ABBEYCONSULTANTS

Appendix F Part 1

BASELINE SAP CALCULATIONS

217 High Street Yiewsley

Taylor Wimpey West London

Appendix to report No: PA-ES-YHS-TWWL-20-02

Report Date: July 2020

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 1 2 GF

Address : P 1 2, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.18 (1a)	x	2.55 (2a)	=	135.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.18 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	135.61	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

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

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.46	x	1/[1/(1.4)+ 0.04]	=	13.87			(27)
Floor			53.18	x	0.13	=	6.9134			(28)
Walls Type1	36.03	10.46	25.57	x	0.18	=	4.6			(29)
Walls Type2	9.56	2.1	7.46	x	0.18	=	1.34			(29)
Total area of elements, m²			98.77							(31)
Party wall			28.97	x	0	=	0			(32)
Party ceiling			53.18							(32b)
Internal wall **			97.64							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7625.95 (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 7.04 (36)

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

Total fabric heat loss (33) + (36) = 35.87 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.37	26.21	25.47	25.33	24.68	24.68	24.56	24.93	25.33	25.61	25.9	(38)

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

(39)m=	62.4	62.23	62.08	61.33	61.2	60.55	60.55	60.43	60.8	61.2	61.48	61.77	

Average = Sum(39)$_{1...12}$ /12= 61.33 (39)

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

(40)m=	1.17	1.17	1.17	1.15	1.15	1.14	1.14	1.14	1.14	1.15	1.16	1.16

Average = Sum(40)$_{1...12}$ /12= 1.15 (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 1.78 (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 76.57 (43)

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

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

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

(44)m=	84.22	81.16	78.1	75.04	71.97	68.91	68.91	71.97	75.04	78.1	81.16	84.22

Total = Sum(44)$_{1...12}$ = 918.8 (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=	124.9	109.24	112.73	98.28	94.3	81.37	75.4	86.53	87.56	102.04	111.39	120.96

Total = Sum(45)$_{1...12}$ = 1204.69 (45)

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

(46)m=	18.74	16.39	16.91	14.74	14.14	12.21	11.31	12.98	13.13	15.31	16.71	18.14

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	171.5	151.32	159.32	143.37	140.89	126.46	122	133.12	132.65	148.64	156.48	167.55	(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=	171.5	151.32	159.32	143.37	140.89	126.46	122	133.12	132.65	148.64	156.48	167.55	

Output from water heater (annual)$_{1...12}$ 1753.31 (64)

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

(65)m=	78.81	69.99	74.76	68.75	68.63	63.13	62.35	66.05	65.19	71.21	73.11	77.5	(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=	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	(66)

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

(67)m=	13.98	12.42	10.1	7.65	5.72	4.83	5.21	6.78	9.1	11.55	13.48	14.37	(67)

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

(68)m=	155.48	157.1	153.03	144.38	133.45	123.18	116.32	114.71	118.77	127.43	138.35	148.62	(68)

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

(69)m=	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	(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=	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	(71)

Water heating gains (Table 5)

(72)m=	105.92	104.15	100.48	95.49	92.24	87.68	83.8	88.77	90.54	95.71	101.54	104.16	(72)

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

(73)m=	328.15	326.43	316.37	300.27	284.17	268.45	258.09	263.01	271.17	287.44	306.14	319.91	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	10.46	x	36.79	x	0.63	x	0.7	=	117.62	(77)
Southeast 0.9x	0.77	x	10.46	x	62.67	x	0.63	x	0.7	=	200.35	(77)
Southeast 0.9x	0.77	x	10.46	x	85.75	x	0.63	x	0.7	=	274.13	(77)
Southeast 0.9x	0.77	x	10.46	x	106.25	x	0.63	x	0.7	=	339.66	(77)
Southeast 0.9x	0.77	x	10.46	x	119.01	x	0.63	x	0.7	=	380.44	(77)

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Southeast 0.9x	0.77	x	10.46	x	118.15	x	0.63	x	0.7	=	377.69	(77)
Southeast 0.9x	0.77	x	10.46	x	113.91	x	0.63	x	0.7	=	364.14	(77)
Southeast 0.9x	0.77	x	10.46	x	104.39	x	0.63	x	0.7	=	333.71	(77)
Southeast 0.9x	0.77	x	10.46	x	92.85	x	0.63	x	0.7	=	296.82	(77)
Southeast 0.9x	0.77	x	10.46	x	69.27	x	0.63	x	0.7	=	221.43	(77)
Southeast 0.9x	0.77	x	10.46	x	44.07	x	0.63	x	0.7	=	140.88	(77)
Southeast 0.9x	0.77	x	10.46	x	31.49	x	0.63	x	0.7	=	100.66	(77)

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

(83)m=	117.62	200.35	274.13	339.66	380.44	377.69	364.14	333.71	296.82	221.43	140.88	100.66	(83)

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

(84)m=	445.77	526.78	590.5	639.92	664.61	646.14	622.23	596.72	567.99	508.87	447.02	420.57	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.89	0.76	0.58	0.42	0.46	0.69	0.91	0.98	0.99	(86)

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

(87)m=	19.94	20.15	20.41	20.69	20.89	20.98	21	20.99	20.95	20.7	20.27	19.91	(87)

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

(88)m=	19.94	19.94	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95	(88)

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

(89)m=	0.99	0.97	0.94	0.86	0.7	0.5	0.33	0.36	0.6	0.88	0.97	0.99	(89)

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

(90)m=	18.56	18.85	19.23	19.62	19.86	19.96	19.97	19.97	19.93	19.64	19.04	18.52	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.2	19.45	19.77	20.12	20.34	20.43	20.44	20.44	20.4	20.12	19.6	19.16	(92)

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

(93)m=	19.2	19.45	19.77	20.12	20.34	20.43	20.44	20.44	20.4	20.12	19.6	19.16	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.86	0.73	0.53	0.37	0.41	0.64	0.89	0.97	0.99	(94)

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

(95)m=	439.57	511.12	553.4	551.84	482.75	345.17	231.62	242.67	364.25	450.38	434.11	416	(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=	929.66	905.42	823.73	687.92	528.47	352.83	232.62	244.23	383.05	582.81	768.71	923.89	(97)

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

(98)m=	364.63	264.97	201.13	97.98	34.02	0	0	0	0	98.53	240.91	377.87	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1680.04	(98)
Space heating requirement in kWh/m²/year	31.59	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	364.63	264.97	201.13	97.98	34.02	0	0	0	0	98.53	240.91	377.87	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	389.98	283.39	215.11	104.79	36.39	0	0	0	0	105.38	257.65	404.14	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1796.83 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	171.5	151.32	159.32	143.37	140.89	126.46	122	133.12	132.65	148.64	156.48	167.55	

Efficiency of water heater 79.8 (216)

(217)m=	86.78	86.29	85.44	83.82	81.68	79.8	79.8	79.8	79.8	83.75	85.96	86.92	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	197.63	175.36	186.48	171.04	172.5	158.48	152.88	166.82	166.23	177.48	182.03	192.77	

Total = Sum(219a)$_{1...12}$ = 2099.69 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1796.83
Water heating fuel used		2099.69
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		246.97 (232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	388.12 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	453.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =			841.65	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	128.18	(268)
Total CO2, kg/year	sum of (265)…(271) =			1008.75	(272)

TER = 18.97 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 1 2 TF

Address : P 1 2, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.18 (1a)	x	2.55 (2a)	=	135.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.18 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	135.61	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

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

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.46	x	1/[1/(1.4)+ 0.04]	=	13.87			(27)
Walls Type1	36.03	10.46	25.57	x	0.18	=	4.6			(29)
Walls Type2	9.56	2.1	7.46	x	0.18	=	1.34			(29)
Roof	53.18	0	53.18	x	0.13	=	6.91			(30)
Total area of elements, m²			98.77							(31)
Party wall			28.97	x	0	=	0			(32)
Party floor			53.18							(32a)
Internal wall **			97.64							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6243.27 (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 14.44 (36)

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

Total fabric heat loss (33) + (36) = 43.26 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.37	26.21	25.47	25.33	24.68	24.68	24.56	24.93	25.33	25.61	25.9	(38)

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

(39)m=	69.79	69.63	69.47	68.73	68.59	67.95	67.95	67.83	68.19	68.59	68.87	69.17	

Average = Sum(39)$_{1...12}$ /12= 68.73 (39)

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

(40)m=	1.31	1.31	1.31	1.29	1.29	1.28	1.28	1.28	1.28	1.29	1.3	1.3

Average = Sum(40)$_{1...12}$ /12= 1.29 (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 1.78 (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 76.57 (43)

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

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

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

(44)m=	84.22	81.16	78.1	75.04	71.97	68.91	68.91	71.97	75.04	78.1	81.16	84.22

Total = Sum(44)$_{1...12}$ = 918.8 (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=	124.9	109.24	112.73	98.28	94.3	81.37	75.4	86.53	87.56	102.04	111.39	120.96

Total = Sum(45)$_{1...12}$ = 1204.69 (45)

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

(46)m=	18.74	16.39	16.91	14.74	14.14	12.21	11.31	12.98	13.13	15.31	16.71	18.14

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	171.5	151.32	159.32	143.37	140.89	126.46	122	133.12	132.65	148.64	156.48	167.55	(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=	171.5	151.32	159.32	143.37	140.89	126.46	122	133.12	132.65	148.64	156.48	167.55	

Output from water heater (annual)$_{1...12}$ 1753.31 (64)

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

(65)m=	78.81	69.99	74.76	68.75	68.63	63.13	62.35	66.05	65.19	71.21	73.11	77.5	(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=	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	(66)

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

(67)m=	13.98	12.42	10.1	7.65	5.72	4.83	5.21	6.78	9.1	11.55	13.48	14.37	(67)

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

(68)m=	155.48	157.1	153.03	144.38	133.45	123.18	116.32	114.71	118.77	127.43	138.35	148.62	(68)

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

(69)m=	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	(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=	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	(71)

Water heating gains (Table 5)

(72)m=	105.92	104.15	100.48	95.49	92.24	87.68	83.8	88.77	90.54	95.71	101.54	104.16	(72)

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

(73)m=	328.15	326.43	316.37	300.27	284.17	268.45	258.09	263.01	271.17	287.44	306.14	319.91	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	10.46	x	36.79	x	0.63	x	0.7	=	117.62	(77)
Southeast 0.9x	0.77	x	10.46	x	62.67	x	0.63	x	0.7	=	200.35	(77)
Southeast 0.9x	0.77	x	10.46	x	85.75	x	0.63	x	0.7	=	274.13	(77)
Southeast 0.9x	0.77	x	10.46	x	106.25	x	0.63	x	0.7	=	339.66	(77)
Southeast 0.9x	0.77	x	10.46	x	119.01	x	0.63	x	0.7	=	380.44	(77)

