01		
Average = Sum(40) _{1...12} /12=													0.99	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.41

(42)

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

if TFA ≤ 13.9, N = 1

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

91.35

(43)

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

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

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

(44)m=	100.49	96.83	93.18	89.52	85.87	82.22	82.22	85.87	89.52	93.18	96.83	100.49		
Total = Sum(44) _{1...12} =													1096.21	(44)

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

(45)m=	149.02	130.33	134.49	117.25	112.51	97.08	89.96	103.23	104.47	121.75	132.9	144.32		
Total = Sum(45) _{1...12} =													1437.31	(45)

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

(46)m=	22.35	19.55	20.17	17.59	16.88	14.56	13.49	15.49	15.67	18.26	19.93	21.65		(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

TER WorkSheet: New dwelling created by change of use

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

(61)m=	50.96	44.57	47.48	44.15	43.76	40.54	41.9	43.76	44.15	47.48	47.75	50.96	(61)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(62)m=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	(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=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	
Output from water heater (annual) _{1...12}												1984.77	(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=	62.29	54.48	56.59	50.02	48.35	42.42	40.39	45.26	45.77	52.35	56.13	60.72	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	(66)

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

(67)m=	21.09	18.73	15.23	11.53	8.62	7.28	7.86	10.22	13.72	17.42	20.33	21.68	(67)
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=	213.36	215.57	209.99	198.12	183.12	169.03	159.62	157.4	162.98	174.86	189.85	203.95	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	(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=	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	83.72	81.07	76.06	69.48	64.98	58.91	54.28	60.84	63.57	70.36	77.95	81.62	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	380.27	377.47	363.38	341.22	318.82	297.32	283.86	290.56	302.37	324.74	350.24	369.34	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.63	x	0.7	=	62.75	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.63	x	0.7	=	106.88	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.63	x	0.7	=	146.24	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.63	x	0.7	=	181.19	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.63	x	0.7	=	202.95	(77)

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Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.63	x	0.7	=	201.48	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.63	x	0.7	=	194.25	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.63	x	0.7	=	178.02	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.63	x	0.7	=	158.34	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.63	x	0.7	=	118.12	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.63	x	0.7	=	75.15	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.63	x	0.7	=	53.7	(77)
Northwest 0.9x	0.77	x	1.86	x	11.28	x	0.63	x	0.7	=	12.83	(81)
Northwest 0.9x	0.77	x	1.86	x	22.97	x	0.63	x	0.7	=	26.11	(81)
Northwest 0.9x	0.77	x	1.86	x	41.38	x	0.63	x	0.7	=	47.04	(81)
Northwest 0.9x	0.77	x	1.86	x	67.96	x	0.63	x	0.7	=	77.26	(81)
Northwest 0.9x	0.77	x	1.86	x	91.35	x	0.63	x	0.7	=	103.85	(81)
Northwest 0.9x	0.77	x	1.86	x	97.38	x	0.63	x	0.7	=	110.71	(81)
Northwest 0.9x	0.77	x	1.86	x	91.1	x	0.63	x	0.7	=	103.57	(81)
Northwest 0.9x	0.77	x	1.86	x	72.63	x	0.63	x	0.7	=	82.57	(81)
Northwest 0.9x	0.77	x	1.86	x	50.42	x	0.63	x	0.7	=	57.32	(81)
Northwest 0.9x	0.77	x	1.86	x	28.07	x	0.63	x	0.7	=	31.91	(81)
Northwest 0.9x	0.77	x	1.86	x	14.2	x	0.63	x	0.7	=	16.14	(81)
Northwest 0.9x	0.77	x	1.86	x	9.21	x	0.63	x	0.7	=	10.48	(81)

Solar gains in watts, calculated for each month

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

(83)m=	75.57	132.99	193.28	258.45	306.8	312.2	297.82	260.59	215.66	150.03	91.29	64.17	(83)
--------	-------	--------	--------	--------	-------	-------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	455.84	510.46	556.66	599.67	625.63	609.52	581.68	551.15	518.04	474.78	441.53	433.51	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.9	0.73	0.56	0.61	0.85	0.98	1	1	(86)

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

(87)m=	19.92	20.06	20.27	20.57	20.81	20.96	20.99	20.99	20.9	20.59	20.21	19.91	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(88)m=	20.06	20.07	20.07	20.09	20.09	20.11	20.11	20.11	20.1	20.09	20.09	20.08	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	1	0.99	0.99	0.96	0.86	0.65	0.45	0.5	0.79	0.97	0.99	1	(89)
--------	---	------	------	------	------	------	------	-----	------	------	------	---	------

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

(90)m=	18.62	18.82	19.13	19.57	19.9	20.08	20.1	20.1	20.02	19.6	19.06	18.62	(90)
--------	-------	-------	-------	-------	------	-------	------	------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =

0.48

(91)

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

(92)m=	19.25	19.42	19.68	20.05	20.34	20.5	20.53	20.53	20.45	20.08	19.62	19.24	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

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(93)m=	19.25	19.42	19.68	20.05	20.34	20.5	20.53	20.53	20.45	20.08	19.62	19.24	(93)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	1	0.99	0.98	0.96	0.87	0.69	0.5	0.55	0.82	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	-----	------	------	------	------	---	------

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

(95)m=	454.38	507.18	548.23	573.06	545.53	421.03	292.01	303.9	422.84	458.91	438.58	432.45	(95)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1179.75	1140.41	1031.32	854.59	659.97	442.71	294.94	308.76	479.13	723.71	963.04	1166.83	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	539.68	425.54	359.41	202.7	85.14	0	0	0	0	197.01	377.61	546.38	
--------	--------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------	--

Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 2733.47 (98)

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

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

1 (204)

Efficiency of main space heating system 1

93.4 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

539.68	425.54	359.41	202.7	85.14	0	0	0	0	197.01	377.61	546.38
--------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------

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

577.81	455.61	384.81	217.02	91.15	0	0	0	0	210.93	404.3	584.99
--------	--------	--------	--------	-------	---	---	---	---	--------	-------	--------

Total ($kWh/year$) = $Sum(211)_{1..5,10..12} =$ 2926.62 (211)

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

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

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

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

Water heating

Output from water heater (calculated above)

199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27
--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

80.3 (216)

(217)m=	87.43	87.2	86.73	85.63	83.59	80.3	80.3	80.3	80.3	85.43	86.86	87.5	(217)
---------	-------	------	-------	-------	-------	------	------	------	------	-------	-------	------	-------

Fuel for water heating, $kWh/month$

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

(219)m=	228.74	200.56	209.81	188.5	186.93	171.39	164.21	183.05	185.08	198.08	207.97	223.17	
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Total = $Sum(219a)_{1..12} =$ 2347.48 (219)

Annual totals

$kWh/year$

$kWh/year$

Space heating fuel used, main system 1

2926.62

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Water heating fuel used			2347.48	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =		75	(231)
Electricity for lighting			372.47	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			5721.58	(338)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	632.15	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	507.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1139.21	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	193.31	(268)
Total CO2, kg/year		sum of (265)...(271) =			1371.45	(272)

TER = 17.78 (273)

SAP WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 1d Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.11 (1a)	2.85 (2a)	205.51 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.11 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.51 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0	0 (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) =	0	÷ (5) =	0 (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			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.75 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.75 (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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SAP WorkSheet: New dwelling created by change of use

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

0.96	0.94	0.92	0.82	0.81	0.71	0.71	0.69	0.75	0.81	0.84	0.88
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1.6	= 3.056		(26)
Windows Type 1			2.79	x 1/[1/(1.6)+0.04]	= 4.2		(27)
Windows Type 2			1.02	x 1/[1/(1.6)+0.04]	= 1.53		(27)
Windows Type 3			2.48	x 1/[1/(1.6)+0.04]	= 3.73		(27)
Walls	39.35	8.2	31.15	x 0.3	= 9.34		(29)
Roof	72.11	0	72.11	x 0.18	= 12.98		(30)
Total area of elements, m²			111.46				(31)
Party wall			75.81	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) = 34.84 (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 16.72 (36)

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

Total fabric heat loss (33) + (36) = 51.56 (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=	72.82	71.55	70.28	63.92	62.65	56.29	56.29	55.02	58.83	62.65	65.19	67.73

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

(39)m=	124.38	123.11	121.84	115.48	114.21	107.85	107.85	106.58	110.39	114.21	116.75	119.29
Average = Sum(39) _{1...12} /12=												115.16 (39)

SAP WorkSheet: New dwelling created by change of use

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.72	1.71	1.69	1.6	1.58	1.5	1.5	1.48	1.53	1.58	1.62	1.65		
Average = Sum(40) _{1...12} /12=													1.6	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.3

(42)

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

if TFA ≤ 13.9, N = 1

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

88.74

(43)

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

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

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

(44)m=	97.61	94.06	90.51	86.96	83.41	79.86	79.86	83.41	86.96	90.51	94.06	97.61		
Total = Sum(44) _{1...12} =													1064.83	(44)

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

(45)m=	144.75	126.6	130.64	113.9	109.29	94.31	87.39	100.28	101.48	118.26	129.09	140.18		
Total = Sum(45) _{1...12} =													1396.16	(45)

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

(46)m=	21.71	18.99	19.6	17.08	16.39	14.15	13.11	15.04	15.22	17.74	19.36	21.03		(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

SAP WorkSheet: New dwelling created by change of use

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

(61)m=	49.74	43.29	46.12	42.88	42.51	39.38	40.7	42.51	42.88	46.12	46.39	49.74	(61)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(62)m=	194.49	169.89	176.76	156.78	151.79	133.69	128.08	142.78	144.36	164.38	175.48	189.93	(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=	194.49	169.89	176.76	156.78	151.79	133.69	128.08	142.78	144.36	164.38	175.48	189.93	
Output from water heater (annual) _{1...12}												1928.43	(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=	60.57	52.92	54.97	48.59	46.96	41.2	39.23	43.97	44.46	50.85	54.52	59.05	(65)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	137.77	137.77	137.77	137.77	137.77	137.77	137.77	137.77	137.77	137.77	137.77	137.77	(66)

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

(67)m=	53.5	47.52	38.64	29.26	21.87	18.46	19.95	25.93	34.8	44.19	51.58	54.99	(67)
--------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(68)m=	301.75	304.88	296.99	280.19	258.99	239.06	225.74	222.61	230.5	247.3	268.5	288.43	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	--------	------

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

(69)m=	51.07	51.07	51.07	51.07	51.07	51.07	51.07	51.07	51.07	51.07	51.07	51.07	(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=	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	81.4	78.75	73.88	67.49	63.12	57.23	52.73	59.1	61.75	68.35	75.72	79.36	(72)
--------	------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(73)m=	536.65	531.14	509.51	476.93	443.98	414.74	398.42	407.64	427.06	459.84	495.8	522.78	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.48	x	36.79	x	0.4	x	0.7	=	17.71	(77)
Southeast 0.9x	0.77	x	2.48	x	62.67	x	0.4	x	0.7	=	30.16	(77)
Southeast 0.9x	0.77	x	2.48	x	85.75	x	0.4	x	0.7	=	41.27	(77)
Southeast 0.9x	0.77	x	2.48	x	106.25	x	0.4	x	0.7	=	51.13	(77)
Southeast 0.9x	0.77	x	2.48	x	119.01	x	0.4	x	0.7	=	57.27	(77)

SAP WorkSheet: New dwelling created by change of use

Southeast 0.9x	0.77	x	2.48	x	118.15	x	0.4	x	0.7	=	56.86	(77)
Southeast 0.9x	0.77	x	2.48	x	113.91	x	0.4	x	0.7	=	54.82	(77)
Southeast 0.9x	0.77	x	2.48	x	104.39	x	0.4	x	0.7	=	50.23	(77)
Southeast 0.9x	0.77	x	2.48	x	92.85	x	0.4	x	0.7	=	44.68	(77)
Southeast 0.9x	0.77	x	2.48	x	69.27	x	0.4	x	0.7	=	33.33	(77)
Southeast 0.9x	0.77	x	2.48	x	44.07	x	0.4	x	0.7	=	21.21	(77)
Southeast 0.9x	0.77	x	2.48	x	31.49	x	0.4	x	0.7	=	15.15	(77)
Northwest 0.9x	0.77	x	2.79	x	11.28	x	0.4	x	0.7	=	6.11	(81)
Northwest 0.9x	0.77	x	1.02	x	11.28	x	0.4	x	0.7	=	2.23	(81)
Northwest 0.9x	0.77	x	2.79	x	22.97	x	0.4	x	0.7	=	12.43	(81)
Northwest 0.9x	0.77	x	1.02	x	22.97	x	0.4	x	0.7	=	4.55	(81)
Northwest 0.9x	0.77	x	2.79	x	41.38	x	0.4	x	0.7	=	22.4	(81)
Northwest 0.9x	0.77	x	1.02	x	41.38	x	0.4	x	0.7	=	8.19	(81)
Northwest 0.9x	0.77	x	2.79	x	67.96	x	0.4	x	0.7	=	36.79	(81)
Northwest 0.9x	0.77	x	1.02	x	67.96	x	0.4	x	0.7	=	13.45	(81)
Northwest 0.9x	0.77	x	2.79	x	91.35	x	0.4	x	0.7	=	49.45	(81)
Northwest 0.9x	0.77	x	1.02	x	91.35	x	0.4	x	0.7	=	18.08	(81)
Northwest 0.9x	0.77	x	2.79	x	97.38	x	0.4	x	0.7	=	52.72	(81)
Northwest 0.9x	0.77	x	1.02	x	97.38	x	0.4	x	0.7	=	19.27	(81)
Northwest 0.9x	0.77	x	2.79	x	91.1	x	0.4	x	0.7	=	49.32	(81)
Northwest 0.9x	0.77	x	1.02	x	91.1	x	0.4	x	0.7	=	18.03	(81)
Northwest 0.9x	0.77	x	2.79	x	72.63	x	0.4	x	0.7	=	39.32	(81)
Northwest 0.9x	0.77	x	1.02	x	72.63	x	0.4	x	0.7	=	14.37	(81)
Northwest 0.9x	0.77	x	2.79	x	50.42	x	0.4	x	0.7	=	27.3	(81)
Northwest 0.9x	0.77	x	1.02	x	50.42	x	0.4	x	0.7	=	9.98	(81)
Northwest 0.9x	0.77	x	2.79	x	28.07	x	0.4	x	0.7	=	15.19	(81)
Northwest 0.9x	0.77	x	1.02	x	28.07	x	0.4	x	0.7	=	5.56	(81)
Northwest 0.9x	0.77	x	2.79	x	14.2	x	0.4	x	0.7	=	7.69	(81)
Northwest 0.9x	0.77	x	1.02	x	14.2	x	0.4	x	0.7	=	2.81	(81)
Northwest 0.9x	0.77	x	2.79	x	9.21	x	0.4	x	0.7	=	4.99	(81)
Northwest 0.9x	0.77	x	1.02	x	9.21	x	0.4	x	0.7	=	1.82	(81)

Solar gains in watts, calculated for each month

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

(83)m=

26.05	47.14	71.86	101.37	124.8	128.85	122.17	103.93	81.96	54.08	31.7	21.96
-------	-------	-------	--------	-------	--------	--------	--------	-------	-------	------	-------

 (83)

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

(84)m=

562.7	578.28	581.37	578.3	568.78	543.59	520.59	511.57	509.02	513.92	527.51	544.75
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 (84)

7. Mean internal temperature (heating season)

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

21 (85)

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.99	0.99	0.98	0.96	0.89	0.76	0.79	0.92	0.98	0.99	0.99

 (86)

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

(87)m=

19.21	19.34	19.59	20	20.38	20.74	20.91	20.89	20.65	20.17	19.68	19.26
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 (87)

SAP WorkSheet: New dwelling created by change of use

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

(88)m=	19.52	19.54	19.55	19.61	19.63	19.69	19.69	19.7	19.66	19.63	19.6	19.57	(88)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	------

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

(89)m=	0.99	0.99	0.99	0.97	0.93	0.81	0.6	0.63	0.87	0.97	0.99	0.99	(89)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

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

(90)m=	17.22	17.41	17.78	18.42	18.96	19.49	19.65	19.65	19.36	18.68	17.95	17.31	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

$$fLA = \text{Living area} \div (4) = 0.41 \quad (91)$$

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

(92)m=	18.03	18.19	18.51	19.06	19.54	20	20.16	20.16	19.88	19.29	18.65	18.1	(92)
--------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------	------

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

(93)m=	18.03	18.19	18.51	19.06	19.54	20	20.16	20.16	19.88	19.29	18.65	18.1	(93)
--------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.98	0.97	0.93	0.83	0.67	0.7	0.88	0.96	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

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

(95)m=	556.34	570.34	570.14	559.01	529.54	451.44	347.23	356.2	447.9	494.39	518.84	539.39	(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=	1707.15	1635.92	1463.7	1173.52	894.91	582.45	384	400.35	638	991.98	1348.62	1658.36	(97)
--------	---------	---------	--------	---------	--------	--------	-----	--------	-----	--------	---------	---------	------

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

(98)m=	856.2	716.06	664.81	442.45	271.83	0	0	0	0	370.21	597.44	832.51	(98)
--------	-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..5,9..12} = 4751.52 \quad (98)$$

Space heating requirement in kWh/m²/year

$$65.89 \quad (99)$$

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

Space heating:

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

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

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

Efficiency of main space heating system 1 90.3 (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)

856.2	716.06	664.81	442.45	271.83	0	0	0	0	370.21	597.44	832.51
-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

948.18	792.98	736.22	489.97	301.03	0	0	0	0	409.98	661.62	921.94
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..5,10..12} = 5261.93 \quad (211)$$

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

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

SAP WorkSheet: New dwelling created by change of use

Water heating

Output from water heater (calculated above)

194.49	169.89	176.76	156.78	151.79	133.69	128.08	142.78	144.36	164.38	175.48	189.93
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

81

(216)

(217)m=	88.42	88.35	88.17	87.67	86.73	81	81	81	81	87.22	88.01	88.41
---------	-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	219.96	192.29	200.47	178.84	175.01	165.05	158.13	176.28	178.22	188.47	199.39	214.81
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2246.92

(219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

5261.93

Water heating fuel used

2246.92

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

225.65

(230a)

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

300.65

(231)

Electricity for lighting

377.92

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

8187.42

(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	183.12 (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 =	78.19 (247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	39.66 (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 =	49.85 (250)
Additional standing charges (Table 12)				120 (251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost

(245)...(247) + (250)...(254) =

470.81

(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] =	1.69	(257)
SAP rating (Section 12)		76.45	(258)

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

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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SAP WorkSheet: New dwelling created by change of use

Space heating (main system 1)	(211) x	0.216	=	1136.58	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	485.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1621.91	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	156.04	(267)
Electricity for lighting	(232) x	0.519	=	196.14	(268)
Total CO ₂ , kg/year		sum of (265)...(271) =		1974.09	(272)
CO₂ emissions per m²		(272) ÷ (4) =		27.38	(273)
El rating (section 14)				77	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	6419.55	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2741.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			9160.8	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	923.01	(267)
Electricity for lighting	(232) x	0	=	1160.21	(268)
'Total Primary Energy		sum of (265)...(271) =		11244.02	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		155.93	(273)

TFEE WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 1d Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	72.11	(1a) x	2.85	(2a) =	205.51
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.11	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			205.51

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15
<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
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0
<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
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.4
<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			0
Shelter factor	(20) = 1 - [0.075 x (19)] =		1
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.4

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
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TFEE WorkSheet: New dwelling created by change of use

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

0.5	0.49	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47
-----	------	------	------	------	------	------	------	-----	------	------	------

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= 0.63 0.62 0.62 0.59 0.59 0.57 0.57 0.57 0.58 0.59 0.6 0.61 (24d)

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

(25)m= 0.63 0.62 0.62 0.59 0.59 0.57 0.57 0.57 0.58 0.59 0.6 0.61 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1	= 1.91		(26)
Windows Type 1			2.79	x1/[1/(1.4)+ 0.04] =	3.7		(27)
Windows Type 2			1.02	x1/[1/(1.4)+ 0.04] =	1.35		(27)
Windows Type 3			2.48	x1/[1/(1.4)+ 0.04] =	3.29		(27)
Walls	39.35	8.2	31.15	x 0.18	= 5.61		(29)
Roof	72.11	0	72.11	x 0.13	= 9.37		(30)
Total area of elements, m²			111.46				(31)
Party wall			75.81	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) = 25.23 (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 5.57 (36)

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

Total fabric heat loss (33) + (36) = 30.8 (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=	42.55	42.22	41.89	40.34	40.05	38.71	38.71	38.46	39.23	40.05	40.64	41.25

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

(39)m=	73.36	73.02	72.69	71.15	70.86	69.51	69.51	69.26	70.03	70.86	71.44	72.05
Average = Sum(39) _{1...12} /12=												71.15 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.02	1.01	1.01	0.99	0.98	0.96	0.96	0.96	0.97	0.98	0.99	1		
Average = Sum(40) _{1...12} /12=													0.99	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.3

(42)

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

if TFA ≤ 13.9, N = 1

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

88.74

(43)

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

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

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

(44)m=	97.61	94.06	90.51	86.96	83.41	79.86	79.86	83.41	86.96	90.51	94.06	97.61		
Total = Sum(44) _{1...12} =													1064.83	(44)

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

(45)m=	144.75	126.6	130.64	113.9	109.29	94.31	87.39	100.28	101.48	118.26	129.09	140.18		
Total = Sum(45) _{1...12} =													1396.16	(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

TFEE WorkSheet: New dwelling created by change of use

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

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

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

(62)m=	123.04	107.61	111.04	96.81	92.89	80.16	74.28	85.24	86.25	100.52	109.73	119.16	(62)
--------	--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------	------

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	123.04	107.61	111.04	96.81	92.89	80.16	74.28	85.24	86.25	100.52	109.73	119.16	
Output from water heater (annual) _{1...12}												1186.73	(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=	30.76	26.9	27.76	24.2	23.22	20.04	18.57	21.31	21.56	25.13	27.43	29.79	(65)
--------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	(66)

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

(67)m=	21.4	19.01	15.46	11.7	8.75	7.39	7.98	10.37	13.92	17.68	20.63	21.99	(67)
--------	------	-------	-------	------	------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=	202.17	204.27	198.98	187.73	173.52	160.17	151.25	149.15	154.44	165.69	179.9	193.25	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(69)m=	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	(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=	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	41.34	40.03	37.31	33.62	31.21	27.83	24.96	28.64	29.95	33.78	38.1	40.04	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(73)m=	322.36	320.75	309.2	290.49	270.93	252.83	241.63	245.61	255.75	274.59	296.07	312.73	(73)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Southeast 0.9x	0.77	x	2.48	x	36.79	x	0.63	x	0.7	=	27.89	(77)
Southeast 0.9x	0.77	x	2.48	x	62.67	x	0.63	x	0.7	=	47.5	(77)
Southeast 0.9x	0.77	x	2.48	x	85.75	x	0.63	x	0.7	=	64.99	(77)
Southeast 0.9x	0.77	x	2.48	x	106.25	x	0.63	x	0.7	=	80.53	(77)
Southeast 0.9x	0.77	x	2.48	x	119.01	x	0.63	x	0.7	=	90.2	(77)

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Southeast 0.9x	0.77	x	2.48	x	118.15	x	0.63	x	0.7	=	89.55	(77)
Southeast 0.9x	0.77	x	2.48	x	113.91	x	0.63	x	0.7	=	86.33	(77)
Southeast 0.9x	0.77	x	2.48	x	104.39	x	0.63	x	0.7	=	79.12	(77)
Southeast 0.9x	0.77	x	2.48	x	92.85	x	0.63	x	0.7	=	70.37	(77)
Southeast 0.9x	0.77	x	2.48	x	69.27	x	0.63	x	0.7	=	52.5	(77)
Southeast 0.9x	0.77	x	2.48	x	44.07	x	0.63	x	0.7	=	33.4	(77)
Southeast 0.9x	0.77	x	2.48	x	31.49	x	0.63	x	0.7	=	23.87	(77)
Northwest 0.9x	0.77	x	2.79	x	11.28	x	0.63	x	0.7	=	9.62	(81)
Northwest 0.9x	0.77	x	1.02	x	11.28	x	0.63	x	0.7	=	3.52	(81)
Northwest 0.9x	0.77	x	2.79	x	22.97	x	0.63	x	0.7	=	19.58	(81)
Northwest 0.9x	0.77	x	1.02	x	22.97	x	0.63	x	0.7	=	7.16	(81)
Northwest 0.9x	0.77	x	2.79	x	41.38	x	0.63	x	0.7	=	35.28	(81)
Northwest 0.9x	0.77	x	1.02	x	41.38	x	0.63	x	0.7	=	12.9	(81)
Northwest 0.9x	0.77	x	2.79	x	67.96	x	0.63	x	0.7	=	57.94	(81)
Northwest 0.9x	0.77	x	1.02	x	67.96	x	0.63	x	0.7	=	21.18	(81)
Northwest 0.9x	0.77	x	2.79	x	91.35	x	0.63	x	0.7	=	77.89	(81)
Northwest 0.9x	0.77	x	1.02	x	91.35	x	0.63	x	0.7	=	28.47	(81)
Northwest 0.9x	0.77	x	2.79	x	97.38	x	0.63	x	0.7	=	83.04	(81)
Northwest 0.9x	0.77	x	1.02	x	97.38	x	0.63	x	0.7	=	30.36	(81)
Northwest 0.9x	0.77	x	2.79	x	91.1	x	0.63	x	0.7	=	77.68	(81)
Northwest 0.9x	0.77	x	1.02	x	91.1	x	0.63	x	0.7	=	28.4	(81)
Northwest 0.9x	0.77	x	2.79	x	72.63	x	0.63	x	0.7	=	61.93	(81)
Northwest 0.9x	0.77	x	1.02	x	72.63	x	0.63	x	0.7	=	22.64	(81)
Northwest 0.9x	0.77	x	2.79	x	50.42	x	0.63	x	0.7	=	42.99	(81)
Northwest 0.9x	0.77	x	1.02	x	50.42	x	0.63	x	0.7	=	15.72	(81)
Northwest 0.9x	0.77	x	2.79	x	28.07	x	0.63	x	0.7	=	23.93	(81)
Northwest 0.9x	0.77	x	1.02	x	28.07	x	0.63	x	0.7	=	8.75	(81)
Northwest 0.9x	0.77	x	2.79	x	14.2	x	0.63	x	0.7	=	12.11	(81)
Northwest 0.9x	0.77	x	1.02	x	14.2	x	0.63	x	0.7	=	4.43	(81)
Northwest 0.9x	0.77	x	2.79	x	9.21	x	0.63	x	0.7	=	7.86	(81)
Northwest 0.9x	0.77	x	1.02	x	9.21	x	0.63	x	0.7	=	2.87	(81)

Solar gains in watts, calculated for each month

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

(83)m=

41.02	74.24	113.17	159.66	196.56	202.94	192.41	163.69	129.08	85.18	49.93	34.59
-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------

 (83)

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

(84)m=

363.38	395	422.37	450.15	467.49	455.77	434.04	409.29	384.83	359.77	346.01	347.32
--------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	1	0.99	0.95	0.84	0.67	0.73	0.93	0.99	1	1

 (86)

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

(87)m=

19.85	19.96	20.15	20.44	20.71	20.92	20.98	20.97	20.83	20.49	20.13	19.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