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Southeast 0.9x	0.77	x	10.46	x	118.15	x	0.63	x	0.7	=	377.69	(77)
Southeast 0.9x	0.77	x	10.46	x	113.91	x	0.63	x	0.7	=	364.14	(77)
Southeast 0.9x	0.77	x	10.46	x	104.39	x	0.63	x	0.7	=	333.71	(77)
Southeast 0.9x	0.77	x	10.46	x	92.85	x	0.63	x	0.7	=	296.82	(77)
Southeast 0.9x	0.77	x	10.46	x	69.27	x	0.63	x	0.7	=	221.43	(77)
Southeast 0.9x	0.77	x	10.46	x	44.07	x	0.63	x	0.7	=	140.88	(77)
Southeast 0.9x	0.77	x	10.46	x	31.49	x	0.63	x	0.7	=	100.66	(77)

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

(83)m=	117.62	200.35	274.13	339.66	380.44	377.69	364.14	333.71	296.82	221.43	140.88	100.66	(83)

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

(84)m=	445.77	526.78	590.5	639.92	664.61	646.14	622.23	596.72	567.99	508.87	447.02	420.57	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.8	0.63	0.47	0.51	0.74	0.93	0.98	0.99	(86)

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

(87)m=	19.76	19.96	20.25	20.57	20.82	20.96	20.99	20.99	20.91	20.59	20.11	19.72	(87)

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

(88)m=	19.83	19.83	19.84	19.85	19.85	19.86	19.86	19.86	19.85	19.85	19.84	19.84	(88)

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

(89)m=	0.99	0.98	0.95	0.88	0.74	0.54	0.35	0.39	0.65	0.9	0.98	0.99	(89)

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

(90)m=	18.22	18.51	18.92	19.37	19.69	19.83	19.86	19.86	19.79	19.4	18.73	18.17	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	18.93	19.18	19.53	19.92	20.21	20.35	20.38	20.38	20.31	19.95	19.37	18.88	(92)

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

(93)m=	18.93	19.18	19.53	19.92	20.21	20.35	20.38	20.38	20.31	19.95	19.37	18.88	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.88	0.76	0.58	0.41	0.45	0.68	0.9	0.97	0.99	(94)

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

(95)m=	439.81	512.48	557.97	564.78	507.76	374.62	254.19	265.93	388.86	458.73	435.24	416.11	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	1020.85	994.45	905.08	757.63	583.64	390.65	256.73	269.72	423.26	641.13	844.88	1015.57	(97)

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

(98)m=	432.3	323.89	258.25	138.85	56.45	0	0	0	0	135.7	294.94	446	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2086.38	(98)
Space heating requirement in kWh/m²/year	39.23	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	432.3	323.89	258.25	138.85	56.45	0	0	0	0	135.7	294.94	446	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	462.35	346.41	276.21	148.51	60.38	0	0	0	0	145.14	315.45	477	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2231.43 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	171.5	151.32	159.32	143.37	140.89	126.46	122	133.12	132.65	148.64	156.48	167.55	

Efficiency of water heater 79.8 (216)

(217)m=	87.18	86.79	86.1	84.73	82.59	79.8	79.8	79.8	79.8	84.57	86.48	87.3	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.72	174.35	185.05	169.21	170.59	158.48	152.88	166.82	166.23	175.75	180.94	191.92	

Total = Sum(219a)$_{1...12}$ = 2088.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2231.43
Water heating fuel used		2088.93
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		246.97 (232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	481.99 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	451.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =			933.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	128.18	(268)
Total CO2, kg/year	sum of (265)…(271) =			1100.3	(272)

TER = 20.69 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 1 2

Address : P 1 2, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	53.18 (1a)	x	2.55 (2a)	=	135.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.18 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	135.61	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

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

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.46	x	1/[1/(1.4)+ 0.04]	=	13.87			(27)
Walls Type1	36.03	10.46	25.57	x	0.18	=	4.6			(29)
Walls Type2	9.56	2.1	7.46	x	0.18	=	1.34			(29)
Total area of elements, m²			45.59							(31)
Party wall			28.97	x	0	=	0			(32)
Party floor			53.18							(32a)
Party ceiling			53.18							(32b)
Internal wall **			97.64							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.91 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7360.05 (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 4.31 (36)

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

Total fabric heat loss (33) + (36) = 26.23 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.37	26.21	25.47	25.33	24.68	24.68	24.56	24.93	25.33	25.61	25.9	(38)

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

(39)m=	52.75	52.59	52.44	51.69	51.55	50.91	50.91	50.79	51.16	51.55	51.84	52.13	

Average = Sum(39)$_{1...12}$ /12= 51.69 (39)

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

(40)m=	0.99	0.99	0.99	0.97	0.97	0.96	0.96	0.96	0.96	0.97	0.97	0.98

Average = Sum(40)$_{1...12}$ /12= 0.97 (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 1.78 (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 76.57 (43)

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

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

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

(44)m=	84.22	81.16	78.1	75.04	71.97	68.91	68.91	71.97	75.04	78.1	81.16	84.22

Total = Sum(44)$_{1...12}$ = 918.8 (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=	124.9	109.24	112.73	98.28	94.3	81.37	75.4	86.53	87.56	102.04	111.39	120.96

Total = Sum(45)$_{1...12}$ = 1204.69 (45)

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

(46)m=	18.74	16.39	16.91	14.74	14.14	12.21	11.31	12.98	13.13	15.31	16.71	18.14

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	171.5	151.32	159.32	143.37	140.89	126.46	122	133.12	132.65	148.64	156.48	167.55	(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=	171.5	151.32	159.32	143.37	140.89	126.46	122	133.12	132.65	148.64	156.48	167.55	

Output from water heater (annual)$_{1...12}$ 1753.31 (64)

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

(65)m=	78.81	69.99	74.76	68.75	68.63	63.13	62.35	66.05	65.19	71.21	73.11	77.5	(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=	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	89.19	(66)

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

(67)m=	13.98	12.42	10.1	7.65	5.72	4.83	5.21	6.78	9.1	11.55	13.48	14.37	(67)

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

(68)m=	155.48	157.1	153.03	144.38	133.45	123.18	116.32	114.71	118.77	127.43	138.35	148.62	(68)

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

(69)m=	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	31.92	(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=	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	-71.35	(71)

Water heating gains (Table 5)

(72)m=	105.92	104.15	100.48	95.49	92.24	87.68	83.8	88.77	90.54	95.71	101.54	104.16	(72)

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

(73)m=	328.15	326.43	316.37	300.27	284.17	268.45	258.09	263.01	271.17	287.44	306.14	319.91	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	10.46	x	36.79	x	0.63	x	0.7	=	117.62	(77)
Southeast 0.9x	0.77	x	10.46	x	62.67	x	0.63	x	0.7	=	200.35	(77)
Southeast 0.9x	0.77	x	10.46	x	85.75	x	0.63	x	0.7	=	274.13	(77)
Southeast 0.9x	0.77	x	10.46	x	106.25	x	0.63	x	0.7	=	339.66	(77)
Southeast 0.9x	0.77	x	10.46	x	119.01	x	0.63	x	0.7	=	380.44	(77)

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Southeast 0.9x	0.77	x	10.46	x	118.15	x	0.63	x	0.7	=	377.69	(77)
Southeast 0.9x	0.77	x	10.46	x	113.91	x	0.63	x	0.7	=	364.14	(77)
Southeast 0.9x	0.77	x	10.46	x	104.39	x	0.63	x	0.7	=	333.71	(77)
Southeast 0.9x	0.77	x	10.46	x	92.85	x	0.63	x	0.7	=	296.82	(77)
Southeast 0.9x	0.77	x	10.46	x	69.27	x	0.63	x	0.7	=	221.43	(77)
Southeast 0.9x	0.77	x	10.46	x	44.07	x	0.63	x	0.7	=	140.88	(77)
Southeast 0.9x	0.77	x	10.46	x	31.49	x	0.63	x	0.7	=	100.66	(77)

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

(83)m=	117.62	200.35	274.13	339.66	380.44	377.69	364.14	333.71	296.82	221.43	140.88	100.66	(83)

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

(84)m=	445.77	526.78	590.5	639.92	664.61	646.14	622.23	596.72	567.99	508.87	447.02	420.57	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.94	0.84	0.69	0.5	0.36	0.39	0.61	0.87	0.97	0.99	(86)

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

(87)m=	20.2	20.39	20.62	20.84	20.96	20.99	21	21	20.98	20.83	20.48	20.16	(87)

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

(88)m=	20.09	20.09	20.1	20.11	20.11	20.12	20.12	20.12	20.12	20.11	20.1	20.1	(88)

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

(89)m=	0.99	0.97	0.92	0.81	0.63	0.43	0.29	0.32	0.53	0.84	0.97	0.99	(89)

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

(90)m=	19.04	19.32	19.64	19.94	20.07	20.12	20.12	20.12	20.1	19.94	19.46	19	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	19.58	19.81	20.09	20.35	20.48	20.52	20.52	20.53	20.51	20.35	19.93	19.54	(92)

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

(93)m=	19.58	19.81	20.09	20.35	20.48	20.52	20.52	20.53	20.51	20.35	19.93	19.54	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.92	0.82	0.66	0.46	0.32	0.35	0.57	0.85	0.96	0.99	(94)

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

(95)m=	438.68	507.4	542.06	522.89	435.72	299.52	199.61	209.21	322.07	431.05	430.99	415.46	(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=	805.87	784.36	712.69	592.12	452.69	301.4	199.79	209.51	327.89	502.6	664.97	799.43	(97)

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

(98)m=	273.19	186.12	126.95	49.84	12.62	0	0	0	0	53.23	168.47	285.68	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1156.1	(98)
Space heating requirement in kWh/m²/year	21.74	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	273.19	186.12	126.95	49.84	12.62	0	0	0	0	53.23	168.47	285.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	292.18	199.05	135.77	53.31	13.5	0	0	0	0	56.93	180.18	305.54	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1236.47 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	171.5	151.32	159.32	143.37	140.89	126.46	122	133.12	132.65	148.64	156.48	167.55	

Efficiency of water heater 79.8 (216)

(217)m=	86.05	85.37	84.22	82.31	80.58	79.8	79.8	79.8	79.8	82.37	85.01	86.23	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	199.3	177.26	189.18	174.18	174.84	158.48	152.88	166.82	166.23	180.46	184.07	194.32	