TFEE WorkSheet: New dwelling created by change of use

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

(88)m=	20.07	20.07	20.08	20.09	20.1	20.11	20.11	20.12	20.11	20.1	20.09	20.08	(88)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	------

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

(89)m=	1	1	1	0.98	0.93	0.77	0.55	0.61	0.89	0.99	1	1	(89)
--------	---	---	---	------	------	------	------	------	------	------	---	---	------

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

(90)m=	19.01	19.12	19.32	19.62	19.88	20.07	20.11	20.11	20	19.67	19.31	19.02	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.41	(91)
---------------------------	------	------

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

(92)m=	19.35	19.46	19.66	19.95	20.22	20.41	20.46	20.46	20.34	20	19.64	19.35	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	------

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

(93)m=	19.35	19.46	19.66	19.95	20.22	20.41	20.46	20.46	20.34	20	19.64	19.35	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.98	0.94	0.8	0.6	0.66	0.9	0.99	1	1	(94)
--------	---	---	------	------	------	-----	-----	------	-----	------	---	---	------

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

(95)m=	362.87	394	419.92	441.91	437.65	363.34	261.94	270.37	346.53	354.79	345.04	346.95	(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=	1104.02	1063.09	956.43	786.34	603.75	404.12	268.49	281.08	436.81	666.23	896.06	1091.73	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	551.41	449.63	399.16	247.99	123.58	0	0	0	0	231.72	396.73	554.11	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	2954.34	(98)
---	---------	------

Space heating requirement in kWh/m²/year

40.97	(99)
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8c. Space cooling requirement

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

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

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

(100)m=	0	0	0	0	0	653.41	514.39	526.39	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.83	0.91	0.88	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

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

(102)m=	0	0	0	0	0	541.92	466.07	464.34	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	619.55	592.55	565.5	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	-------	---	---	---	---	-------

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

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

(104)m=	0	0	0	0	0	55.9	94.1	75.26	0	0	0	0	(104)
---------	---	---	---	---	---	------	------	-------	---	---	---	---	-------

Total = Sum(104) =	225.26	(104)
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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)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

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

TFEE WorkSheet: New dwelling created by change of use

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

(107)m=	0	0	0	0	0	13.97	23.52	18.82	0	0	0	0
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(107) = 56.31 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 0.78 (108)

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

Fabric Energy Efficiency (99) + (108) = 41.75 (109)

Target Fabric Energy Efficiency (TFEE) 48.01 (109)

DFEE WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 1d Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.11 (1a)	2.85 (2a)	205.51 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.11 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.51 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				3	30 (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) =	30	÷ (5) =	0.15 (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			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.9 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.9 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DFEE WorkSheet: New dwelling created by change of use

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

1.14	1.12	1.1	0.99	0.96	0.85	0.85	0.83	0.9	0.96	1.01	1.05
------	------	-----	------	------	------	------	------	-----	------	------	------

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= 1.14 1.12 1.1 0.99 0.96 0.86 0.86 0.84 0.9 0.96 1.01 1.05 (24d)

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

(25)m= 1.14 1.12 1.1 0.99 0.96 0.86 0.86 0.84 0.9 0.96 1.01 1.05 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1.6	= 3.056		(26)
Windows Type 1			2.79	x 1/[1/(1.6)+0.04]	= 4.2		(27)
Windows Type 2			1.02	x 1/[1/(1.6)+0.04]	= 1.53		(27)
Windows Type 3			2.48	x 1/[1/(1.6)+0.04]	= 3.73		(27)
Walls	39.35	8.2	31.15	x 0.3	= 9.34		(29)
Roof	72.11	0	72.11	x 0.18	= 12.98		(30)
Total area of elements, m²			111.46				(31)
Party wall			75.81	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) = 34.84 (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 16.72 (36)

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

Total fabric heat loss (33) + (36) = 51.56 (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=	77.47	75.96	74.44	66.85	65.37	58.48	58.48	57.2	61.13	65.37	68.36	71.4

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

(39)m=	129.03	127.51	126	118.41	116.93	110.04	110.04	108.76	112.69	116.93	119.92	122.96
Average = Sum(39) _{1...12} /12=												118.27 (39)

DFEE WorkSheet: New dwelling created by change of use

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.79	1.77	1.75	1.64	1.62	1.53	1.53	1.51	1.56	1.62	1.66	1.71		
Average = Sum(40) _{1...12} /12=													1.64	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.3

(42)

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

if TFA ≤ 13.9, N = 1

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

88.74

(43)

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

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

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

(44)m=	97.61	94.06	90.51	86.96	83.41	79.86	79.86	83.41	86.96	90.51	94.06	97.61		
Total = Sum(44) _{1...12} =													1064.83	(44)

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

(45)m=	144.75	126.6	130.64	113.9	109.29	94.31	87.39	100.28	101.48	118.26	129.09	140.18		
Total = Sum(45) _{1...12} =													1396.16	(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	
--------	---	---	---	---	---	---	---	---	---	---	---	---	--

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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

(56)

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

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

(57)

Primary circuit loss (annual) from Table 3

0

(58)

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

DFEE WorkSheet: New dwelling created by change of use

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

(61)m=

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

 (61)

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

(62)m=

123.04	107.61	111.04	96.81	92.89	80.16	74.28	85.24	86.25	100.52	109.73	119.16
--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------

 (62)

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

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

(63)m=

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

 (63)

Output from water heater

(64)m=

123.04	107.61	111.04	96.81	92.89	80.16	74.28	85.24	86.25	100.52	109.73	119.16
--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------

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

1186.73

 (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=

30.76	26.9	27.76	24.2	23.22	20.04	18.57	21.31	21.56	25.13	27.43	29.79
-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 (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
114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81

 (66)

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

(67)m=

21.4	19.01	15.46	11.7	8.75	7.39	7.98	10.37	13.92	17.68	20.63	21.99
------	-------	-------	------	------	------	------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

202.17	204.27	198.98	187.73	173.52	160.17	151.25	149.15	154.44	165.69	179.9	193.25
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (68)

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

(69)m=

34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

41.34	40.03	37.31	33.62	31.21	27.83	24.96	28.64	29.95	33.78	38.1	40.04
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

 (72)

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

(73)m=

322.36	320.75	309.2	290.49	270.93	252.83	241.63	245.61	255.75	274.59	296.07	312.73
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)						
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.48</td></tr></table>	2.48	x	<table><tr><td>36.79</td></tr></table>	36.79	x	<table><tr><td>0.4</td></tr></table>	0.4	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>17.71</td></tr></table> (77)	17.71
0.77																	
2.48																	
36.79																	
0.4																	
0.7																	
17.71																	
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.48</td></tr></table>	2.48	x	<table><tr><td>62.67</td></tr></table>	62.67	x	<table><tr><td>0.4</td></tr></table>	0.4	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>30.16</td></tr></table> (77)	30.16
0.77																	
2.48																	
62.67																	
0.4																	
0.7																	
30.16																	
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.48</td></tr></table>	2.48	x	<table><tr><td>85.75</td></tr></table>	85.75	x	<table><tr><td>0.4</td></tr></table>	0.4	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>41.27</td></tr></table> (77)	41.27
0.77																	
2.48																	
85.75																	
0.4																	
0.7																	
41.27																	
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.48</td></tr></table>	2.48	x	<table><tr><td>106.25</td></tr></table>	106.25	x	<table><tr><td>0.4</td></tr></table>	0.4	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>51.13</td></tr></table> (77)	51.13
0.77																	
2.48																	
106.25																	
0.4																	
0.7																	
51.13																	
Southeast 0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>2.48</td></tr></table>	2.48	x	<table><tr><td>119.01</td></tr></table>	119.01	x	<table><tr><td>0.4</td></tr></table>	0.4	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>57.27</td></tr></table> (77)	57.27
0.77																	
2.48																	
119.01																	
0.4																	
0.7																	
57.27																	

DFEE WorkSheet: New dwelling created by change of use

Southeast 0.9x	0.77	x	2.48	x	118.15	x	0.4	x	0.7	=	56.86	(77)
Southeast 0.9x	0.77	x	2.48	x	113.91	x	0.4	x	0.7	=	54.82	(77)
Southeast 0.9x	0.77	x	2.48	x	104.39	x	0.4	x	0.7	=	50.23	(77)
Southeast 0.9x	0.77	x	2.48	x	92.85	x	0.4	x	0.7	=	44.68	(77)
Southeast 0.9x	0.77	x	2.48	x	69.27	x	0.4	x	0.7	=	33.33	(77)
Southeast 0.9x	0.77	x	2.48	x	44.07	x	0.4	x	0.7	=	21.21	(77)
Southeast 0.9x	0.77	x	2.48	x	31.49	x	0.4	x	0.7	=	15.15	(77)
Northwest 0.9x	0.77	x	2.79	x	11.28	x	0.4	x	0.7	=	6.11	(81)
Northwest 0.9x	0.77	x	1.02	x	11.28	x	0.4	x	0.7	=	2.23	(81)
Northwest 0.9x	0.77	x	2.79	x	22.97	x	0.4	x	0.7	=	12.43	(81)
Northwest 0.9x	0.77	x	1.02	x	22.97	x	0.4	x	0.7	=	4.55	(81)
Northwest 0.9x	0.77	x	2.79	x	41.38	x	0.4	x	0.7	=	22.4	(81)
Northwest 0.9x	0.77	x	1.02	x	41.38	x	0.4	x	0.7	=	8.19	(81)
Northwest 0.9x	0.77	x	2.79	x	67.96	x	0.4	x	0.7	=	36.79	(81)
Northwest 0.9x	0.77	x	1.02	x	67.96	x	0.4	x	0.7	=	13.45	(81)
Northwest 0.9x	0.77	x	2.79	x	91.35	x	0.4	x	0.7	=	49.45	(81)
Northwest 0.9x	0.77	x	1.02	x	91.35	x	0.4	x	0.7	=	18.08	(81)
Northwest 0.9x	0.77	x	2.79	x	97.38	x	0.4	x	0.7	=	52.72	(81)
Northwest 0.9x	0.77	x	1.02	x	97.38	x	0.4	x	0.7	=	19.27	(81)
Northwest 0.9x	0.77	x	2.79	x	91.1	x	0.4	x	0.7	=	49.32	(81)
Northwest 0.9x	0.77	x	1.02	x	91.1	x	0.4	x	0.7	=	18.03	(81)
Northwest 0.9x	0.77	x	2.79	x	72.63	x	0.4	x	0.7	=	39.32	(81)
Northwest 0.9x	0.77	x	1.02	x	72.63	x	0.4	x	0.7	=	14.37	(81)
Northwest 0.9x	0.77	x	2.79	x	50.42	x	0.4	x	0.7	=	27.3	(81)
Northwest 0.9x	0.77	x	1.02	x	50.42	x	0.4	x	0.7	=	9.98	(81)
Northwest 0.9x	0.77	x	2.79	x	28.07	x	0.4	x	0.7	=	15.19	(81)
Northwest 0.9x	0.77	x	1.02	x	28.07	x	0.4	x	0.7	=	5.56	(81)
Northwest 0.9x	0.77	x	2.79	x	14.2	x	0.4	x	0.7	=	7.69	(81)
Northwest 0.9x	0.77	x	1.02	x	14.2	x	0.4	x	0.7	=	2.81	(81)
Northwest 0.9x	0.77	x	2.79	x	9.21	x	0.4	x	0.7	=	4.99	(81)
Northwest 0.9x	0.77	x	1.02	x	9.21	x	0.4	x	0.7	=	1.82	(81)

Solar gains in watts, calculated for each month

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

(83)m=

26.05	47.14	71.86	101.37	124.8	128.85	122.17	103.93	81.96	54.08	31.7	21.96
-------	-------	-------	--------	-------	--------	--------	--------	-------	-------	------	-------

 (83)

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

(84)m=

348.4	367.89	381.05	391.86	395.73	381.68	363.8	349.53	337.71	328.67	327.78	334.69
-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	1	0.99	0.99	0.96	0.9	0.92	0.98	1	1	1

 (86)

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

(87)m=

18.89	19.03	19.3	19.75	20.16	20.59	20.81	20.78	20.46	19.93	19.4	18.95
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	-------

 (87)

DFEE WorkSheet: New dwelling created by change of use

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

(88)m=	19.48	19.49	19.51	19.58	19.6	19.67	19.67	19.68	19.64	19.6	19.57	19.54	(88)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	------

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

(89)m=	1	1	1	0.99	0.98	0.92	0.77	0.81	0.96	0.99	1	1	(89)
--------	---	---	---	------	------	------	------	------	------	------	---	---	------

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

(90)m=	17.6	17.74	18.03	18.54	18.95	19.42	19.6	19.59	19.28	18.73	18.18	17.7	(90)
--------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =	0.41	(91)
---------------------------	------	------

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

(92)m=	18.12	18.26	18.54	19.03	19.44	19.89	20.09	20.07	19.76	19.22	18.67	18.21	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.12	18.26	18.54	19.03	19.44	19.89	20.09	20.07	19.76	19.22	18.67	18.21	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	1	1	0.99	0.98	0.93	0.82	0.85	0.96	0.99	1	1	(94)
--------	---	---	---	------	------	------	------	------	------	------	---	---	------

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

(95)m=	347.6	366.77	379.21	388.16	386.4	354.5	299.13	297.95	324.32	325.71	326.71	334.08	(95)
--------	-------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1783.62	1704.08	1517.46	1199.36	905.55	582.22	383.85	399.51	637.32	1007.45	1387.93	1722.47	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	---------	---------	------

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

(98)m=	1068.4	898.68	846.86	584.06	386.25	0	0	0	0	507.22	764.08	1032.96	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												6088.52	(98)

Space heating requirement in kWh/m²/year

84.43	(99)
-------	------

8c. Space cooling requirement

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

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

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

(100)m=	0	0	0	0	0	1034.34	814.27	826.57	0	0	0	0	(100)
---------	---	---	---	---	---	---------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.5	0.59	0.57	0	0	0	0	(101)
---------	---	---	---	---	---	-----	------	------	---	---	---	---	-------

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

(102)m=	0	0	0	0	0	514.5	478.44	468.89	0	0	0	0	(102)
---------	---	---	---	---	---	-------	--------	--------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	532.96	510.44	495.66	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

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

(104)m=	0	0	0	0	0	13.29	23.81	19.91	0	0	0	0	
Total = Sum(104) =												57.01	(104)

Cooled fraction

f C = cooled area ÷ (4) =

1	(105)
---	-------

Intermittency factor (Table 10b)

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

Total = Sum(104) =

0	(106)
---	-------

DFEE WorkSheet: New dwelling created by change of use

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

(107)m=	0	0	0	0	0	3.32	5.95	4.98	0	0	0	0
---------	---	---	---	---	---	------	------	------	---	---	---	---

Total = Sum(107) = 14.25 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 0.2 (108)

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

Fabric Energy Efficiency (99) + (108) = 84.63 (109)

DER WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 1d Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.11 (1a) x	2.85 (2a) =	205.51 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.11 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.51 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (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		15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.75 (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		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.75 (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 created by change of use

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

0.96	0.94	0.92	0.82	0.81	0.71	0.71	0.69	0.75	0.81	0.84	0.88
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1.6	= 3.056		(26)
Windows Type 1			2.79	x1/[1/(1.6)+ 0.04]	= 4.2		(27)
Windows Type 2			1.02	x1/[1/(1.6)+ 0.04]	= 1.53		(27)
Windows Type 3			2.48	x1/[1/(1.6)+ 0.04]	= 3.73		(27)
Walls	39.35	8.2	31.15	x 0.3	= 9.34		(29)
Roof	72.11	0	72.11	x 0.18	= 12.98		(30)
Total area of elements, m²			111.46				(31)
Party wall			75.81	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) = 34.84 (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 16.72 (36)

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

Total fabric heat loss (33) + (36) = 51.56 (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=	72.82	71.55	70.28	63.92	62.65	56.29	56.29	55.02	58.83	62.65	65.19	67.73

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

(39)m=	124.38	123.11	121.84	115.48	114.21	107.85	107.85	106.58	110.39	114.21	116.75	119.29
Average = Sum(39) _{1...12} /12=												115.16 (39)

DER WorkSheet: New dwelling created by change of use

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.72	1.71	1.69	1.6	1.58	1.5	1.5	1.48	1.53	1.58	1.62	1.65		
Average = Sum(40) _{1...12} /12=													1.6	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.3

(42)

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

if TFA ≤ 13.9, N = 1

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

88.74

(43)

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

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

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

(44)m=	97.61	94.06	90.51	86.96	83.41	79.86	79.86	83.41	86.96	90.51	94.06	97.61		
Total = Sum(44) _{1...12} =													1064.83	(44)

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

(45)m=	144.75	126.6	130.64	113.9	109.29	94.31	87.39	100.28	101.48	118.26	129.09	140.18		
Total = Sum(45) _{1...12} =													1396.16	(45)

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

(46)m=	21.71	18.99	19.6	17.08	16.39	14.15	13.11	15.04	15.22	17.74	19.36	21.03		(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

DER WorkSheet: New dwelling created by change of use

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

(61)m=	49.74	43.29	46.12	42.88	42.51	39.38	40.7	42.51	42.88	46.12	46.39	49.74	(61)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(62)m=	194.49	169.89	176.76	156.78	151.79	133.69	128.08	142.78	144.36	164.38	175.48	189.93	(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=	194.49	169.89	176.76	156.78	151.79	133.69	128.08	142.78	144.36	164.38	175.48	189.93	
Output from water heater (annual) _{1...12}												1928.43	(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=	60.57	52.92	54.97	48.59	46.96	41.2	39.23	43.97	44.46	50.85	54.52	59.05	(65)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	(66)

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

(67)m=	21.4	19.01	15.46	11.7	8.75	7.39	7.98	10.37	13.92	17.68	20.63	21.99	(67)
--------	------	-------	-------	------	------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=	202.17	204.27	198.98	187.73	173.52	160.17	151.25	149.15	154.44	165.69	179.9	193.25	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(69)m=	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	(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=	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	81.4	78.75	73.88	67.49	63.12	57.23	52.73	59.1	61.75	68.35	75.72	79.36	(72)
--------	------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(73)m=	365.42	362.47	348.77	327.36	305.84	285.22	272.4	279.06	290.55	312.16	336.69	355.05	(73)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c	=	Gains (W)	
Southeast 0.9x	0.77	x	2.48	x	36.79	x	0.4	x	0.7	=	17.71	(77)
Southeast 0.9x	0.77	x	2.48	x	62.67	x	0.4	x	0.7	=	30.16	(77)
Southeast 0.9x	0.77	x	2.48	x	85.75	x	0.4	x	0.7	=	41.27	(77)
Southeast 0.9x	0.77	x	2.48	x	106.25	x	0.4	x	0.7	=	51.13	(77)
Southeast 0.9x	0.77	x	2.48	x	119.01	x	0.4	x	0.7	=	57.27	(77)

DER WorkSheet: New dwelling created by change of use

Southeast 0.9x	0.77	x	2.48	x	118.15	x	0.4	x	0.7	=	56.86	(77)
Southeast 0.9x	0.77	x	2.48	x	113.91	x	0.4	x	0.7	=	54.82	(77)
Southeast 0.9x	0.77	x	2.48	x	104.39	x	0.4	x	0.7	=	50.23	(77)
Southeast 0.9x	0.77	x	2.48	x	92.85	x	0.4	x	0.7	=	44.68	(77)
Southeast 0.9x	0.77	x	2.48	x	69.27	x	0.4	x	0.7	=	33.33	(77)
Southeast 0.9x	0.77	x	2.48	x	44.07	x	0.4	x	0.7	=	21.21	(77)
Southeast 0.9x	0.77	x	2.48	x	31.49	x	0.4	x	0.7	=	15.15	(77)
Northwest 0.9x	0.77	x	2.79	x	11.28	x	0.4	x	0.7	=	6.11	(81)
Northwest 0.9x	0.77	x	1.02	x	11.28	x	0.4	x	0.7	=	2.23	(81)
Northwest 0.9x	0.77	x	2.79	x	22.97	x	0.4	x	0.7	=	12.43	(81)
Northwest 0.9x	0.77	x	1.02	x	22.97	x	0.4	x	0.7	=	4.55	(81)
Northwest 0.9x	0.77	x	2.79	x	41.38	x	0.4	x	0.7	=	22.4	(81)
Northwest 0.9x	0.77	x	1.02	x	41.38	x	0.4	x	0.7	=	8.19	(81)
Northwest 0.9x	0.77	x	2.79	x	67.96	x	0.4	x	0.7	=	36.79	(81)
Northwest 0.9x	0.77	x	1.02	x	67.96	x	0.4	x	0.7	=	13.45	(81)
Northwest 0.9x	0.77	x	2.79	x	91.35	x	0.4	x	0.7	=	49.45	(81)
Northwest 0.9x	0.77	x	1.02	x	91.35	x	0.4	x	0.7	=	18.08	(81)
Northwest 0.9x	0.77	x	2.79	x	97.38	x	0.4	x	0.7	=	52.72	(81)
Northwest 0.9x	0.77	x	1.02	x	97.38	x	0.4	x	0.7	=	19.27	(81)
Northwest 0.9x	0.77	x	2.79	x	91.1	x	0.4	x	0.7	=	49.32	(81)
Northwest 0.9x	0.77	x	1.02	x	91.1	x	0.4	x	0.7	=	18.03	(81)
Northwest 0.9x	0.77	x	2.79	x	72.63	x	0.4	x	0.7	=	39.32	(81)
Northwest 0.9x	0.77	x	1.02	x	72.63	x	0.4	x	0.7	=	14.37	(81)
Northwest 0.9x	0.77	x	2.79	x	50.42	x	0.4	x	0.7	=	27.3	(81)
Northwest 0.9x	0.77	x	1.02	x	50.42	x	0.4	x	0.7	=	9.98	(81)
Northwest 0.9x	0.77	x	2.79	x	28.07	x	0.4	x	0.7	=	15.19	(81)
Northwest 0.9x	0.77	x	1.02	x	28.07	x	0.4	x	0.7	=	5.56	(81)
Northwest 0.9x	0.77	x	2.79	x	14.2	x	0.4	x	0.7	=	7.69	(81)
Northwest 0.9x	0.77	x	1.02	x	14.2	x	0.4	x	0.7	=	2.81	(81)
Northwest 0.9x	0.77	x	2.79	x	9.21	x	0.4	x	0.7	=	4.99	(81)
Northwest 0.9x	0.77	x	1.02	x	9.21	x	0.4	x	0.7	=	1.82	(81)

Solar gains in watts, calculated for each month

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

(83)m=

26.05	47.14	71.86	101.37	124.8	128.85	122.17	103.93	81.96	54.08	31.7	21.96
-------	-------	-------	--------	-------	--------	--------	--------	-------	-------	------	-------

 (83)

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

(84)m=

391.47	409.6	420.62	428.73	430.64	414.07	394.57	382.99	372.51	366.24	368.4	377.02
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	1	0.99	0.98	0.95	0.87	0.89	0.97	0.99	1	1

 (86)

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

(87)m=

19.01	19.14	19.4	19.83	20.23	20.63	20.84	20.82	20.51	20.01	19.49	19.06
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (87)

DER WorkSheet: New dwelling created by change of use

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

(88)m=	19.52	19.54	19.55	19.61	19.63	19.69	19.69	19.7	19.66	19.63	19.6	19.57	(88)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	------

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

(89)m=	1	1	0.99	0.99	0.97	0.9	0.73	0.77	0.94	0.99	1	1	(89)
--------	---	---	------	------	------	-----	------	------	------	------	---	---	------

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

(90)m=	16.93	17.12	17.51	18.18	18.76	19.37	19.61	19.6	19.2	18.44	17.68	17.03	(90)
--------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	------

fLA = Living area ÷ (4) =	0.41	(91)
---------------------------	------	------

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

(92)m=	17.77	17.94	18.28	18.85	19.36	19.88	20.11	20.09	19.73	19.08	18.42	17.85	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	17.77	17.94	18.28	18.85	19.36	19.88	20.11	20.09	19.73	19.08	18.42	17.85	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.99	0.97	0.91	0.79	0.82	0.94	0.99	0.99	1	(94)
--------	---	---	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	390.05	407.69	417.6	422.88	416.64	375.99	310.34	312.55	351.91	361.18	366.47	375.9	(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=	1675.72	1605.35	1435.15	1148.88	874.58	569.92	378.37	393.66	621.42	968.07	1321.04	1628.41	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	956.54	804.83	757.06	522.72	340.71	0	0	0	0	451.53	687.29	931.87	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98) _{1...5,9...12} =	5452.53	(98)
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Space heating requirement in kWh/m²/year

75.61	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system

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

Fraction of space heat from main system(s)

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

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

Fraction of total heating from main system 1

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

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

Efficiency of main space heating system 1

90.3	(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)

956.54	804.83	757.06	522.72	340.71	0	0	0	0	451.53	687.29	931.87
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

1059.29	891.28	838.38	578.87	377.3	0	0	0	0	500.03	761.11	1031.97
---------	--------	--------	--------	-------	---	---	---	---	--------	--------	---------

Total (kWh/year) =Sum(211) _{1...5,10...12} =	6038.24	(211)
---	---------	-------

Space heating fuel (secondary), kWh/month

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

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

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

DER WorkSheet: New dwelling created by change of use

Water heating

Output from water heater (calculated above)

194.49	169.89	176.76	156.78	151.79	133.69	128.08	142.78	144.36	164.38	175.48	189.93
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

81

(216)

(217)m=	88.58	88.53	88.38	87.97	87.21	81	81	81	81	87.62	88.24	88.58
---------	-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	219.56	191.91	200.01	178.22	174.05	165.05	158.13	176.28	178.22	187.62	198.86	214.42
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

2242.32

(219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

6038.24

Water heating fuel used

2242.32

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

225.65

(230a)

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

300.65

(231)

Electricity for lighting

377.92

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

8959.14

(338)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1304.26	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	484.34	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1788.6	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	156.04	(267)
Electricity for lighting	(232) x	0.519	=	196.14	(268)
Total CO2, kg/year			sum of (265)...(271) =	2140.78	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =	29.69	(273)
EI rating (section 14)				76	(274)

TER WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 1d Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	72.11 (1a)	2.85 (2a)	205.51 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	72.11 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.51 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				3	30 (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) =	30	÷ (5) =	0.15 (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)			0.4 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.4 (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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TER WorkSheet: New dwelling created by change of use

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

0.5	0.49	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47
-----	------	------	------	------	------	------	------	-----	------	------	------

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= 0.63 0.62 0.62 0.59 0.59 0.57 0.57 0.57 0.58 0.59 0.6 0.61 (24d)

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

(25)m= 0.63 0.62 0.62 0.59 0.59 0.57 0.57 0.57 0.58 0.59 0.6 0.61 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1	= 1.91		(26)
Windows Type 1			2.79	x 1/[1/(1.4)+0.04]	= 3.7		(27)
Windows Type 2			1.02	x 1/[1/(1.4)+0.04]	= 1.35		(27)
Windows Type 3			2.48	x 1/[1/(1.4)+0.04]	= 3.29		(27)
Walls	39.35	8.2	31.15	x 0.18	= 5.61		(29)
Roof	72.11	0	72.11	x 0.13	= 9.37		(30)
Total area of elements, m²			111.46				(31)
Party wall			75.81	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) = 25.23 (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 5.57 (36)