Total = Sum(219a)$_{1...12}$ = 2118.02 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1236.47
Water heating fuel used		2118.02
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		246.97 (232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	267.08 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	457.49	(264)
Space and water heating	(261) + (262) + (263) + (264) =			724.57	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	128.18	(268)
Total CO2, kg/year	sum of (265)…(271) =			891.67	(272)

TER = 16.77 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 1 3 GF

Address : P 1 3, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.11 (1a)	x	2.55 (2a)	=	130.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.11 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	130.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

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

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			8.89	x	1/[1/(1.4)+ 0.04]	=	11.79			(27)
Floor			51.11	x	0.13	=	6.6443			(28)
Walls Type1	39.42	8.89	30.53	x	0.18	=	5.5			(29)
Walls Type2	7.37	2.1	5.27	x	0.18	=	0.95			(29)
Walls Type3	10.07	0	10.07	x	0.18	=	1.81			(29)
Total area of elements, m²			107.97							(31)
Party wall			21.68	x	0	=	0			(32)
Party ceiling			51.11							(32b)
Internal wall **			93.84							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8779.62 (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 7.57 (36)

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

Total fabric heat loss (33) + (36) = 36.35 (37)

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

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

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(38)m=	25.62	25.46	25.3	24.56	24.43	23.79	23.79	23.67	24.03	24.43	24.71	25	(38)

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

(39)m=	61.97	61.81	61.65	60.92	60.78	60.14	60.14	60.02	60.39	60.78	61.06	61.35	

Average = Sum(39)$_{1...12}$ /12= 60.92 (39)

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

(40)m=	1.21	1.21	1.21	1.19	1.19	1.18	1.18	1.17	1.18	1.19	1.19	1.2	

Average = Sum(40)$_{1...12}$ /12= 1.19 (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 1.72 (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 75.12 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.63	79.62	76.62	73.61	70.61	67.61	67.61	70.61	73.61	76.62	79.62	82.63	

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

Total = Sum(44)$_{1...12}$ = 901.4 (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=	122.54	107.17	110.59	96.42	92.51	79.83	73.98	84.89	85.9	100.11	109.28	118.67	

Total = Sum(45)$_{1...12}$ = 1181.88 (45)

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

(46)m=	18.38	16.08	16.59	14.46	13.88	11.97	11.1	12.73	12.89	15.02	16.39	17.8	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	169.13	149.26	157.19	141.51	139.11	124.92	120.57	131.48	130.99	146.71	154.37	165.26	(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=	169.13	149.26	157.19	141.51	139.11	124.92	120.57	131.48	130.99	146.71	154.37	165.26	

Output from water heater (annual)$_{1...12}$ | 1730.5 | (64)

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

(65)m=	78.02	69.3	74.05	68.13	68.04	62.62	61.87	65.5	64.64	70.56	72.41	76.73	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	(66)

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

(67)m=	13.75	12.21	9.93	7.52	5.62	4.74	5.13	6.66	8.94	11.36	13.25	14.13	(67)

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

(68)m=	150.12	151.67	147.75	139.39	128.84	118.93	112.3	110.75	114.67	123.03	133.58	143.49	(68)

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

(69)m=	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	(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=	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	(71)

Water heating gains (Table 5)

(72)m=	104.86	103.13	99.53	94.63	91.45	86.97	83.16	88.04	89.77	94.84	100.57	103.14	(72)

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

(73)m=	320.57	318.86	309.05	293.38	277.75	262.48	252.44	257.29	265.23	281.07	299.24	312.6	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	8.89	x	36.79	x	0.63	x	0.7	=	99.97	(77)
Southeast 0.9x	0.77	x	8.89	x	62.67	x	0.63	x	0.7	=	170.28	(77)

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Southeast	0.9x	0.77	x	8.89	x	85.75	x	0.63	x	0.7	=	232.98	(77)
Southeast	0.9x	0.77	x	8.89	x	106.25	x	0.63	x	0.7	=	288.67	(77)
Southeast	0.9x	0.77	x	8.89	x	119.01	x	0.63	x	0.7	=	323.34	(77)
Southeast	0.9x	0.77	x	8.89	x	118.15	x	0.63	x	0.7	=	321	(77)
Southeast	0.9x	0.77	x	8.89	x	113.91	x	0.63	x	0.7	=	309.48	(77)
Southeast	0.9x	0.77	x	8.89	x	104.39	x	0.63	x	0.7	=	283.62	(77)
Southeast	0.9x	0.77	x	8.89	x	92.85	x	0.63	x	0.7	=	252.27	(77)
Southeast	0.9x	0.77	x	8.89	x	69.27	x	0.63	x	0.7	=	188.19	(77)
Southeast	0.9x	0.77	x	8.89	x	44.07	x	0.63	x	0.7	=	119.74	(77)
Southeast	0.9x	0.77	x	8.89	x	31.49	x	0.63	x	0.7	=	85.55	(77)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	99.97	170.28	232.98	288.67	323.34	321	309.48	283.62	252.27	188.19	119.74	85.55	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	420.54	489.13	542.03	582.05	601.09	583.49	561.92	540.91	517.5	469.26	418.98	398.15	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.8	0.63	0.46	0.5	0.73	0.93	0.98	0.99	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.88	20.07	20.32	20.62	20.85	20.97	20.99	20.99	20.93	20.64	20.2	19.84	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	19.91	19.91	19.91	19.93	19.93	19.94	19.94	19.94	19.93	19.93	19.92	19.92	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.98	0.95	0.88	0.75	0.54	0.36	0.39	0.64	0.9	0.98	0.99	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.44	18.72	19.09	19.51	19.79	19.92	19.94	19.94	19.88	19.54	18.93	18.4	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.1	19.33	19.65	20.02	20.27	20.4	20.42	20.42	20.36	20.04	19.51	19.06	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.1	19.33	19.65	20.02	20.27	20.4	20.42	20.42	20.36	20.04	19.51	19.06	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.97	0.95	0.89	0.77	0.58	0.41	0.44	0.68	0.9	0.97	0.99	(94)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	415.16	476.61	513.72	515.84	460.52	336.99	228.01	238.67	352.3	423.26	408.22	394.11	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

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

(97)m=	917	891.99	810.74	677.15	521.13	348.58	229.66	241.15	378.08	573.9	757.71	911.61	(97)

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

(98)m=	373.38	279.13	220.99	116.14	45.1	0	0	0	0	112.07	251.64	385.02	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1783.46 (98)

Space heating requirement in kWh/m²/year 34.89 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	373.38	279.13	220.99	116.14	45.1	0	0	0	0	112.07	251.64	385.02	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	399.33	298.54	236.35	124.22	48.23	0	0	0	0	119.87	269.13	411.79	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1907.45 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	169.13	149.26	157.19	141.51	139.11	124.92	120.57	131.48	130.99	146.71	154.37	165.26	

Efficiency of water heater 79.8 (216)

(217)m=	86.87	86.46	85.72	84.29	82.18	79.8	79.8	79.8	79.8	84.11	86.11	87	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	194.7	172.63	183.37	167.88	169.27	156.55	151.09	164.77	164.15	174.43	179.27	189.97	

Total = Sum(219a)$_{1...12}$ = 2068.06 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1907.45
Water heating fuel used		2068.06
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		242.78 (232)

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

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	412.01	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	446.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =				858.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	126	(268)
Total CO2, kg/year		sum of (265)…(271) =			1023.64	(272)

TER = 20.03 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 1 3 TF

Address : P 1 3, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.11 (1a)	x	2.55 (2a)	=	130.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.11 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	130.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

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

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			8.89	x	1/[1/(1.4)+ 0.04]	=	11.79			(27)
Walls Type1	39.42	8.89	30.53	x	0.18	=	5.5			(29)
Walls Type2	7.37	2.1	5.27	x	0.18	=	0.95			(29)
Walls Type3	10.07	0	10.07	x	0.18	=	1.81			(29)
Roof	51.11	0	51.11	x	0.13	=	6.64			(30)
Total area of elements, m²			107.97							(31)
Party wall			21.68	x	0	=	0			(32)
Party floor			51.11							(32a)
Internal wall **			93.84							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.79 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7450.76 (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 16.62 (36)

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

Total fabric heat loss (33) + (36) = 45.4 (37)

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

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

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(38)m=	25.62	25.46	25.3	24.56	24.43	23.79	23.79	23.67	24.03	24.43	24.71	25	(38)

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

(39)m=	71.02	70.86	70.7	69.97	69.83	69.19	69.19	69.07	69.44	69.83	70.11	70.4	

Average = Sum(39)$_{1...12}$ /12= 69.97 (39)

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

(40)m=	1.39	1.39	1.38	1.37	1.37	1.35	1.35	1.35	1.36	1.37	1.37	1.38	

Average = Sum(40)$_{1...12}$ /12= 1.37 (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 1.72 (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 75.12 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.63	79.62	76.62	73.61	70.61	67.61	67.61	70.61	73.61	76.62	79.62	82.63	

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

Total = Sum(44)$_{1...12}$ = 901.4 (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=	122.54	107.17	110.59	96.42	92.51	79.83	73.98	84.89	85.9	100.11	109.28	118.67	

Total = Sum(45)$_{1...12}$ = 1181.88 (45)

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

(46)m=	18.38	16.08	16.59	14.46	13.88	11.97	11.1	12.73	12.89	15.02	16.39	17.8	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	169.13	149.26	157.19	141.51	139.11	124.92	120.57	131.48	130.99	146.71	154.37	165.26	(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=	169.13	149.26	157.19	141.51	139.11	124.92	120.57	131.48	130.99	146.71	154.37	165.26	

Output from water heater (annual)$_{1...12}$ | 1730.5 | (64)

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

(65)m=	78.02	69.3	74.05	68.13	68.04	62.62	61.87	65.5	64.64	70.56	72.41	76.73	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	(66)

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

(67)m=	13.75	12.21	9.93	7.52	5.62	4.74	5.13	6.66	8.94	11.36	13.25	14.13	(67)

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

(68)m=	150.12	151.67	147.75	139.39	128.84	118.93	112.3	110.75	114.67	123.03	133.58	143.49	(68)

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

(69)m=	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	(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=	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	(71)

Water heating gains (Table 5)

(72)m=	104.86	103.13	99.53	94.63	91.45	86.97	83.16	88.04	89.77	94.84	100.57	103.14	(72)