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

Total fabric heat loss (33) + (36) = 30.8 (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=	42.55	42.22	41.89	40.34	40.05	38.71	38.71	38.46	39.23	40.05	40.64	41.25

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

(39)m=	73.36	73.02	72.69	71.15	70.86	69.51	69.51	69.26	70.03	70.86	71.44	72.05
Average = Sum(39) _{1...12} /12=												71.15 (39)

TER WorkSheet: New dwelling created by change of use

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.02	1.01	1.01	0.99	0.98	0.96	0.96	0.96	0.97	0.98	0.99	1		
Average = Sum(40) _{1...12} /12=													0.99	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.3

(42)

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

if TFA ≤ 13.9, N = 1

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

88.74

(43)

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

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

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

(44)m=	97.61	94.06	90.51	86.96	83.41	79.86	79.86	83.41	86.96	90.51	94.06	97.61		
Total = Sum(44) _{1...12} =													1064.83	(44)

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

(45)m=	144.75	126.6	130.64	113.9	109.29	94.31	87.39	100.28	101.48	118.26	129.09	140.18		
Total = Sum(45) _{1...12} =													1396.16	(45)

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

(46)m=	21.71	18.99	19.6	17.08	16.39	14.15	13.11	15.04	15.22	17.74	19.36	21.03		(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

TER WorkSheet: New dwelling created by change of use

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

(61)m=	49.74	43.29	46.12	42.88	42.51	39.38	40.7	42.51	42.88	46.12	46.39	49.74	(61)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(62)m=	194.49	169.89	176.76	156.78	151.79	133.69	128.08	142.78	144.36	164.38	175.48	189.93	(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=	194.49	169.89	176.76	156.78	151.79	133.69	128.08	142.78	144.36	164.38	175.48	189.93	
Output from water heater (annual) _{1...12}												1928.43	(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=	60.57	52.92	54.97	48.59	46.96	41.2	39.23	43.97	44.46	50.85	54.52	59.05	(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=	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	114.81	(66)

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

(67)m=	21.4	19.01	15.46	11.7	8.75	7.39	7.98	10.37	13.92	17.68	20.63	21.99	(67)
--------	------	-------	-------	------	------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=	202.17	204.27	198.98	187.73	173.52	160.17	151.25	149.15	154.44	165.69	179.9	193.25	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(69)m=	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	34.48	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	-91.85	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	81.4	78.75	73.88	67.49	63.12	57.23	52.73	59.1	61.75	68.35	75.72	79.36	(72)
--------	------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(73)m=	365.42	362.47	348.77	327.36	305.84	285.22	272.4	279.06	290.55	312.16	336.69	355.05	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.48	x	36.79	x	0.63	x	0.7	=	27.89	(77)
Southeast 0.9x	0.77	x	2.48	x	62.67	x	0.63	x	0.7	=	47.5	(77)
Southeast 0.9x	0.77	x	2.48	x	85.75	x	0.63	x	0.7	=	64.99	(77)
Southeast 0.9x	0.77	x	2.48	x	106.25	x	0.63	x	0.7	=	80.53	(77)
Southeast 0.9x	0.77	x	2.48	x	119.01	x	0.63	x	0.7	=	90.2	(77)

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Southeast 0.9x	0.77	x	2.48	x	118.15	x	0.63	x	0.7	=	89.55	(77)
Southeast 0.9x	0.77	x	2.48	x	113.91	x	0.63	x	0.7	=	86.33	(77)
Southeast 0.9x	0.77	x	2.48	x	104.39	x	0.63	x	0.7	=	79.12	(77)
Southeast 0.9x	0.77	x	2.48	x	92.85	x	0.63	x	0.7	=	70.37	(77)
Southeast 0.9x	0.77	x	2.48	x	69.27	x	0.63	x	0.7	=	52.5	(77)
Southeast 0.9x	0.77	x	2.48	x	44.07	x	0.63	x	0.7	=	33.4	(77)
Southeast 0.9x	0.77	x	2.48	x	31.49	x	0.63	x	0.7	=	23.87	(77)
Northwest 0.9x	0.77	x	2.79	x	11.28	x	0.63	x	0.7	=	9.62	(81)
Northwest 0.9x	0.77	x	1.02	x	11.28	x	0.63	x	0.7	=	3.52	(81)
Northwest 0.9x	0.77	x	2.79	x	22.97	x	0.63	x	0.7	=	19.58	(81)
Northwest 0.9x	0.77	x	1.02	x	22.97	x	0.63	x	0.7	=	7.16	(81)
Northwest 0.9x	0.77	x	2.79	x	41.38	x	0.63	x	0.7	=	35.28	(81)
Northwest 0.9x	0.77	x	1.02	x	41.38	x	0.63	x	0.7	=	12.9	(81)
Northwest 0.9x	0.77	x	2.79	x	67.96	x	0.63	x	0.7	=	57.94	(81)
Northwest 0.9x	0.77	x	1.02	x	67.96	x	0.63	x	0.7	=	21.18	(81)
Northwest 0.9x	0.77	x	2.79	x	91.35	x	0.63	x	0.7	=	77.89	(81)
Northwest 0.9x	0.77	x	1.02	x	91.35	x	0.63	x	0.7	=	28.47	(81)
Northwest 0.9x	0.77	x	2.79	x	97.38	x	0.63	x	0.7	=	83.04	(81)
Northwest 0.9x	0.77	x	1.02	x	97.38	x	0.63	x	0.7	=	30.36	(81)
Northwest 0.9x	0.77	x	2.79	x	91.1	x	0.63	x	0.7	=	77.68	(81)
Northwest 0.9x	0.77	x	1.02	x	91.1	x	0.63	x	0.7	=	28.4	(81)
Northwest 0.9x	0.77	x	2.79	x	72.63	x	0.63	x	0.7	=	61.93	(81)
Northwest 0.9x	0.77	x	1.02	x	72.63	x	0.63	x	0.7	=	22.64	(81)
Northwest 0.9x	0.77	x	2.79	x	50.42	x	0.63	x	0.7	=	42.99	(81)
Northwest 0.9x	0.77	x	1.02	x	50.42	x	0.63	x	0.7	=	15.72	(81)
Northwest 0.9x	0.77	x	2.79	x	28.07	x	0.63	x	0.7	=	23.93	(81)
Northwest 0.9x	0.77	x	1.02	x	28.07	x	0.63	x	0.7	=	8.75	(81)
Northwest 0.9x	0.77	x	2.79	x	14.2	x	0.63	x	0.7	=	12.11	(81)
Northwest 0.9x	0.77	x	1.02	x	14.2	x	0.63	x	0.7	=	4.43	(81)
Northwest 0.9x	0.77	x	2.79	x	9.21	x	0.63	x	0.7	=	7.86	(81)
Northwest 0.9x	0.77	x	1.02	x	9.21	x	0.63	x	0.7	=	2.87	(81)

Solar gains in watts, calculated for each month

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

(83)m=

41.02	74.24	113.17	159.66	196.56	202.94	192.41	163.69	129.08	85.18	49.93	34.59
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 (83)

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

(84)m=

406.44	436.71	461.94	487.02	502.4	488.16	464.81	442.75	419.64	397.34	386.63	389.65
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 (84)

7. Mean internal temperature (heating season)

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

21

 (85)

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

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	0.99	0.98	0.94	0.81	0.64	0.69	0.91	0.99	1	1

 (86)

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

(87)m=

19.91	20.01	20.2	20.49	20.75	20.93	20.99	20.98	20.86	20.54	20.19	19.9
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 (87)

TER WorkSheet: New dwelling created by change of use

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

(88)m=	20.07	20.07	20.08	20.09	20.1	20.11	20.11	20.12	20.11	20.1	20.09	20.08	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.91	0.73	0.52	0.57	0.85	0.98	1	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.6	18.76	19.04	19.46	19.83	20.06	20.11	20.11	19.98	19.54	19.02	18.6	(90)
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$$fLA = \text{Living area} \div (4) = 0.41 \quad (91)$$

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

(92)m=	19.13	19.27	19.51	19.88	20.2	20.42	20.46	20.46	20.34	19.94	19.49	19.13	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.13	19.27	19.51	19.88	20.2	20.42	20.46	20.46	20.34	19.94	19.49	19.13	(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
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.97	0.92	0.76	0.57	0.62	0.87	0.98	0.99	1	(94)
--------	---	---	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	405.36	434.77	457.61	474	460.42	372.11	263.78	273.61	364.62	388.45	384.64	388.83	(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=	1087.88	1048.97	945.95	781.03	602.44	404.32	268.61	281.27	436.95	662.05	885.51	1075.64	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	507.79	412.74	363.33	221.06	105.66	0	0	0	0	203.56	360.63	510.99	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												2685.76	(98)

Space heating requirement in kWh/m²/year

37.25	(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

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

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

Efficiency of main space heating system 1

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

Efficiency of secondary/supplementary heating system, %

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

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

Space heating requirement (calculated above)

507.79	412.74	363.33	221.06	105.66	0	0	0	0	203.56	360.63	510.99
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

543.67	441.9	389	236.68	113.13	0	0	0	0	217.95	386.11	547.1
--------	-------	-----	--------	--------	---	---	---	---	--------	--------	-------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1...5,10...12} = 2875.55 \quad (211)$$

Space heating fuel (secondary), kWh/month

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

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

TER WorkSheet: New dwelling created by change of use

Water heating

Output from water heater (calculated above)

194.49	169.89	176.76	156.78	151.79	133.69	128.08	142.78	144.36	164.38	175.48	189.93
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

80.3 (216)

(217)m= 87.36 87.2 86.83 85.92 84.16 80.3 80.3 80.3 80.3 85.59 86.83 87.42 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

222.64	194.83	203.58	182.48	180.36	166.49	159.51	177.81	179.78	192.06	202.1	217.25
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

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

2278.9 (219)

Annual totals

kWh/year

kWh/year

Space heating fuel used, main system 1

2875.55

Water heating fuel used

2278.9

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

(231)

Electricity for lighting

377.92

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

5607.36

(338)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	621.12	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	492.24	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1113.36	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	196.14	(268)
Total CO2, kg/year		sum of (265)...(271) =		1348.43	(272)

TER =

18.7 (273)

SAP WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 1b Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.14 (1a)	2.85 (2a)	219.85 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.14 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	219.85 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0	0 (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) =	0	÷ (5) =	0 (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			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.75 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.75 (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
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SAP WorkSheet: New dwelling created by change of use

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

0.96	0.94	0.92	0.82	0.81	0.71	0.71	0.69	0.75	0.81	0.84	0.88
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1.6	= 3.056		(26)
Windows Type 1			1.86	x1/[1/(1.6)+0.04]	= 2.8		(27)
Windows Type 2			2.79	x1/[1/(1.6)+0.04]	= 4.2		(27)
Floor			77.14	x 0.25	= 19.285		(28)
Walls	33.53	11.21	22.32	x 0.3	= 6.7		(29)
Roof	77.14	0	77.14	x 0.18	= 13.89		(30)
Total area of elements, m²			187.81				(31)
Party wall			75.81	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) = 56.91 (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 28.17 (36)

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

Total fabric heat loss (33) + (36) = 85.08 (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=	77.9	76.54	75.18	68.38	67.02	60.22	60.22	58.86	62.94	67.02	69.74	72.46

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

(39)m=	162.98	161.62	160.26	153.46	152.1	145.3	145.3	143.93	148.02	152.1	154.82	157.54
Average = Sum(39) _{1...12} /12=												153.12 (39)

SAP WorkSheet: New dwelling created by change of use

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	2.11	2.1	2.08	1.99	1.97	1.88	1.88	1.87	1.92	1.97	2.01	2.04		
Average = Sum(40) _{1...12} /12=													1.98	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.41

(42)

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

if TFA ≤ 13.9, N = 1

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

91.35

(43)

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

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

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

(44)m=	100.49	96.83	93.18	89.52	85.87	82.22	82.22	85.87	89.52	93.18	96.83	100.49		
Total = Sum(44) _{1...12} =													1096.21	(44)

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

(45)m=	149.02	130.33	134.49	117.25	112.51	97.08	89.96	103.23	104.47	121.75	132.9	144.32		
Total = Sum(45) _{1...12} =													1437.31	(45)

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

(46)m=	22.35	19.55	20.17	17.59	16.88	14.56	13.49	15.49	15.67	18.26	19.93	21.65		(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

(61)m=	50.96	44.57	47.48	44.15	43.76	40.54	41.9	43.76	44.15	47.48	47.75	50.96	(61)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(62)m=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	(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=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	
Output from water heater (annual) _{1...12}												1984.77	(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=	62.29	54.48	56.59	50.02	48.35	42.42	40.39	45.26	45.77	52.35	56.13	60.72	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	144.38	144.38	144.38	144.38	144.38	144.38	144.38	144.38	144.38	144.38	144.38	144.38	(66)

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

(67)m=	52.73	46.83	38.09	28.83	21.55	18.2	19.66	25.56	34.3	43.56	50.84	54.19	(67)
--------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	------

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

(68)m=	318.45	321.75	313.42	295.7	273.32	252.29	238.24	234.93	243.26	260.99	283.36	304.4	(68)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(69)m=	51.84	51.84	51.84	51.84	51.84	51.84	51.84	51.84	51.84	51.84	51.84	51.84	(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=	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	83.72	81.07	76.06	69.48	64.98	58.91	54.28	60.84	63.57	70.36	77.95	81.62	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	557.87	552.62	530.54	496.98	462.83	432.37	415.15	424.3	444.11	477.88	515.12	543.18	(73)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.4	x	0.7	=	39.84	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.4	x	0.7	=	67.86	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.4	x	0.7	=	92.85	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.4	x	0.7	=	115.04	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.4	x	0.7	=	128.86	(77)