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

(73)m=	320.57	318.86	309.05	293.38	277.75	262.48	252.44	257.29	265.23	281.07	299.24	312.6	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	8.89	x	36.79	x	0.63	x	0.7	=	99.97	(77)
Southeast 0.9x	0.77	x	8.89	x	62.67	x	0.63	x	0.7	=	170.28	(77)

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Southeast	0.9x	0.77	x	8.89	x	85.75	x	0.63	x	0.7	=	232.98	(77)
Southeast	0.9x	0.77	x	8.89	x	106.25	x	0.63	x	0.7	=	288.67	(77)
Southeast	0.9x	0.77	x	8.89	x	119.01	x	0.63	x	0.7	=	323.34	(77)
Southeast	0.9x	0.77	x	8.89	x	118.15	x	0.63	x	0.7	=	321	(77)
Southeast	0.9x	0.77	x	8.89	x	113.91	x	0.63	x	0.7	=	309.48	(77)
Southeast	0.9x	0.77	x	8.89	x	104.39	x	0.63	x	0.7	=	283.62	(77)
Southeast	0.9x	0.77	x	8.89	x	92.85	x	0.63	x	0.7	=	252.27	(77)
Southeast	0.9x	0.77	x	8.89	x	69.27	x	0.63	x	0.7	=	188.19	(77)
Southeast	0.9x	0.77	x	8.89	x	44.07	x	0.63	x	0.7	=	119.74	(77)
Southeast	0.9x	0.77	x	8.89	x	31.49	x	0.63	x	0.7	=	85.55	(77)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	99.97	170.28	232.98	288.67	323.34	321	309.48	283.62	252.27	188.19	119.74	85.55	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	420.54	489.13	542.03	582.05	601.09	583.49	561.92	540.91	517.5	469.26	418.98	398.15	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.93	0.84	0.69	0.52	0.56	0.78	0.94	0.99	0.99	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.65	19.84	20.12	20.46	20.75	20.93	20.98	20.98	20.87	20.5	20.01	19.61	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	19.77	19.77	19.78	19.79	19.79	19.8	19.8	19.8	19.8	19.79	19.79	19.78	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.98	0.96	0.91	0.79	0.59	0.39	0.43	0.69	0.92	0.98	0.99	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.01	18.29	18.69	19.18	19.55	19.75	19.79	19.79	19.7	19.24	18.55	17.97	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.76	19	19.34	19.76	20.1	20.29	20.34	20.33	20.23	19.81	19.21	18.72	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.76	19	19.34	19.76	20.1	20.29	20.34	20.33	20.23	19.81	19.21	18.72	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.98	0.95	0.9	0.8	0.63	0.45	0.49	0.73	0.92	0.98	0.99	(94)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	415.29	477.62	517.27	526.51	483.44	368.12	253.91	265.05	376.8	430.38	409.11	394.14	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

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

(97)m=	1026.77	998.95	908.15	760.12	586.5	393.63	258.49	271.61	425.81	643.45	849.25	1022	(97)

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

(98)m=	454.94	350.34	290.81	168.2	76.68	0	0	0	0	158.53	316.9	467.13	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2283.52 (98)

Space heating requirement in kWh/m²/year 44.68 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	454.94	350.34	290.81	168.2	76.68	0	0	0	0	158.53	316.9	467.13	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	486.56	374.69	311.03	179.89	82.01	0	0	0	0	169.55	338.93	499.6	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2442.26 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	169.13	149.26	157.19	141.51	139.11	124.92	120.57	131.48	130.99	146.71	154.37	165.26	

Efficiency of water heater 79.8 (216)

(217)m=	87.33	87.01	86.43	85.28	83.3	79.8	79.8	79.8	79.8	85.02	86.69	87.44	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	193.68	171.53	181.86	165.94	167	156.55	151.09	164.77	164.15	172.55	178.07	189.01	

Total = Sum(219a)$_{1...12}$ = 2056.19 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2442.26
Water heating fuel used		2056.19
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		242.78 (232)

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

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	527.53	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	444.14	(264)
Space and water heating	(261) + (262) + (263) + (264) =				971.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	126	(268)
Total CO2, kg/year		sum of (265)…(271) =			1136.59	(272)

TER = 22.24 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 1 3

Address : P 1 3, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.11 (1a)	x	2.55 (2a)	=	130.33	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.11 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	130.33	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

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

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			8.89	x	1/[1/(1.4)+ 0.04]	=	11.79			(27)
Walls Type1	39.42	8.89	30.53	x	0.18	=	5.5			(29)
Walls Type2	7.37	2.1	5.27	x	0.18	=	0.95			(29)
Walls Type3	10.07	0	10.07	x	0.18	=	1.81			(29)
Total area of elements, m²			56.86							(31)
Party wall			21.68	x	0	=	0			(32)
Party floor			51.11							(32a)
Party ceiling			51.11							(32b)
Internal wall **			93.84							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.14 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8524.07 (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 4.67 (36)

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

Total fabric heat loss (33) + (36) = 26.81 (37)

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

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

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(38)m=	25.62	25.46	25.3	24.56	24.43	23.79	23.79	23.67	24.03	24.43	24.71	25	(38)

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

(39)m=	52.43	52.27	52.11	51.38	51.24	50.6	50.6	50.48	50.85	51.24	51.52	51.81	

Average = Sum(39)$_{1...12}$ /12= 51.38 (39)

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

(40)m=	1.03	1.02	1.02	1.01	1	0.99	0.99	0.99	0.99	1	1.01	1.01	

Average = Sum(40)$_{1...12}$ /12= 1.01 (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 1.72 (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 75.12 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.63	79.62	76.62	73.61	70.61	67.61	67.61	70.61	73.61	76.62	79.62	82.63	

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

Total = Sum(44)$_{1...12}$ = 901.4 (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=	122.54	107.17	110.59	96.42	92.51	79.83	73.98	84.89	85.9	100.11	109.28	118.67	

Total = Sum(45)$_{1...12}$ = 1181.88 (45)

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

(46)m=	18.38	16.08	16.59	14.46	13.88	11.97	11.1	12.73	12.89	15.02	16.39	17.8	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	169.13	149.26	157.19	141.51	139.11	124.92	120.57	131.48	130.99	146.71	154.37	165.26	(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=	169.13	149.26	157.19	141.51	139.11	124.92	120.57	131.48	130.99	146.71	154.37	165.26	

Output from water heater (annual)$_{1...12}$ | 1730.5 | (64)

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

(65)m=	78.02	69.3	74.05	68.13	68.04	62.62	61.87	65.5	64.64	70.56	72.41	76.73	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	86.14	(66)

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

(67)m=	13.75	12.21	9.93	7.52	5.62	4.74	5.13	6.66	8.94	11.36	13.25	14.13	(67)

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

(68)m=	150.12	151.67	147.75	139.39	128.84	118.93	112.3	110.75	114.67	123.03	133.58	143.49	(68)

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

(69)m=	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	(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=	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	-68.91	(71)

Water heating gains (Table 5)

(72)m=	104.86	103.13	99.53	94.63	91.45	86.97	83.16	88.04	89.77	94.84	100.57	103.14	(72)

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

(73)m=	320.57	318.86	309.05	293.38	277.75	262.48	252.44	257.29	265.23	281.07	299.24	312.6	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	8.89	x	36.79	x	0.63	x	0.7	=	99.97	(77)
Southeast 0.9x	0.77	x	8.89	x	62.67	x	0.63	x	0.7	=	170.28	(77)

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Southeast	0.9x	0.77	x	8.89	x	85.75	x	0.63	x	0.7	=	232.98	(77)
Southeast	0.9x	0.77	x	8.89	x	106.25	x	0.63	x	0.7	=	288.67	(77)
Southeast	0.9x	0.77	x	8.89	x	119.01	x	0.63	x	0.7	=	323.34	(77)
Southeast	0.9x	0.77	x	8.89	x	118.15	x	0.63	x	0.7	=	321	(77)
Southeast	0.9x	0.77	x	8.89	x	113.91	x	0.63	x	0.7	=	309.48	(77)
Southeast	0.9x	0.77	x	8.89	x	104.39	x	0.63	x	0.7	=	283.62	(77)
Southeast	0.9x	0.77	x	8.89	x	92.85	x	0.63	x	0.7	=	252.27	(77)
Southeast	0.9x	0.77	x	8.89	x	69.27	x	0.63	x	0.7	=	188.19	(77)
Southeast	0.9x	0.77	x	8.89	x	44.07	x	0.63	x	0.7	=	119.74	(77)
Southeast	0.9x	0.77	x	8.89	x	31.49	x	0.63	x	0.7	=	85.55	(77)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	99.97	170.28	232.98	288.67	323.34	321	309.48	283.62	252.27	188.19	119.74	85.55	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	420.54	489.13	542.03	582.05	601.09	583.49	561.92	540.91	517.5	469.26	418.98	398.15	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.74	0.55	0.39	0.43	0.65	0.9	0.98	0.99	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	20.14	20.32	20.55	20.79	20.94	20.99	21	21	20.97	20.79	20.42	20.1	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.06	20.06	20.07	20.08	20.08	20.09	20.09	20.09	20.09	20.08	20.08	20.07	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.97	0.94	0.84	0.68	0.47	0.31	0.34	0.58	0.86	0.97	0.99	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.93	19.19	19.52	19.85	20.02	20.09	20.09	20.09	20.07	19.86	19.35	18.89	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.48	19.7	19.99	20.28	20.44	20.5	20.51	20.51	20.48	20.28	19.84	19.44	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.48	19.7	19.99	20.28	20.44	20.5	20.51	20.51	20.48	20.28	19.84	19.44	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.97	0.93	0.85	0.7	0.51	0.35	0.38	0.61	0.87	0.97	0.99	(94)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	414.55	474.12	506.04	494.97	422.33	295.16	197.25	206.71	315.46	408.95	406	393.74	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

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

(97)m=	795.91	773.82	702.76	584.49	447.81	298.44	197.59	207.26	324.52	496.13	656.41	789.81	(97)

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

(98)m=	283.73	201.4	146.36	64.46	18.96	0	0	0	0	64.86	180.3	294.68	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1254.73 (98)

Space heating requirement in kWh/m²/year 24.55 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	283.73	201.4	146.36	64.46	18.96	0	0	0	0	64.86	180.3	294.68	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	303.45	215.4	156.53	68.94	20.28	0	0	0	0	69.37	192.83	315.16	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1341.96 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	169.13	149.26	157.19	141.51	139.11	124.92	120.57	131.48	130.99	146.71	154.37	165.26	

Efficiency of water heater 79.8 (216)

(217)m=	86.18	85.61	84.62	82.87	80.95	79.8	79.8	79.8	79.8	82.8	85.23	86.34	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.24	174.34	185.75	170.77	171.85	156.55	151.09	164.77	164.15	177.18	181.12	191.41	

Total = Sum(219a)$_{1...12}$ = 2085.21 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1341.96
Water heating fuel used		2085.21
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		242.78 (232)

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

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	289.86	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	450.4	(264)
Space and water heating	(261) + (262) + (263) + (264) =				740.27	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	126	(268)
Total CO2, kg/year		sum of (265)…(271) =			905.19	(272)

TER = 17.71 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 3 GF

Address : P 2 3, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.12	(1a) x	2.55	(2a) =	178.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.12	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		178.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.36	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

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

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Floor			70.12	x	0.13	=	9.1156			(28)
Walls Type1	43.96	12.56	31.4	x	0.18	=	5.65			(29)
Walls Type2	4.49	2.1	2.39	x	0.18	=	0.43			(29)
Total area of elements, m²			118.57							(31)
Party wall			36.95	x	0	=	0			(32)
Party ceiling			70.12							(32b)
Internal wall **			128.74							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.95 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9841.86 (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 7.6 (36)

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

Total fabric heat loss (33) + (36) = 41.55 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.55	35.32	35.09	34	33.8	32.86	32.86	32.69	33.22	33.8	34.21	34.64	(38)

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

(39)m=	77.1	76.86	76.63	75.55	75.35	74.41	74.41	74.23	74.77	75.35	75.76	76.19	

Average = Sum(39)$_{1...12}$ /12= 75.55 (39)

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

(40)m=	1.1	1.1	1.09	1.08	1.07	1.06	1.06	1.06	1.07	1.07	1.08	1.09

Average = Sum(40)$_{1...12}$ /12= 1.08 (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 2.25 (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 87.61 (43)

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

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

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

(44)m=	96.38	92.87	89.37	85.86	82.36	78.85	78.85	82.36	85.86	89.37	92.87	96.38

Total = Sum(44)$_{1...12}$ = 1051.37 (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=	142.92	125	128.99	112.46	107.9	93.11	86.28	99.01	100.19	116.77	127.46	138.41

Total = Sum(45)$_{1...12}$ = 1378.52 (45)

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

(46)m=	21.44	18.75	19.35	16.87	16.19	13.97	12.94	14.85	15.03	17.51	19.12	20.76

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	189.52	167.09	175.59	157.55	154.5	138.21	132.88	145.61	145.29	163.36	172.55	185.01	(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=	189.52	167.09	175.59	157.55	154.5	138.21	132.88	145.61	145.29	163.36	172.55	185.01	

Output from water heater (annual)$_{1...12}$ 1927.14 (64)

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

(65)m=	84.8	75.23	80.17	73.47	73.15	67.03	65.97	70.2	69.39	76.1	78.45	83.3	(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=	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	(66)

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

(67)m=	18	15.99	13.01	9.85	7.36	6.21	6.71	8.73	11.71	14.87	17.36	18.5	(67)

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

(68)m=	197.58	199.63	194.46	183.46	169.58	156.53	147.81	145.76	150.93	161.93	175.81	188.86	(68)

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

(69)m=	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	(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=	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	(71)

Water heating gains (Table 5)

(72)m=	113.98	111.95	107.75	102.04	98.33	93.1	88.66	94.35	96.37	102.29	108.96	111.96	(72)

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

(73)m=	389.29	387.31	374.95	355.08	335	315.58	302.92	308.57	318.75	338.82	361.87	379.06	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest0.9x	0.77	x	12.56	x	36.79	x	0.63	x	0.7	=	141.23	(79)
Southwest0.9x	0.77	x	12.56	x	62.67	x	0.63	x	0.7	=	240.57	(79)
Southwest0.9x	0.77	x	12.56	x	85.75	x	0.63	x	0.7	=	329.16	(79)
Southwest0.9x	0.77	x	12.56	x	106.25	x	0.63	x	0.7	=	407.85	(79)
Southwest0.9x	0.77	x	12.56	x	119.01	x	0.63	x	0.7	=	456.82	(79)

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Southwest 0.9x	0.77	x	12.56	x	118.15		0.63	x	0.7	=	453.52	(79)
Southwest 0.9x	0.77	x	12.56	x	113.91		0.63	x	0.7	=	437.24	(79)
Southwest 0.9x	0.77	x	12.56	x	104.39		0.63	x	0.7	=	400.7	(79)
Southwest 0.9x	0.77	x	12.56	x	92.85		0.63	x	0.7	=	356.41	(79)
Southwest 0.9x	0.77	x	12.56	x	69.27		0.63	x	0.7	=	265.88	(79)
Southwest 0.9x	0.77	x	12.56	x	44.07		0.63	x	0.7	=	169.16	(79)
Southwest 0.9x	0.77	x	12.56	x	31.49		0.63	x	0.7	=	120.87	(79)

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

(83)m=	141.23	240.57	329.16	407.85	456.82	453.52	437.24	400.7	356.41	265.88	169.16	120.87	(83)

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

(84)m=	530.53	627.88	704.11	762.92	791.82	769.1	740.16	709.28	675.16	604.7	531.03	499.93	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.91	0.79	0.6	0.44	0.48	0.71	0.93	0.99	1	(86)

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

(87)m=	19.97	20.16	20.42	20.7	20.89	20.98	21	21	20.95	20.7	20.28	19.94	(87)

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

(88)m=	20	20	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.02	20.02	20.01	(88)

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

(89)m=	0.99	0.98	0.95	0.88	0.73	0.52	0.34	0.38	0.63	0.9	0.98	0.99	(89)

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

(90)m=	18.65	18.92	19.29	19.68	19.92	20.02	20.03	20.03	19.99	19.69	19.11	18.61	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

(92)m=	19.11	19.36	19.68	20.04	20.26	20.36	20.37	20.37	20.33	20.04	19.52	19.07	(92)

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

(93)m=	19.11	19.36	19.68	20.04	20.26	20.36	20.37	20.37	20.33	20.04	19.52	19.07	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.88	0.74	0.55	0.38	0.41	0.66	0.9	0.98	0.99	(94)

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

(95)m=	525.25	613.62	668.07	670.87	589.65	419.85	279.47	293.1	443.77	545.06	519.46	496.13	(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=	1141.83	1111.23	1010.03	841.43	645.2	428.27	280.43	294.64	465.73	711.61	940.8	1133.14	(97)

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

(98)m=	458.74	334.39	254.42	122.8	41.33	0	0	0	0	123.91	303.37	473.93	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2112.9	(98)
Space heating requirement in kWh/m²/year	30.13	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	458.74	334.39	254.42	122.8	41.33	0	0	0	0	123.91	303.37	473.93	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	490.63	357.64	272.11	131.33	44.21	0	0	0	0	132.53	324.46	506.88	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2259.79 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater (calculated above)	189.52	167.09	175.59	157.55	154.5	138.21	132.88	145.61	145.29	163.36	172.55	185.01
Efficiency of water heater												79.8 (216)
(217)m=	87.09	86.63	85.8	84.16	81.84	79.8	79.8	79.8	79.8	84.09	86.3	87.22 (217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	217.62	192.87	204.64	187.2	188.78	173.19	166.51	182.46	182.06	194.27	199.93	212.12

Total = Sum(219a)$_{1...12}$ = 2301.68 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2259.79
Water heating fuel used		2301.68
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		317.96 (232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	488.11 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	497.16	(264)
Space and water heating	(261) + (262) + (263) + (264) =			985.28	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	165.02	(268)
Total CO2, kg/year	sum of (265)…(271) =			1189.23	(272)

TER = 16.96 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 3 TF

Address : P 2 3, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.12	(1a) x	2.55	(2a) =	178.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.12	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		178.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.36	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

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

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Walls Type1	43.96	12.56	31.4	x	0.18	=	5.65			(29)
Walls Type2	4.49	2.1	2.39	x	0.18	=	0.43			(29)
Roof	70.12	0	70.12	x	0.13	=	9.12			(30)
Total area of elements, m²			118.57							(31)
Party wall			36.95	x	0	=	0			(32)
Party floor			70.12							(32a)
Internal wall **			128.74							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.95 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8018.74 (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 15.57 (36)

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

Total fabric heat loss (33) + (36) = 49.52 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.55	35.32	35.09	34	33.8	32.86	32.86	32.69	33.22	33.8	34.21	34.64	(38)

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

(39)m=	85.07	84.83	84.6	83.52	83.32	82.38	82.38	82.2	82.74	83.32	83.73	84.16	

Average = Sum(39)$_{1...12}$ /12= 83.52 (39)

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

(40)m=	1.21	1.21	1.21	1.19	1.19	1.17	1.17	1.17	1.18	1.19	1.19	1.2

Average = Sum(40)$_{1...12}$ /12= 1.19 (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 2.25 (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 87.61 (43)

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

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

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

(44)m=	96.38	92.87	89.37	85.86	82.36	78.85	78.85	82.36	85.86	89.37	92.87	96.38

Total = Sum(44)$_{1...12}$ = 1051.37 (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=	142.92	125	128.99	112.46	107.9	93.11	86.28	99.01	100.19	116.77	127.46	138.41

Total = Sum(45)$_{1...12}$ = 1378.52 (45)

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

(46)m=	21.44	18.75	19.35	16.87	16.19	13.97	12.94	14.85	15.03	17.51	19.12	20.76

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	189.52	167.09	175.59	157.55	154.5	138.21	132.88	145.61	145.29	163.36	172.55	185.01	(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=	189.52	167.09	175.59	157.55	154.5	138.21	132.88	145.61	145.29	163.36	172.55	185.01	

Output from water heater (annual)$_{1...12}$ 1927.14 (64)

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

(65)m=	84.8	75.23	80.17	73.47	73.15	67.03	65.97	70.2	69.39	76.1	78.45	83.3	(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=	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	(66)

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

(67)m=	18	15.99	13.01	9.85	7.36	6.21	6.71	8.73	11.71	14.87	17.36	18.5	(67)

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

(68)m=	197.58	199.63	194.46	183.46	169.58	156.53	147.81	145.76	150.93	161.93	175.81	188.86	(68)

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

(69)m=	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	(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=	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	(71)

Water heating gains (Table 5)

(72)m=	113.98	111.95	107.75	102.04	98.33	93.1	88.66	94.35	96.37	102.29	108.96	111.96	(72)