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Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.4	x	0.7	=	127.93	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.4	x	0.7	=	123.33	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.4	x	0.7	=	113.03	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.4	x	0.7	=	100.53	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.4	x	0.7	=	75	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.4	x	0.7	=	47.72	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.4	x	0.7	=	34.09	(77)
Northwest 0.9x	0.77	x	1.86	x	11.28	x	0.4	x	0.7	=	8.14	(81)
Northwest 0.9x	0.77	x	1.86	x	22.97	x	0.4	x	0.7	=	16.58	(81)
Northwest 0.9x	0.77	x	1.86	x	41.38	x	0.4	x	0.7	=	29.87	(81)
Northwest 0.9x	0.77	x	1.86	x	67.96	x	0.4	x	0.7	=	49.05	(81)
Northwest 0.9x	0.77	x	1.86	x	91.35	x	0.4	x	0.7	=	65.94	(81)
Northwest 0.9x	0.77	x	1.86	x	97.38	x	0.4	x	0.7	=	70.29	(81)
Northwest 0.9x	0.77	x	1.86	x	91.1	x	0.4	x	0.7	=	65.76	(81)
Northwest 0.9x	0.77	x	1.86	x	72.63	x	0.4	x	0.7	=	52.42	(81)
Northwest 0.9x	0.77	x	1.86	x	50.42	x	0.4	x	0.7	=	36.4	(81)
Northwest 0.9x	0.77	x	1.86	x	28.07	x	0.4	x	0.7	=	20.26	(81)
Northwest 0.9x	0.77	x	1.86	x	14.2	x	0.4	x	0.7	=	10.25	(81)
Northwest 0.9x	0.77	x	1.86	x	9.21	x	0.4	x	0.7	=	6.65	(81)

Solar gains in watts, calculated for each month

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

(83)m=	47.98	84.44	122.72	164.1	194.79	198.22	189.09	165.45	136.93	95.26	57.96	40.74	(83)
--------	-------	-------	--------	-------	--------	--------	--------	--------	--------	-------	-------	-------	------

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

(84)m=	605.85	637.06	653.26	661.08	657.62	630.59	604.25	589.75	581.04	573.14	573.09	583.92	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)
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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	0.99	0.99	0.98	0.96	0.9	0.8	0.82	0.93	0.98	0.99	0.99	(86)

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

(87)m=	18.8	18.95	19.25	19.72	20.17	20.61	20.83	20.81	20.49	19.92	19.33	18.84	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.26	19.27	19.28	19.34	19.35	19.41	19.41	19.42	19.39	19.35	19.33	19.31	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.99	0.98	0.97	0.93	0.81	0.61	0.65	0.87	0.97	0.99	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	16.47	16.7	17.14	17.85	18.5	19.12	19.35	19.34	18.96	18.15	17.28	16.54	(90)
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fLA = Living area ÷ (4) =

0.48 (91)

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

(92)m=	17.6	17.79	18.16	18.76	19.3	19.84	20.06	20.05	19.7	19	18.27	17.65	(92)
--------	------	-------	-------	-------	------	-------	-------	-------	------	----	-------	-------	------

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

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(93)m=	17.6	17.79	18.16	18.76	19.3	19.84	20.06	20.05	19.7	19	18.27	17.65	(93)
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8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	0.99	0.98	0.98	0.96	0.93	0.84	0.7	0.73	0.89	0.96	0.98	0.99	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

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

(95)m=	598.34	627.12	638.81	636.69	610.74	531.23	423.09	430.43	515.64	550.88	563.07	577.62	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	2167.33	2082.64	1868.37	1512.45	1156.49	761.24	503.24	525.2	828.3	1277.93	1729.51	2119.08	(97)
--------	---------	---------	---------	---------	---------	--------	--------	-------	-------	---------	---------	---------	------

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

(98)m=	1167.33	978.11	914.79	630.54	406.04	0	0	0	0	540.92	839.84	1146.84	
Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$												6624.42	(98)

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

85.88	(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 90.3 (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)

1167.33	978.11	914.79	630.54	406.04	0	0	0	0	540.92	839.84	1146.84
---------	--------	--------	--------	--------	---	---	---	---	--------	--------	---------

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

1292.72	1083.18	1013.06	698.28	449.66	0	0	0	0	599.02	930.06	1270.04
---------	---------	---------	--------	--------	---	---	---	---	--------	--------	---------

Total ($kWh/year$) = $Sum(211)_{1..5,10..12} =$ 7336.01 (211)

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

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

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

Water heating

Output from water heater (calculated above)

199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27
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Efficiency of water heater 81 (216)

(217)m= (217)

88.81	88.75	88.61	88.24	87.51	81	81	81	81	87.9	88.5	88.82
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Fuel for water heating, $kWh/month$

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

(219)m=	225.18	197.06	205.36	182.92	178.57	169.91	162.79	181.47	183.48	192.53	204.12	219.86	
Total = $Sum(219a)_{1..12} =$												2303.26	(219)

Annual totals

Space heating fuel used, main system 1

$kWh/year$ $kWh/year$

7336.01

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Water heating fuel used		2303.26	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.39		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	316.39	(231)
Electricity for lighting		372.47	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		10328.14	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	255.29	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	80.15	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	41.73	(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 =	49.13	(250)
Additional standing charges (Table 12)				120	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =			546.31	(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] =	1.88	(257)
SAP rating (Section 12)		73.79	(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	=	1584.58	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	497.5	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2082.08	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	164.21	(267)
Electricity for lighting	(232) x	0.519	=	193.31	(268)
Total CO2, kg/year			sum of (265)...(271) =	2439.61	(272)
CO2 emissions per m²			(272) ÷ (4) =	31.63	(273)

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El rating (section 14)

73

(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	8949.94	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2809.98	(264)
Space and water heating	(261) + (262) + (263) + (264) =			11759.92	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	971.33	(267)
Electricity for lighting	(232) x	0	=	1143.5	(268)
'Total Primary Energy		sum of (265)...(271) =		13874.74	(272)
Primary energy kWh/m ² /year		(272) ÷ (4) =		179.86	(273)

TFEE WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 1b Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.14 (1a)	2.85 (2a)	219.85 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.14 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	219.85 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14 (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)			0.39 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.39 (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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TFEE WorkSheet: New dwelling created by change of use

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

0.49	0.48	0.47	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.43	0.45
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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= 0.62 0.62 0.61 0.59 0.59 0.57 0.57 0.56 0.57 0.59 0.59 0.6 (24d)

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

(25)m= 0.62 0.62 0.61 0.59 0.59 0.57 0.57 0.56 0.57 0.59 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1	= 1.91		(26)
Windows Type 1			1.86	x1/[1/(1.4)+0.04]	= 2.47		(27)
Windows Type 2			2.79	x1/[1/(1.4)+0.04]	= 3.7		(27)
Floor			77.14	x 0.13	= 10.0282		(28)
Walls	33.53	11.21	22.32	x 0.18	= 4.02		(29)
Roof	77.14	0	77.14	x 0.13	= 10.03		(30)
Total area of elements, m²			187.81				(31)
Party wall			75.81	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) = 38.31 (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 9.39 (36)

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

Total fabric heat loss (33) + (36) = 47.7 (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=	45.08	44.74	44.4	42.83	42.54	41.16	41.16	40.91	41.69	42.54	43.13	43.75

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

(39)m= 92.79 92.44 92.11 90.53 90.24 88.87 88.87 88.61 89.4 90.24 90.84 91.46
Average = Sum(39)_{1...12} /12= 90.53 (39)

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Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.2	1.2	1.19	1.17	1.17	1.15	1.15	1.15	1.16	1.17	1.18	1.19		
Average = Sum(40) _{1...12} /12=													1.17	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.41

(42)

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

if TFA ≤ 13.9, N = 1

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

91.35

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

(44)m=	100.49	96.83	93.18	89.52	85.87	82.22	82.22	85.87	89.52	93.18	96.83	100.49		
Total = Sum(44) _{1...12} =													1096.21	(44)

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

(45)m=	149.02	130.33	134.49	117.25	112.51	97.08	89.96	103.23	104.47	121.75	132.9	144.32		
Total = Sum(45) _{1...12} =													1437.31	(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

0

(58)

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

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

(59)m=	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) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)
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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=	126.67	110.78	114.32	99.66	95.63	82.52	76.47	87.75	88.8	103.48	112.96	122.67	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	126.67	110.78	114.32	99.66	95.63	82.52	76.47	87.75	88.8	103.48	112.96	122.67	
Output from water heater (annual) _{1...12}												1221.71	(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=	31.67	27.7	28.58	24.92	23.91	20.63	19.12	21.94	22.2	25.87	28.24	30.67	(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=	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	(66)

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

(67)m=	21.09	18.73	15.23	11.53	8.62	7.28	7.86	10.22	13.72	17.42	20.33	21.68	(67)
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=	213.36	215.57	209.99	198.12	183.12	169.03	159.62	157.4	162.98	174.86	189.85	203.95	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	42.56	41.21	38.41	34.61	32.13	28.65	25.7	29.49	30.83	34.77	39.22	41.22	(72)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(73)m=	336.11	334.62	322.74	303.35	282.97	264.06	252.27	256.21	266.63	286.15	308.51	325.94	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.63	x	0.7	=	62.75	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.63	x	0.7	=	106.88	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.63	x	0.7	=	146.24	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.63	x	0.7	=	181.19	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.63	x	0.7	=	202.95	(77)

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Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.63	x	0.7	=	201.48	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.63	x	0.7	=	194.25	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.63	x	0.7	=	178.02	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.63	x	0.7	=	158.34	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.63	x	0.7	=	118.12	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.63	x	0.7	=	75.15	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.63	x	0.7	=	53.7	(77)
Northwest 0.9x	0.77	x	1.86	x	11.28	x	0.63	x	0.7	=	12.83	(81)
Northwest 0.9x	0.77	x	1.86	x	22.97	x	0.63	x	0.7	=	26.11	(81)
Northwest 0.9x	0.77	x	1.86	x	41.38	x	0.63	x	0.7	=	47.04	(81)
Northwest 0.9x	0.77	x	1.86	x	67.96	x	0.63	x	0.7	=	77.26	(81)
Northwest 0.9x	0.77	x	1.86	x	91.35	x	0.63	x	0.7	=	103.85	(81)
Northwest 0.9x	0.77	x	1.86	x	97.38	x	0.63	x	0.7	=	110.71	(81)
Northwest 0.9x	0.77	x	1.86	x	91.1	x	0.63	x	0.7	=	103.57	(81)
Northwest 0.9x	0.77	x	1.86	x	72.63	x	0.63	x	0.7	=	82.57	(81)
Northwest 0.9x	0.77	x	1.86	x	50.42	x	0.63	x	0.7	=	57.32	(81)
Northwest 0.9x	0.77	x	1.86	x	28.07	x	0.63	x	0.7	=	31.91	(81)
Northwest 0.9x	0.77	x	1.86	x	14.2	x	0.63	x	0.7	=	16.14	(81)
Northwest 0.9x	0.77	x	1.86	x	9.21	x	0.63	x	0.7	=	10.48	(81)

Solar gains in watts, calculated for each month

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

(83)m=	75.57	132.99	193.28	258.45	306.8	312.2	297.82	260.59	215.66	150.03	91.29	64.17	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	411.68	467.6	516.02	561.8	589.78	576.26	550.1	516.8	482.3	436.18	399.8	390.11	(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	1	0.99	0.98	0.94	0.83	0.67	0.72	0.92	0.99	1	1	(86)

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

(87)m=	19.63	19.77	20.01	20.34	20.66	20.89	20.97	20.96	20.79	20.38	19.95	19.61	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.92	19.92	19.92	19.94	19.94	19.96	19.96	19.96	19.95	19.94	19.94	19.93	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.97	0.91	0.75	0.53	0.59	0.87	0.98	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	18.67	18.81	19.05	19.39	19.69	19.9	19.95	19.95	19.82	19.44	19.01	18.66	(90)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.48 (91)

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

(92)m=	19.13	19.27	19.51	19.85	20.16	20.38	20.44	20.44	20.29	19.9	19.46	19.12	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	19.13	19.27	19.51	19.85	20.16	20.38	20.44	20.44	20.29	19.9	19.46	19.12	(93)
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8. Space heating requirement

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

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

(94)m=	1	1	0.99	0.97	0.92	0.78	0.6	0.65	0.88	0.98	1	1	(94)
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Useful gains, $h_m G_m$, $W = (94)m \times (84)m$

(95)m=	410.85	465.71	511.16	546.6	542.21	450.86	329.03	338.25	426.76	427.83	398.22	389.51	(95)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

(97)m=	1376.05	1328.52	1198.49	991.4	763.3	513.53	341.59	357.65	553.34	838.9	1123.16	1364.7	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	718.11	579.81	511.37	320.25	164.49	0	0	0	0	305.84	521.96	725.54	
Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$												3847.37	(98)

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

49.88	(99)
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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 L_m (calculated using $25^\circ C$ internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	835.36	657.63	673.47	0	0	0	0	(100)
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Utilisation factor for loss h_m

(101)m=	0	0	0	0	0	0.79	0.87	0.85	0	0	0	0	(101)
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Useful loss, $h_m L_m$ (Watts) = $(100)m \times (101)m$

(102)m=	0	0	0	0	0	663.73	575.41	570.25	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	764.02	731.67	694.53	0	0	0	0	(103)
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Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set $(104)m$ to zero if $(104)m < 3 \times (98)m$

(104)m=	0	0	0	0	0	72.21	116.26	92.46	0	0	0	0	
Total = $Sum(104) =$												280.93	(104)
Cooled fraction f C = cooled area $\div$ (4) =												1	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = $Sum(104) =$												0	(106)

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

(107)m=	0	0	0	0	0	18.05	29.06	23.12	0	0	0	0	
Total = $Sum(107) =$												70.23	(107)