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

(73)m=	389.29	387.31	374.95	355.08	335	315.58	302.92	308.57	318.75	338.82	361.87	379.06	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest0.9x	0.77	x	12.56	x	36.79	x	0.63	x	0.7	=	141.23	(79)
Southwest0.9x	0.77	x	12.56	x	62.67	x	0.63	x	0.7	=	240.57	(79)
Southwest0.9x	0.77	x	12.56	x	85.75	x	0.63	x	0.7	=	329.16	(79)
Southwest0.9x	0.77	x	12.56	x	106.25	x	0.63	x	0.7	=	407.85	(79)
Southwest0.9x	0.77	x	12.56	x	119.01	x	0.63	x	0.7	=	456.82	(79)

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Southwest 0.9x	0.77	x	12.56	x	118.15		0.63	x	0.7	=	453.52	(79)
Southwest 0.9x	0.77	x	12.56	x	113.91		0.63	x	0.7	=	437.24	(79)
Southwest 0.9x	0.77	x	12.56	x	104.39		0.63	x	0.7	=	400.7	(79)
Southwest 0.9x	0.77	x	12.56	x	92.85		0.63	x	0.7	=	356.41	(79)
Southwest 0.9x	0.77	x	12.56	x	69.27		0.63	x	0.7	=	265.88	(79)
Southwest 0.9x	0.77	x	12.56	x	44.07		0.63	x	0.7	=	169.16	(79)
Southwest 0.9x	0.77	x	12.56	x	31.49		0.63	x	0.7	=	120.87	(79)

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

(83)m=	141.23	240.57	329.16	407.85	456.82	453.52	437.24	400.7	356.41	265.88	169.16	120.87	(83)

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

(84)m=	530.53	627.88	704.11	762.92	791.82	769.1	740.16	709.28	675.16	604.7	531.03	499.93	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.82	0.65	0.48	0.52	0.75	0.94	0.99	1	(86)

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

(87)m=	19.82	20.01	20.28	20.59	20.83	20.96	20.99	20.99	20.92	20.6	20.15	19.78	(87)

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

(88)m=	19.91	19.91	19.91	19.93	19.93	19.94	19.94	19.94	19.94	19.93	19.92	19.92	(88)

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

(89)m=	0.99	0.98	0.96	0.9	0.77	0.56	0.37	0.41	0.67	0.92	0.98	0.99	(89)

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

(90)m=	18.36	18.64	19.02	19.47	19.77	19.92	19.94	19.94	19.88	19.49	18.85	18.31	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

(92)m=	18.87	19.12	19.46	19.86	20.14	20.28	20.31	20.31	20.24	19.88	19.31	18.83	(92)

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

(93)m=	18.87	19.12	19.46	19.86	20.14	20.28	20.31	20.31	20.24	19.88	19.31	18.83	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.9	0.78	0.59	0.41	0.45	0.7	0.91	0.98	0.99	(94)

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

(95)m=	525.39	614.7	672.14	683.65	615.98	451.41	303.05	317.53	469.99	553.05	520.33	496.18	(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=	1239.14	1206.19	1096.63	915.47	703.63	468.02	305.31	321.04	508.06	773.37	1021.94	1231.05	(97)

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

(98)m=	531.03	397.48	315.82	166.91	65.21	0	0	0	0	163.92	361.16	546.75	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2548.27	(98)
Space heating requirement in kWh/m²/year	36.34	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	531.03	397.48	315.82	166.91	65.21	0	0	0	0	163.92	361.16	546.75	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	567.95	425.11	337.77	178.51	69.74	0	0	0	0	175.31	386.27	584.76	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2725.42 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	189.52	167.09	175.59	157.55	154.5	138.21	132.88	145.61	145.29	163.36	172.55	185.01	

Efficiency of water heater 79.8 (216)

(217)m=	87.42	87.05	86.36	84.97	82.7	79.8	79.8	79.8	79.8	84.82	86.74	87.53	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	216.8	191.95	203.31	185.42	186.81	173.19	166.51	182.46	182.06	192.59	198.93	211.36	

Total = Sum(219a)$_{1...12}$ = 2291.41 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2725.42	
Water heating fuel used		2291.41	
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		317.96	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	588.69	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	494.94	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1083.64	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	165.02	(268)
Total CO2, kg/year	sum of (265)…(271) =			1287.58	(272)

TER = 18.36 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 3

Address : P 2 3, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.12	(1a) x	2.55	(2a) =	178.81	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.12	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		178.81	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.42 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.36 (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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

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

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Walls Type1	43.96	12.56	31.4	x	0.18	=	5.65			(29)
Walls Type2	4.49	2.1	2.39	x	0.18	=	0.43			(29)
Total area of elements, m²			48.45							(31)
Party wall			36.95	x	0	=	0			(32)
Party floor			70.12							(32a)
Party ceiling			70.12							(32b)
Internal wall **			128.74							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 24.83 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9491.26 (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 4.52 (36)

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

Total fabric heat loss (33) + (36) = 29.35 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.55	35.32	35.09	34	33.8	32.86	32.86	32.69	33.22	33.8	34.21	34.64	(38)

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

(39)m=	64.9	64.67	64.44	63.36	63.16	62.21	62.21	62.04	62.58	63.16	63.56	63.99	

Average = Sum(39)$_{1...12}$ /12= 63.36 (39)

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

(40)m=	0.93	0.92	0.92	0.9	0.9	0.89	0.89	0.88	0.89	0.9	0.91	0.91

Average = Sum(40)$_{1...12}$ /12= 0.9 (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 2.25 (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 87.61 (43)

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

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

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

(44)m=	96.38	92.87	89.37	85.86	82.36	78.85	78.85	82.36	85.86	89.37	92.87	96.38

Total = Sum(44)$_{1...12}$ = 1051.37 (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=	142.92	125	128.99	112.46	107.9	93.11	86.28	99.01	100.19	116.77	127.46	138.41

Total = Sum(45)$_{1...12}$ = 1378.52 (45)

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

(46)m=	21.44	18.75	19.35	16.87	16.19	13.97	12.94	14.85	15.03	17.51	19.12	20.76

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	189.52	167.09	175.59	157.55	154.5	138.21	132.88	145.61	145.29	163.36	172.55	185.01	(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=	189.52	167.09	175.59	157.55	154.5	138.21	132.88	145.61	145.29	163.36	172.55	185.01	

Output from water heater (annual)$_{1...12}$ 1927.14 (64)

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

(65)m=	84.8	75.23	80.17	73.47	73.15	67.03	65.97	70.2	69.39	76.1	78.45	83.3	(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=	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	112.45	(66)

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

(67)m=	18	15.99	13.01	9.85	7.36	6.21	6.71	8.73	11.71	14.87	17.36	18.5	(67)

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

(68)m=	197.58	199.63	194.46	183.46	169.58	156.53	147.81	145.76	150.93	161.93	175.81	188.86	(68)

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

(69)m=	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	34.25	(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=	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	-89.96	(71)

Water heating gains (Table 5)

(72)m=	113.98	111.95	107.75	102.04	98.33	93.1	88.66	94.35	96.37	102.29	108.96	111.96	(72)

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

(73)m=	389.29	387.31	374.95	355.08	335	315.58	302.92	308.57	318.75	338.82	361.87	379.06	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest0.9x	0.77	x	12.56	x	36.79	x	0.63	x	0.7	=	141.23	(79)
Southwest0.9x	0.77	x	12.56	x	62.67	x	0.63	x	0.7	=	240.57	(79)
Southwest0.9x	0.77	x	12.56	x	85.75	x	0.63	x	0.7	=	329.16	(79)
Southwest0.9x	0.77	x	12.56	x	106.25	x	0.63	x	0.7	=	407.85	(79)
Southwest0.9x	0.77	x	12.56	x	119.01	x	0.63	x	0.7	=	456.82	(79)

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Southwest 0.9x	0.77	x	12.56	x	118.15		0.63	x	0.7	=	453.52	(79)
Southwest 0.9x	0.77	x	12.56	x	113.91		0.63	x	0.7	=	437.24	(79)
Southwest 0.9x	0.77	x	12.56	x	104.39		0.63	x	0.7	=	400.7	(79)
Southwest 0.9x	0.77	x	12.56	x	92.85		0.63	x	0.7	=	356.41	(79)
Southwest 0.9x	0.77	x	12.56	x	69.27		0.63	x	0.7	=	265.88	(79)
Southwest 0.9x	0.77	x	12.56	x	44.07		0.63	x	0.7	=	169.16	(79)
Southwest 0.9x	0.77	x	12.56	x	31.49		0.63	x	0.7	=	120.87	(79)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	141.23	240.57	329.16	407.85	456.82	453.52	437.24	400.7	356.41	265.88	169.16	120.87	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	530.53	627.88	704.11	762.92	791.82	769.1	740.16	709.28	675.16	604.7	531.03	499.93	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.86	0.71	0.51	0.37	0.4	0.62	0.89	0.98	0.99	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	20.22	20.41	20.63	20.85	20.96	21	21	21	20.99	20.84	20.49	20.19	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.15	20.15	20.15	20.16	20.17	20.18	20.18	20.18	20.17	20.17	20.16	20.16	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.97	0.93	0.83	0.65	0.45	0.3	0.33	0.56	0.86	0.98	0.99	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	19.12	19.38	19.7	20	20.13	20.18	20.18	20.18	20.16	19.99	19.52	19.08	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.5	19.74	20.02	20.29	20.42	20.46	20.47	20.47	20.45	20.29	19.86	19.47	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.5	19.74	20.02	20.29	20.42	20.46	20.47	20.47	20.45	20.29	19.86	19.47	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.97	0.93	0.83	0.67	0.47	0.32	0.36	0.58	0.86	0.97	0.99	(94)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	524.53	610.09	656.06	636.9	531.34	362.84	240.31	252.01	391.13	523.03	516.52	495.72	(95)

Monthly average external temperature from Table 8

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	986.76	959.71	871.34	721.94	550.86	364.7	240.46	252.27	397.43	611.84	811.1	977.11	(97)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	343.9	234.95	160.17	61.23	14.53	0	0	0	0	66.07	212.1	358.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1451.09	(98)
Space heating requirement in kWh/m²/year	20.69	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	343.9	234.95	160.17	61.23	14.53	0	0	0	0	66.07	212.1	358.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	367.8	251.28	171.3	65.49	15.54	0	0	0	0	70.66	226.85	383.05	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1551.97 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	189.52	167.09	175.59	157.55	154.5	138.21	132.88	145.61	145.29	163.36	172.55	185.01

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	86.38	85.72	84.57	82.53	80.62	79.8	79.8	79.8	79.8	82.61	85.37	86.55	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	219.39	194.92	207.62	190.9	191.64	173.19	166.51	182.46	182.06	197.74	202.13	213.77

Total = Sum(219a)$_{1...12}$ = 2322.34 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1551.97
Water heating fuel used		2322.34
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		317.96 (232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	335.23 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	501.62	(264)
Space and water heating	(261) + (262) + (263) + (264) =			836.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	165.02	(268)
Total CO2, kg/year	sum of (265)…(271) =			1040.8	(272)

TER = 14.84 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 4 GF

Address : P 2 4, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.67 (1a)	x	2.55 (2a)	=	180.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.67 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	180.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

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

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Floor			70.67	x	0.13	=	9.187099			(28)
Walls Type1	28.1	12.56	15.54	x	0.18	=	2.8			(29)
Walls Type2	8.21	2.1	6.11	x	0.18	=	1.1			(29)
Walls Type3	2.52	0	2.52	x	0.18	=	0.45			(29)
Walls Type4	11.83	0	11.83	x	0.18	=	2.13			(29)
Total area of elements, m²			121.33							(31)
Party wall			34.96	x	0	=	0			(32)
Party ceiling			70.67							(32b)
Internal wall **			129.75							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.42 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11826.18 (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 7.58 (36)

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

Total fabric heat loss (33) + (36) = 42 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.79	35.56	35.33	34.24	34.04	33.1	33.1	32.92	33.46	34.04	34.45	34.88	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	77.79	77.56	77.33	76.24	76.04	75.1	75.1	74.92	75.46	76.04	76.45	76.88	

Average = Sum(39)$_{1...12}$ /12= 76.24 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.1	1.1	1.09	1.08	1.08	1.06	1.06	1.06	1.07	1.08	1.08	1.09	

Average = Sum(40)$_{1...12}$ /12= 1.08 (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 2.26 (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 87.93 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	96.72	93.2	89.69	86.17	82.65	79.14	79.14	82.65	86.17	89.69	93.2	96.72	

Total = Sum(44)$_{1...12}$ = 1055.15 (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=	143.44	125.45	129.45	112.86	108.29	93.45	86.59	99.37	100.55	117.19	127.92	138.91	

Total = Sum(45)$_{1...12}$ = 1383.47 (45)

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

(46)m=	21.52	18.82	19.42	16.93	16.24	14.02	12.99	14.91	15.08	17.58	19.19	20.84	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	190.03	167.54	176.05	157.95	154.89	138.54	133.19	145.96	145.65	163.78	173.01	185.51	(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=	190.03	167.54	176.05	157.95	154.89	138.54	133.19	145.96	145.65	163.78	173.01	185.51	

Output from water heater (annual)$_{1...12}$ — 1932.09 — (64)

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

(65)m=	84.97	75.38	80.32	73.6	73.28	67.14	66.07	70.32	69.51	76.24	78.61	83.46	(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=	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	(66)

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

(67)m=	18.14	16.12	13.11	9.92	7.42	6.26	6.77	8.79	11.8	14.99	17.49	18.65	(67)

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

(68)m=	198.86	200.92	195.72	184.65	170.68	157.54	148.77	146.7	151.9	162.97	176.95	190.08	(68)

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

(69)m=	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	(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=	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	(71)

Water heating gains (Table 5)

(72)m=	114.2	112.17	107.96	102.22	98.5	93.26	88.8	94.51	96.54	102.47	109.18	112.18	(72)

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

(73)m=	391.14	389.14	376.72	356.73	336.53	316.99	304.27	309.94	320.18	340.37	363.55	380.85	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northwest 0.9x	0.77	x	12.56	x	11.28	x	0.63	x	0.7	=	43.31	(81)
Northwest 0.9x	0.77	x	12.56	x	22.97	x	0.63	x	0.7	=	88.16	(81)
Northwest 0.9x	0.77	x	12.56	x	41.38	x	0.63	x	0.7	=	158.83	(81)
Northwest 0.9x	0.77	x	12.56	x	67.96	x	0.63	x	0.7	=	260.85	(81)
Northwest 0.9x	0.77	x	12.56	x	91.35	x	0.63	x	0.7	=	350.63	(81)
Northwest 0.9x	0.77	x	12.56	x	97.38	x	0.63	x	0.7	=	373.81	(81)
Northwest 0.9x	0.77	x	12.56	x	91.1	x	0.63	x	0.7	=	349.69	(81)
Northwest 0.9x	0.77	x	12.56	x	72.63	x	0.63	x	0.7	=	278.78	(81)
Northwest 0.9x	0.77	x	12.56	x	50.42	x	0.63	x	0.7	=	193.54	(81)
Northwest 0.9x	0.77	x	12.56	x	28.07	x	0.63	x	0.7	=	107.74	(81)
Northwest 0.9x	0.77	x	12.56	x	14.2	x	0.63	x	0.7	=	54.49	(81)
Northwest 0.9x	0.77	x	12.56	x	9.21	x	0.63	x	0.7	=	35.37	(81)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	43.31	88.16	158.83	260.85	350.63	373.81	349.69	278.78	193.54	107.74	54.49	35.37	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	434.45	477.3	535.55	617.58	687.16	690.8	653.96	588.72	513.72	448.11	418.05	416.22	(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	0.96	0.85	0.66	0.5	0.57	0.85	0.98	1	1	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.84	19.96	20.21	20.55	20.84	20.97	20.99	20.99	20.89	20.53	20.13	19.82	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20	20	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.02	20.02	20.01	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	1	0.99	0.98	0.94	0.8	0.58	0.39	0.46	0.78	0.97	0.99	1	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.45	18.63	18.99	19.49	19.86	20.01	20.03	20.03	19.93	19.46	18.89	18.44	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.93	19.09	19.41	19.86	20.2	20.34	20.36	20.36	20.26	19.83	19.32	18.92	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.93	19.09	19.41	19.86	20.2	20.34	20.36	20.36	20.26	19.83	19.32	18.92	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	1	0.99	0.98	0.94	0.81	0.6	0.43	0.5	0.8	0.96	0.99	1	(94)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	432.66	473.83	525.8	579.34	559.72	417.62	280.86	293.04	409.7	432.16	414.71	414.84	(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)

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

(97)m=	1138.35	1100.89	998.37	835.68	646.41	431.29	282.66	296.82	465.12	701.92	934.16	1131.38	(97)

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

(98)m=	525.03	421.38	351.6	184.57	64.5	0	0	0	0	200.7	374	533.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2654.89 (98)

Space heating requirement in kWh/m²/year 37.57 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	525.03	421.38	351.6	184.57	64.5	0	0	0	0	200.7	374	533.11	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	561.53	450.68	376.04	197.4	68.99	0	0	0	0	214.65	400	570.17	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2839.45 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	190.03	167.54	176.05	157.95	154.89	138.54	133.19	145.96	145.65	163.78	173.01	185.51	

Efficiency of water heater 79.8 (216)

(217)m=	87.39	87.17	86.62	85.23	82.67	79.8	79.8	79.8	79.8	85.36	86.82	87.47	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	217.46	192.18	203.23	185.32	187.35	173.61	166.9	182.91	182.51	191.88	199.28	212.07	

Total = Sum(219a)$_{1...12}$ = 2294.71 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2839.45
Water heating fuel used		2294.71
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)

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Electricity for lighting				320.43	(232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	613.32	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	495.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1108.98	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	166.3	(268)
Total CO2, kg/year	sum of (265)…(271) =				1314.21	(272)

TER = 18.6 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 4 TF

Address : P 2 4, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.67 (1a)	x	2.55 (2a)	=	180.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.67 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	180.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

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

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Walls Type1	28.1	12.56	15.54	x	0.18	=	2.8			(29)
Walls Type2	8.21	2.1	6.11	x	0.18	=	1.1			(29)
Walls Type3	2.52	0	2.52	x	0.18	=	0.45			(29)
Walls Type4	11.83	0	11.83	x	0.18	=	2.13			(29)
Roof	70.67	0	70.67	x	0.13	=	9.19			(30)
Total area of elements, m²			121.33							(31)
Party wall			34.96	x	0	=	0			(32)
Party floor			70.67							(32a)
Internal wall **			129.75							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.42 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9988.76 (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 15.87 (36)

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

Total fabric heat loss (33) + (36) = 50.29 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.79	35.56	35.33	34.24	34.04	33.1	33.1	32.92	33.46	34.04	34.45	34.88	(38)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	86.08	85.84	85.61	84.53	84.33	83.39	83.39	83.21	83.75	84.33	84.74	85.17	

Average = Sum(39)$_{1...12}$ /12= 84.53 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.22	1.21	1.21	1.2	1.19	1.18	1.18	1.18	1.19	1.19	1.2	1.21	

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.26 (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 87.93 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	96.72	93.2	89.69	86.17	82.65	79.14	79.14	82.65	86.17	89.69	93.2	96.72	

Total = Sum(44)$_{1...12}$ = 1055.15 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	143.44	125.45	129.45	112.86	108.29	93.45	86.59	99.37	100.55	117.19	127.92	138.91	

Total = Sum(45)$_{1...12}$ = 1383.47 (45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	21.52	18.82	19.42	16.93	16.24	14.02	12.99	14.91	15.08	17.58	19.19	20.84	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	190.03	167.54	176.05	157.95	154.89	138.54	133.19	145.96	145.65	163.78	173.01	185.51	(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=	190.03	167.54	176.05	157.95	154.89	138.54	133.19	145.96	145.65	163.78	173.01	185.51	

Output from water heater (annual)$_{1...12}$ — 1932.09 — (64)

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

(65)m=	84.97	75.38	80.32	73.6	73.28	67.14	66.07	70.32	69.51	76.24	78.61	83.46	(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=	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	(66)

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

(67)m=	18.14	16.12	13.11	9.92	7.42	6.26	6.77	8.79	11.8	14.99	17.49	18.65	(67)

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

(68)m=	198.86	200.92	195.72	184.65	170.68	157.54	148.77	146.7	151.9	162.97	176.95	190.08	(68)

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

(69)m=	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	(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=	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	(71)

Water heating gains (Table 5)

(72)m=	114.2	112.17	107.96	102.22	98.5	93.26	88.8	94.51	96.54	102.47	109.18	112.18	(72)