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

$(107) \div (4) =$	0.91	(108)
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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency $(99) + (108) =$

50.79	(109)
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Target Fabric Energy Efficiency (TFEE)

58.4	(109)
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DFEE WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 1b Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.14 (1a)	2.85 (2a)	219.85 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.14 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	219.85 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				3	30 (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) =	30	÷ (5) =	0.14 (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			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.89 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.89 (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 created by change of use

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

1.13	1.11	1.09	0.98	0.95	0.84	0.84	0.82	0.89	0.95	1	1.04
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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= 1.13 1.11 1.09 0.98 0.95 0.85 0.85 0.84 0.89 0.95 1 1.04 (24d)

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

(25)m= 1.13 1.11 1.09 0.98 0.95 0.85 0.85 0.84 0.89 0.95 1 1.04 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1.6	= 3.056		(26)
Windows Type 1			1.86	x1/[1/(1.6)+0.04]	= 2.8		(27)
Windows Type 2			2.79	x1/[1/(1.6)+0.04]	= 4.2		(27)
Floor			77.14	x 0.25	= 19.285		(28)
Walls	33.53	11.21	22.32	x 0.3	= 6.7		(29)
Roof	77.14	0	77.14	x 0.18	= 13.89		(30)
Total area of elements, m²			187.81				(31)
Party wall			75.81	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) = 56.91 (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 28.17 (36)

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

Total fabric heat loss (33) + (36) = 85.08 (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=	82	80.39	78.78	70.77	69.22	62	62	60.66	64.78	69.22	72.35	75.57

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

(39)m=	167.08	165.47	163.86	155.85	154.3	147.08	147.08	145.74	149.86	154.3	157.43	160.65
Average = Sum(39) _{1...12} /12=											155.72	(39)

DFEE WorkSheet: New dwelling created by change of use

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	2.17	2.15	2.12	2.02	2	1.91	1.91	1.89	1.94	2	2.04	2.08		
Average = Sum(40) _{1...12} /12=													2.02	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.41

(42)

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

if TFA ≤ 13.9, N = 1

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

91.35

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

(44)m=	100.49	96.83	93.18	89.52	85.87	82.22	82.22	85.87	89.52	93.18	96.83	100.49		
Total = Sum(44) _{1...12} =													1096.21	(44)

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

(45)m=	149.02	130.33	134.49	117.25	112.51	97.08	89.96	103.23	104.47	121.75	132.9	144.32		
Total = Sum(45) _{1...12} =													1437.31	(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

DFEE WorkSheet: New dwelling created by change of use

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

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

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

(62)m=	126.67	110.78	114.32	99.66	95.63	82.52	76.47	87.75	88.8	103.48	112.96	122.67	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	126.67	110.78	114.32	99.66	95.63	82.52	76.47	87.75	88.8	103.48	112.96	122.67	
Output from water heater (annual) _{1...12}												1221.71	(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=	31.67	27.7	28.58	24.92	23.91	20.63	19.12	21.94	22.2	25.87	28.24	30.67	(65)
--------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	(66)

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

(67)m=	21.09	18.73	15.23	11.53	8.62	7.28	7.86	10.22	13.72	17.42	20.33	21.68	(67)
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=	213.36	215.57	209.99	198.12	183.12	169.03	159.62	157.4	162.98	174.86	189.85	203.95	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	(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=	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	42.56	41.21	38.41	34.61	32.13	28.65	25.7	29.49	30.83	34.77	39.22	41.22	(72)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(73)m=	336.11	334.62	322.74	303.35	282.97	264.06	252.27	256.21	266.63	286.15	308.51	325.94	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.4	x	0.7	=	39.84	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.4	x	0.7	=	67.86	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.4	x	0.7	=	92.85	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.4	x	0.7	=	115.04	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.4	x	0.7	=	128.86	(77)

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Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.4	x	0.7	=	127.93	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.4	x	0.7	=	123.33	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.4	x	0.7	=	113.03	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.4	x	0.7	=	100.53	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.4	x	0.7	=	75	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.4	x	0.7	=	47.72	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.4	x	0.7	=	34.09	(77)
Northwest 0.9x	0.77	x	1.86	x	11.28	x	0.4	x	0.7	=	8.14	(81)
Northwest 0.9x	0.77	x	1.86	x	22.97	x	0.4	x	0.7	=	16.58	(81)
Northwest 0.9x	0.77	x	1.86	x	41.38	x	0.4	x	0.7	=	29.87	(81)
Northwest 0.9x	0.77	x	1.86	x	67.96	x	0.4	x	0.7	=	49.05	(81)
Northwest 0.9x	0.77	x	1.86	x	91.35	x	0.4	x	0.7	=	65.94	(81)
Northwest 0.9x	0.77	x	1.86	x	97.38	x	0.4	x	0.7	=	70.29	(81)
Northwest 0.9x	0.77	x	1.86	x	91.1	x	0.4	x	0.7	=	65.76	(81)
Northwest 0.9x	0.77	x	1.86	x	72.63	x	0.4	x	0.7	=	52.42	(81)
Northwest 0.9x	0.77	x	1.86	x	50.42	x	0.4	x	0.7	=	36.4	(81)
Northwest 0.9x	0.77	x	1.86	x	28.07	x	0.4	x	0.7	=	20.26	(81)
Northwest 0.9x	0.77	x	1.86	x	14.2	x	0.4	x	0.7	=	10.25	(81)
Northwest 0.9x	0.77	x	1.86	x	9.21	x	0.4	x	0.7	=	6.65	(81)

Solar gains in watts, calculated for each month

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

(83)m=	47.98	84.44	122.72	164.1	194.79	198.22	189.09	165.45	136.93	95.26	57.96	40.74	(83)
--------	-------	-------	--------	-------	--------	--------	--------	--------	--------	-------	-------	-------	------

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

(84)m=	384.09	419.05	445.45	467.45	477.77	462.28	441.37	421.66	403.56	381.41	366.47	366.68	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)
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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	1	1	0.99	0.98	0.95	0.9	0.91	0.97	0.99	1	1	(86)

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

(87)m=	18.53	18.69	19	19.51	19.98	20.46	20.73	20.69	20.32	19.71	19.09	18.57	(87)
--------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.23	19.24	19.25	19.32	19.33	19.4	19.4	19.41	19.37	19.33	19.31	19.28	(88)
--------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.99	0.97	0.9	0.75	0.79	0.95	0.99	1	1	(89)
--------	---	---	------	------	------	-----	------	------	------	------	---	---	------

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

(90)m=	17.06	17.22	17.55	18.1	18.58	19.09	19.31	19.3	18.94	18.31	17.68	17.14	(90)
--------	-------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.48 (91)

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

(92)m=	17.77	17.93	18.25	18.78	19.26	19.75	20	19.97	19.6	18.99	18.36	17.83	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DFEE WorkSheet: New dwelling created by change of use

(93)m=	17.77	17.93	18.25	18.78	19.26	19.75	20	19.97	19.6	18.99	18.36	17.83	(93)
--------	-------	-------	-------	-------	-------	-------	----	-------	------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	1	1	0.99	0.99	0.97	0.92	0.82	0.85	0.95	0.99	1	1	(94)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(95)m=	382.85	417.14	442.19	460.97	462.8	425	361.65	358	384.37	376.69	364.79	365.72	(95)
--------	--------	--------	--------	--------	-------	-----	--------	-----	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	2250.05	2155.97	1925.52	1539.49	1166.03	757.94	499.38	520.45	824.91	1293.81	1772.55	2189.8	(97)
--------	---------	---------	---------	---------	---------	--------	--------	--------	--------	---------	---------	--------	------

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

(98)m=	1389.2	1168.5	1103.6	776.54	523.21	0	0	0	0	682.34	1013.59	1357.12	
Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$												8014.08	(98)

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

103.89	(99)
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8c. Space cooling requirement

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

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

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

(100)m=	0	0	0	0	0	1382.55	1088.39	1107.65	0	0	0	0	(100)
---------	---	---	---	---	---	---------	---------	---------	---	---	---	---	-------

Utilisation factor for loss h_m

(101)m=	0	0	0	0	0	0.44	0.52	0.5	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	-----	---	---	---	---	-------

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

(102)m=	0	0	0	0	0	606.77	565.91	551.27	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	630.8	604.58	583.33	0	0	0	0	(103)
---------	---	---	---	---	---	-------	--------	--------	---	---	---	---	-------

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

(104)m=	0	0	0	0	0	17.3	28.78	23.85	0	0	0	0	
Total = $Sum(104) =$												69.93	(104)
Cooled fraction $f_C = \text{cooled area} \div (4) =$												1	(105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
Total = $Sum(104) =$												0	(106)

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

(107)m=	0	0	0	0	0	4.32	7.19	5.96	0	0	0	0	
Total = $Sum(107) =$												17.48	(107)

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

$(107) \div (4) =$

0.23	(108)
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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency	$(99) + (108) =$	104.12	(109)
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DER WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 1b Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.14 (1a)	2.85 (2a)	219.85 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.14 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	219.85 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0	0 (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) =	0	÷ (5) =	0 (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			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.75 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.75 (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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DER WorkSheet: New dwelling created by change of use

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

0.96	0.94	0.92	0.82	0.81	0.71	0.71	0.69	0.75	0.81	0.84	0.88
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 1.07 1.06 1.04 0.94 0.92 0.83 0.83 0.81 0.87 0.92 0.96 1 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1.6	= 3.056		(26)
Windows Type 1			1.86	x1/[1/(1.6)+0.04]	= 2.8		(27)
Windows Type 2			2.79	x1/[1/(1.6)+0.04]	= 4.2		(27)
Floor			77.14	x 0.25	= 19.285		(28)
Walls	33.53	11.21	22.32	x 0.3	= 6.7		(29)
Roof	77.14	0	77.14	x 0.18	= 13.89		(30)
Total area of elements, m²			187.81				(31)
Party wall			75.81	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) = 56.91 (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 28.17 (36)

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

Total fabric heat loss (33) + (36) = 85.08 (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=	77.9	76.54	75.18	68.38	67.02	60.22	60.22	58.86	62.94	67.02	69.74	72.46

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

(39)m=	162.98	161.62	160.26	153.46	152.1	145.3	145.3	143.93	148.02	152.1	154.82	157.54
Average = Sum(39) _{1...12} /12=												153.12 (39)

DER WorkSheet: New dwelling created by change of use

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	2.11	2.1	2.08	1.99	1.97	1.88	1.88	1.87	1.92	1.97	2.01	2.04		
Average = Sum(40) _{1...12} /12=													1.98	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.41

(42)

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

if TFA ≤ 13.9, N = 1

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

91.35

(43)

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

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

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

(44)m=	100.49	96.83	93.18	89.52	85.87	82.22	82.22	85.87	89.52	93.18	96.83	100.49		
Total = Sum(44) _{1...12} =													1096.21	(44)

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

(45)m=	149.02	130.33	134.49	117.25	112.51	97.08	89.96	103.23	104.47	121.75	132.9	144.32		
Total = Sum(45) _{1...12} =													1437.31	(45)

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

(46)m=	22.35	19.55	20.17	17.59	16.88	14.56	13.49	15.49	15.67	18.26	19.93	21.65		(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

DER WorkSheet: New dwelling created by change of use

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

(61)m=	50.96	44.57	47.48	44.15	43.76	40.54	41.9	43.76	44.15	47.48	47.75	50.96	(61)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(62)m=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	(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=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	
Output from water heater (annual) _{1...12}												1984.77	(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=	62.29	54.48	56.59	50.02	48.35	42.42	40.39	45.26	45.77	52.35	56.13	60.72	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	(66)

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

(67)m=	21.09	18.73	15.23	11.53	8.62	7.28	7.86	10.22	13.72	17.42	20.33	21.68	(67)
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=	213.36	215.57	209.99	198.12	183.12	169.03	159.62	157.4	162.98	174.86	189.85	203.95	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	(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=	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	83.72	81.07	76.06	69.48	64.98	58.91	54.28	60.84	63.57	70.36	77.95	81.62	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	380.27	377.47	363.38	341.22	318.82	297.32	283.86	290.56	302.37	324.74	350.24	369.34	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.4	x	0.7	=	39.84	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.4	x	0.7	=	67.86	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.4	x	0.7	=	92.85	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.4	x	0.7	=	115.04	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.4	x	0.7	=	128.86	(77)

DER WorkSheet: New dwelling created by change of use

Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.4	x	0.7	=	127.93	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.4	x	0.7	=	123.33	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.4	x	0.7	=	113.03	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.4	x	0.7	=	100.53	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.4	x	0.7	=	75	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.4	x	0.7	=	47.72	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.4	x	0.7	=	34.09	(77)
Northwest 0.9x	0.77	x	1.86	x	11.28	x	0.4	x	0.7	=	8.14	(81)
Northwest 0.9x	0.77	x	1.86	x	22.97	x	0.4	x	0.7	=	16.58	(81)
Northwest 0.9x	0.77	x	1.86	x	41.38	x	0.4	x	0.7	=	29.87	(81)
Northwest 0.9x	0.77	x	1.86	x	67.96	x	0.4	x	0.7	=	49.05	(81)
Northwest 0.9x	0.77	x	1.86	x	91.35	x	0.4	x	0.7	=	65.94	(81)
Northwest 0.9x	0.77	x	1.86	x	97.38	x	0.4	x	0.7	=	70.29	(81)
Northwest 0.9x	0.77	x	1.86	x	91.1	x	0.4	x	0.7	=	65.76	(81)
Northwest 0.9x	0.77	x	1.86	x	72.63	x	0.4	x	0.7	=	52.42	(81)
Northwest 0.9x	0.77	x	1.86	x	50.42	x	0.4	x	0.7	=	36.4	(81)
Northwest 0.9x	0.77	x	1.86	x	28.07	x	0.4	x	0.7	=	20.26	(81)
Northwest 0.9x	0.77	x	1.86	x	14.2	x	0.4	x	0.7	=	10.25	(81)
Northwest 0.9x	0.77	x	1.86	x	9.21	x	0.4	x	0.7	=	6.65	(81)

Solar gains in watts, calculated for each month

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

(83)m=	47.98	84.44	122.72	164.1	194.79	198.22	189.09	165.45	136.93	95.26	57.96	40.74	(83)
--------	-------	-------	--------	-------	--------	--------	--------	--------	--------	-------	-------	-------	------

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

(84)m=	428.25	461.91	486.1	505.32	513.62	495.54	472.96	456.01	439.3	420	408.2	410.08	(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	1	0.99	0.99	0.98	0.94	0.88	0.9	0.97	0.99	1	1	(86)

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

(87)m=	18.62	18.78	19.08	19.57	20.03	20.5	20.76	20.73	20.36	19.77	19.16	18.66	(87)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.26	19.27	19.28	19.34	19.35	19.41	19.41	19.42	19.39	19.35	19.33	19.31	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.99	0.96	0.89	0.72	0.76	0.93	0.99	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	16.21	16.44	16.89	17.63	18.31	19	19.3	19.28	18.81	17.93	17.04	16.28	(90)
--------	-------	-------	-------	-------	-------	----	------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.48

(91)

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

(92)m=	17.37	17.57	17.95	18.57	19.14	19.73	20.01	19.98	19.56	18.82	18.06	17.43	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

DER WorkSheet: New dwelling created by change of use

(93)m=	17.37	17.57	17.95	18.57	19.14	19.73	20.01	19.98	19.56	18.82	18.06	17.43	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	1	0.99	0.99	0.98	0.96	0.9	0.79	0.82	0.94	0.98	0.99	1	(94)
--------	---	------	------	------	------	-----	------	------	------	------	------	---	------

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

(95)m=	426.2	458.89	481.18	495.97	493.07	447.19	374.98	374.74	412.41	412.7	405.41	408.45	(95)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	2130.9	2047.15	1835.16	1483.49	1132.35	745.1	494.79	515.34	807.83	1249.7	1697.19	2084.13	(97)
--------	--------	---------	---------	---------	---------	-------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	1268.29	1067.31	1007.36	711.01	475.62	0	0	0	0	622.73	930.08	1246.7	
Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$												7329.12	(98)

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

95.01	(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 90.3 (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)

1268.29	1067.31	1007.36	711.01	475.62	0	0	0	0	622.73	930.08	1246.7
---------	---------	---------	--------	--------	---	---	---	---	--------	--------	--------

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

1404.53	1181.96	1115.57	787.39	526.72	0	0	0	0	689.63	1029.99	1380.62		
Total (kWh/year) =Sum(211) _{1..5,10...12} =												8116.41	(211)

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

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

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

Water heating

Output from water heater (calculated above)

199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27
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Efficiency of water heater 81 (216)

(217)m= (217)

88.91	88.86	88.74	88.42	87.81	81	81	81	81	88.14	88.64	88.92
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Fuel for water heating, $kWh/month$

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

(219)m=	224.92	196.82	205.06	182.54	177.96	169.91	162.79	181.47	183.48	192	203.79	219.61	
Total = $Sum(219a)_{1..12} =$												2300.36	(219)

Annual totals

Space heating fuel used, main system 1 $kWh/year$ 8116.41 $kWh/year$

DER WorkSheet: New dwelling created by change of use

Water heating fuel used		2300.36	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	241.39		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	316.39	(231)
Electricity for lighting		372.47	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		11105.64	(338)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1753.14	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	496.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2250.02	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	164.21	(267)
Electricity for lighting	(232) x	0.519	=	193.31	(268)
Total CO2, kg/year		sum of (265)...(271) =		2607.55	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		33.8	(273)
El rating (section 14)				71	(274)

TER WorkSheet: New dwelling created by change of use

User Details:

Assessor Name: Sean Mills **Stroma Number:** STRO034864
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: Flat 1b Baseline

Address : 412 Muswell Hill Broadway, Hornsey, LONDON, N10 1DJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.14 (1a)	2.85 (2a)	219.85 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.14 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	219.85 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				3	30 (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) =	30	÷ (5) =	0.14 (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)			0.39 (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			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.39 (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
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TER WorkSheet: New dwelling created by change of use

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

0.49	0.48	0.47	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.43	0.45
------	------	------	------	------	------	------	------	------	------	------	------

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= 0.62 0.62 0.61 0.59 0.59 0.57 0.57 0.56 0.57 0.59 0.59 0.6 (24d)

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

(25)m= 0.62 0.62 0.61 0.59 0.59 0.57 0.57 0.56 0.57 0.59 0.59 0.6 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			1.91	x 1	= 1.91		(26)
Windows Type 1			1.86	x1/[1/(1.4)+0.04]	= 2.47		(27)
Windows Type 2			2.79	x1/[1/(1.4)+0.04]	= 3.7		(27)
Floor			77.14	x 0.13	= 10.0282		(28)
Walls	33.53	11.21	22.32	x 0.18	= 4.02		(29)
Roof	77.14	0	77.14	x 0.13	= 10.03		(30)
Total area of elements, m²			187.81				(31)
Party wall			75.81	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) = 38.31 (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 9.39 (36)

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

Total fabric heat loss (33) + (36) = 47.7 (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=	45.08	44.74	44.4	42.83	42.54	41.16	41.16	40.91	41.69	42.54	43.13	43.75

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

(39)m=	92.79	92.44	92.11	90.53	90.24	88.87	88.87	88.61	89.4	90.24	90.84	91.46
Average = Sum(39) _{1...12} /12=												90.53 (39)

TER WorkSheet: New dwelling created by change of use

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	1.2	1.2	1.19	1.17	1.17	1.15	1.15	1.15	1.16	1.17	1.18	1.19		
Average = Sum(40) _{1...12} /12=													1.17	(40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.41

(42)

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

if TFA ≤ 13.9, N = 1

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

91.35

(43)

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

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

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

(44)m=	100.49	96.83	93.18	89.52	85.87	82.22	82.22	85.87	89.52	93.18	96.83	100.49		
Total = Sum(44) _{1...12} =													1096.21	(44)

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

(45)m=	149.02	130.33	134.49	117.25	112.51	97.08	89.96	103.23	104.47	121.75	132.9	144.32		
Total = Sum(45) _{1...12} =													1437.31	(45)

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

(46)m=	22.35	19.55	20.17	17.59	16.88	14.56	13.49	15.49	15.67	18.26	19.93	21.65		(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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

TER WorkSheet: New dwelling created by change of use

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

(61)m=	50.96	44.57	47.48	44.15	43.76	40.54	41.9	43.76	44.15	47.48	47.75	50.96	(61)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(62)m=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	(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=	199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27	
Output from water heater (annual) _{1...12}												1984.77	(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=	62.29	54.48	56.59	50.02	48.35	42.42	40.39	45.26	45.77	52.35	56.13	60.72	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	120.32	(66)

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

(67)m=	21.09	18.73	15.23	11.53	8.62	7.28	7.86	10.22	13.72	17.42	20.33	21.68	(67)
--------	-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------	------

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

(68)m=	213.36	215.57	209.99	198.12	183.12	169.03	159.62	157.4	162.98	174.86	189.85	203.95	(68)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	35.03	(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=	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	-96.25	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	83.72	81.07	76.06	69.48	64.98	58.91	54.28	60.84	63.57	70.36	77.95	81.62	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	380.27	377.47	363.38	341.22	318.82	297.32	283.86	290.56	302.37	324.74	350.24	369.34	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.79	x	36.79	x	0.63	x	0.7	=	62.75	(77)
Southeast 0.9x	0.77	x	2.79	x	62.67	x	0.63	x	0.7	=	106.88	(77)
Southeast 0.9x	0.77	x	2.79	x	85.75	x	0.63	x	0.7	=	146.24	(77)
Southeast 0.9x	0.77	x	2.79	x	106.25	x	0.63	x	0.7	=	181.19	(77)
Southeast 0.9x	0.77	x	2.79	x	119.01	x	0.63	x	0.7	=	202.95	(77)

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Southeast 0.9x	0.77	x	2.79	x	118.15	x	0.63	x	0.7	=	201.48	(77)
Southeast 0.9x	0.77	x	2.79	x	113.91	x	0.63	x	0.7	=	194.25	(77)
Southeast 0.9x	0.77	x	2.79	x	104.39	x	0.63	x	0.7	=	178.02	(77)
Southeast 0.9x	0.77	x	2.79	x	92.85	x	0.63	x	0.7	=	158.34	(77)
Southeast 0.9x	0.77	x	2.79	x	69.27	x	0.63	x	0.7	=	118.12	(77)
Southeast 0.9x	0.77	x	2.79	x	44.07	x	0.63	x	0.7	=	75.15	(77)
Southeast 0.9x	0.77	x	2.79	x	31.49	x	0.63	x	0.7	=	53.7	(77)
Northwest 0.9x	0.77	x	1.86	x	11.28	x	0.63	x	0.7	=	12.83	(81)
Northwest 0.9x	0.77	x	1.86	x	22.97	x	0.63	x	0.7	=	26.11	(81)
Northwest 0.9x	0.77	x	1.86	x	41.38	x	0.63	x	0.7	=	47.04	(81)
Northwest 0.9x	0.77	x	1.86	x	67.96	x	0.63	x	0.7	=	77.26	(81)
Northwest 0.9x	0.77	x	1.86	x	91.35	x	0.63	x	0.7	=	103.85	(81)
Northwest 0.9x	0.77	x	1.86	x	97.38	x	0.63	x	0.7	=	110.71	(81)
Northwest 0.9x	0.77	x	1.86	x	91.1	x	0.63	x	0.7	=	103.57	(81)
Northwest 0.9x	0.77	x	1.86	x	72.63	x	0.63	x	0.7	=	82.57	(81)
Northwest 0.9x	0.77	x	1.86	x	50.42	x	0.63	x	0.7	=	57.32	(81)
Northwest 0.9x	0.77	x	1.86	x	28.07	x	0.63	x	0.7	=	31.91	(81)
Northwest 0.9x	0.77	x	1.86	x	14.2	x	0.63	x	0.7	=	16.14	(81)
Northwest 0.9x	0.77	x	1.86	x	9.21	x	0.63	x	0.7	=	10.48	(81)

Solar gains in watts, calculated for each month

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

(83)m=	75.57	132.99	193.28	258.45	306.8	312.2	297.82	260.59	215.66	150.03	91.29	64.17	(83)
--------	-------	--------	--------	--------	-------	-------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	455.84	510.46	556.66	599.67	625.63	609.52	581.68	551.15	518.04	474.78	441.53	433.51	(84)
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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)
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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	1	0.99	0.98	0.93	0.8	0.64	0.69	0.9	0.98	1	1	(86)

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

(87)m=	19.68	19.82	20.05	20.38	20.69	20.9	20.98	20.97	20.81	20.43	20	19.67	(87)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	----	-------	------

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

(88)m=	19.92	19.92	19.92	19.94	19.94	19.96	19.96	19.96	19.95	19.94	19.94	19.93	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.9	0.72	0.5	0.56	0.84	0.97	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=	18.16	18.36	18.71	19.2	19.62	19.89	19.95	19.95	19.79	19.27	18.65	18.15	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.48 (91)

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

(92)m=	18.89	19.07	19.36	19.77	20.13	20.38	20.45	20.44	20.29	19.83	19.3	18.88	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.89	19.07	19.36	19.77	20.13	20.38	20.45	20.44	20.29	19.83	19.3	18.88	(93)
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8. Space heating requirement

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

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

(94)m=	1	0.99	0.99	0.96	0.9	0.76	0.57	0.62	0.86	0.97	0.99	1	(94)
--------	---	------	------	------	-----	------	------	------	------	------	------	---	------

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

(95)m=	454.3	507.26	549.15	578.31	564.45	460.38	331.56	342.45	445.12	461.72	438.68	432.36	(95)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1354.21	1309.61	1184.48	983.96	761.07	513.6	341.74	357.9	553.1	832.72	1108.45	1342.73	(97)
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Space heating requirement for each month, $kWh/month = 0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	669.54	539.18	472.68	292.07	146.29	0	0	0	0	276.02	482.24	677.32	
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Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$ 3555.32 (98)

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

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

1 (204)

Efficiency of main space heating system 1

93.4 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

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

Space heating requirement (calculated above)

669.54	539.18	472.68	292.07	146.29	0	0	0	0	276.02	482.24	677.32
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(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$

716.85	577.28	506.08	312.71	156.62	0	0	0	0	295.53	516.31	725.18
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Total ($kWh/year$) = $Sum(211)_{1..5,10..12} =$ 3806.56 (211)

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

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

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

Water heating

Output from water heater (calculated above)

199.98	174.9	181.97	161.4	156.26	137.63	131.86	146.99	148.62	169.23	180.65	195.27
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Efficiency of water heater

80.3 (216)

(217)m=	87.86	87.7	87.35	86.53	84.89	80.3	80.3	80.3	80.3	86.28	87.4	87.93	(217)
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Fuel for water heating, $kWh/month$

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

(219)m=	227.61	199.44	208.34	186.53	184.09	171.39	164.21	183.05	185.08	196.15	206.68	222.09
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Total = $Sum(219a)_{1..12} =$ 2334.66 (219)

Annual totals

$kWh/year$

$kWh/year$

Space heating fuel used, main system 1

3806.56

TER WorkSheet: New dwelling created by change of use

Water heating fuel used			2334.66	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =		75	(231)
Electricity for lighting			372.47	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			6588.69	(338)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	822.22	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	504.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1326.5	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	193.31	(268)
Total CO2, kg/year		sum of (265)...(271) =		1558.74	(272)

TER = 20.21 (273)