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

(73)m=	391.14	389.14	376.72	356.73	336.53	316.99	304.27	309.94	320.18	340.37	363.55	380.85	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northwest	0.9x	0.77	x	12.56	x	11.28	x	0.63	x	0.7	=	43.31	(81)
Northwest	0.9x	0.77	x	12.56	x	22.97	x	0.63	x	0.7	=	88.16	(81)
Northwest	0.9x	0.77	x	12.56	x	41.38	x	0.63	x	0.7	=	158.83	(81)
Northwest	0.9x	0.77	x	12.56	x	67.96	x	0.63	x	0.7	=	260.85	(81)
Northwest	0.9x	0.77	x	12.56	x	91.35	x	0.63	x	0.7	=	350.63	(81)
Northwest	0.9x	0.77	x	12.56	x	97.38	x	0.63	x	0.7	=	373.81	(81)
Northwest	0.9x	0.77	x	12.56	x	91.1	x	0.63	x	0.7	=	349.69	(81)
Northwest	0.9x	0.77	x	12.56	x	72.63	x	0.63	x	0.7	=	278.78	(81)
Northwest	0.9x	0.77	x	12.56	x	50.42	x	0.63	x	0.7	=	193.54	(81)
Northwest	0.9x	0.77	x	12.56	x	28.07	x	0.63	x	0.7	=	107.74	(81)
Northwest	0.9x	0.77	x	12.56	x	14.2	x	0.63	x	0.7	=	54.49	(81)
Northwest	0.9x	0.77	x	12.56	x	9.21	x	0.63	x	0.7	=	35.37	(81)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	43.31	88.16	158.83	260.85	350.63	373.81	349.69	278.78	193.54	107.74	54.49	35.37	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	434.45	477.3	535.55	617.58	687.16	690.8	653.96	588.72	513.72	448.11	418.05	416.22	(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	0.96	0.88	0.71	0.55	0.62	0.88	0.98	1	1	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.68	19.81	20.07	20.44	20.76	20.94	20.99	20.98	20.83	20.42	20	19.66	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	19.91	19.91	19.91	19.92	19.93	19.94	19.94	19.94	19.93	19.93	19.92	19.92	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	1	0.99	0.99	0.95	0.83	0.62	0.42	0.49	0.81	0.97	0.99	1	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.16	18.34	18.72	19.26	19.69	19.9	19.93	19.93	19.79	19.25	18.63	18.14	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.68	18.85	19.18	19.67	20.06	20.26	20.3	20.29	20.15	19.65	19.1	18.67	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.68	18.85	19.18	19.67	20.06	20.26	20.3	20.29	20.15	19.65	19.1	18.67	(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:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	1	0.99	0.98	0.95	0.84	0.65	0.47	0.54	0.83	0.97	0.99	1	(94)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	432.6	473.85	526.42	584.1	577.59	446.38	304.25	315.99	423.83	433.74	414.76	414.77	(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)

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

(97)m=	1238.24	1197.64	1086	910.07	705.28	471.98	308.31	323.86	506.82	763.59	1017	1232.04	(97)

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

(98)m=	599.4	486.39	416.33	234.69	95.01	0	0	0	0	245.41	433.61	608.05	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3118.89 (98)

Space heating requirement in kWh/m²/year 44.13 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	599.4	486.39	416.33	234.69	95.01	0	0	0	0	245.41	433.61	608.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	641.07	520.2	445.27	251.01	101.61	0	0	0	0	262.47	463.76	650.32	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3335.71 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	190.03	167.54	176.05	157.95	154.89	138.54	133.19	145.96	145.65	163.78	173.01	185.51	

Efficiency of water heater 79.8 (216)

(217)m=	87.67	87.49	87.03	85.87	83.56	79.8	79.8	79.8	79.8	85.89	87.17	87.75	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	216.76	191.48	202.28	183.95	185.37	173.61	166.9	182.91	182.51	190.69	198.48	211.4	

Total = Sum(219a)$_{1...12}$ = 2286.34 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3335.71
Water heating fuel used		2286.34
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)

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Electricity for lighting					320.43	(232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	720.51	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	493.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1214.36	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	166.3	(268)
Total CO2, kg/year		sum of (265)…(271) =			1419.59	(272)

TER = 20.09 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 4

Address : P 2 4, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.67 (1a)	x	2.55 (2a)	=	180.21	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.67 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	180.21	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

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

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Walls Type1	28.1	12.56	15.54	x	0.18	=	2.8			(29)
Walls Type2	8.21	2.1	6.11	x	0.18	=	1.1			(29)
Walls Type3	2.52	0	2.52	x	0.18	=	0.45			(29)
Walls Type4	11.83	0	11.83	x	0.18	=	2.13			(29)
Total area of elements, m²			50.66							(31)
Party wall			34.96	x	0	=	0			(32)
Party floor			70.67							(32a)
Party ceiling			70.67							(32b)
Internal wall **			129.75							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11472.83 (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 4.49 (36)

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

Total fabric heat loss (33) + (36) = 29.72 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.79	35.56	35.33	34.24	34.04	33.1	33.1	32.92	33.46	34.04	34.45	34.88	(38)

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

(39)m=	65.51	65.28	65.05	63.96	63.76	62.82	62.82	62.64	63.18	63.76	64.17	64.6	

Average = Sum(39)$_{1...12}$ /12= 63.96 (39)

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

(40)m=	0.93	0.92	0.92	0.91	0.9	0.89	0.89	0.89	0.89	0.9	0.91	0.91	

Average = Sum(40)$_{1...12}$ /12= 0.91 (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 2.26 (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 87.93 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	96.72	93.2	89.69	86.17	82.65	79.14	79.14	82.65	86.17	89.69	93.2	96.72	

Total = Sum(44)$_{1...12}$ = 1055.15 (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=	143.44	125.45	129.45	112.86	108.29	93.45	86.59	99.37	100.55	117.19	127.92	138.91	

Total = Sum(45)$_{1...12}$ = 1383.47 (45)

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

(46)m=	21.52	18.82	19.42	16.93	16.24	14.02	12.99	14.91	15.08	17.58	19.19	20.84	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	190.03	167.54	176.05	157.95	154.89	138.54	133.19	145.96	145.65	163.78	173.01	185.51	(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=	190.03	167.54	176.05	157.95	154.89	138.54	133.19	145.96	145.65	163.78	173.01	185.51	

Output from water heater (annual)$_{1...12}$ — 1932.09 — (64)

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

(65)m=	84.97	75.38	80.32	73.6	73.28	67.14	66.07	70.32	69.51	76.24	78.61	83.46	(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=	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	113.11	(66)

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

(67)m=	18.14	16.12	13.11	9.92	7.42	6.26	6.77	8.79	11.8	14.99	17.49	18.65	(67)

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

(68)m=	198.86	200.92	195.72	184.65	170.68	157.54	148.77	146.7	151.9	162.97	176.95	190.08	(68)

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

(69)m=	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	34.31	(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=	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	-90.49	(71)

Water heating gains (Table 5)

(72)m=	114.2	112.17	107.96	102.22	98.5	93.26	88.8	94.51	96.54	102.47	109.18	112.18	(72)

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

(73)m=	391.14	389.14	376.72	356.73	336.53	316.99	304.27	309.94	320.18	340.37	363.55	380.85	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northwest	0.9x	0.77	x	12.56	x	11.28	x	0.63	x	0.7	=	43.31	(81)
Northwest	0.9x	0.77	x	12.56	x	22.97	x	0.63	x	0.7	=	88.16	(81)
Northwest	0.9x	0.77	x	12.56	x	41.38	x	0.63	x	0.7	=	158.83	(81)
Northwest	0.9x	0.77	x	12.56	x	67.96	x	0.63	x	0.7	=	260.85	(81)
Northwest	0.9x	0.77	x	12.56	x	91.35	x	0.63	x	0.7	=	350.63	(81)
Northwest	0.9x	0.77	x	12.56	x	97.38	x	0.63	x	0.7	=	373.81	(81)
Northwest	0.9x	0.77	x	12.56	x	91.1	x	0.63	x	0.7	=	349.69	(81)
Northwest	0.9x	0.77	x	12.56	x	72.63	x	0.63	x	0.7	=	278.78	(81)
Northwest	0.9x	0.77	x	12.56	x	50.42	x	0.63	x	0.7	=	193.54	(81)
Northwest	0.9x	0.77	x	12.56	x	28.07	x	0.63	x	0.7	=	107.74	(81)
Northwest	0.9x	0.77	x	12.56	x	14.2	x	0.63	x	0.7	=	54.49	(81)
Northwest	0.9x	0.77	x	12.56	x	9.21	x	0.63	x	0.7	=	35.37	(81)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	43.31	88.16	158.83	260.85	350.63	373.81	349.69	278.78	193.54	107.74	54.49	35.37	(83)

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

(84)m=	434.45	477.3	535.55	617.58	687.16	690.8	653.96	588.72	513.72	448.11	418.05	416.22	(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	0.94	0.79	0.57	0.42	0.49	0.78	0.97	0.99	1	(86)

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

(87)m=	20.08	20.2	20.42	20.73	20.93	20.99	21	21	20.95	20.68	20.34	20.07	(87)

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

(88)m=	20.14	20.15	20.15	20.16	20.17	20.18	20.18	20.18	20.17	20.17	20.16	20.16	(88)

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

(89)m=	1	0.99	0.98	0.92	0.74	0.5	0.34	0.4	0.71	0.95	0.99	1	(89)

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

(90)m=	18.92	19.09	19.41	19.85	20.1	20.17	20.18	20.18	20.14	19.79	19.3	18.9	(90)

fLA = Living area ÷ (4) = 0.35 (91)

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

(92)m=	19.32	19.48	19.76	20.15	20.39	20.46	20.46	20.46	20.42	20.1	19.66	19.31	(92)

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

(93)m=	19.32	19.48	19.76	20.15	20.39	20.46	20.46	20.46	20.42	20.1	19.66	19.31	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.92	0.75	0.53	0.37	0.43	0.73	0.95	0.99	1	(94)

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

(95)m=	432.64	473.51	523.68	565.78	517.43	364.38	242.25	253.68	376.8	427.33	414.34	414.85	(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)

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

(97)m=	984.12	951.41	862.74	719.79	553.93	367.85	242.58	254.46	399.2	605.85	805.93	975.95	(97)

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

(98)m=	410.3	321.15	252.27	110.89	27.15	0	0	0	0	132.82	281.95	417.46	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1953.98 (98)

Space heating requirement in kWh/m²/year 27.65 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	410.3	321.15	252.27	110.89	27.15	0	0	0	0	132.82	281.95	417.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	438.82	343.48	269.8	118.6	29.04	0	0	0	0	142.05	301.55	446.48	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2089.82 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	190.03	167.54	176.05	157.95	154.89	138.54	133.19	145.96	145.65	163.78	173.01	185.51	

Efficiency of water heater 79.8 (216)

(217)m=	86.82	86.52	85.77	83.89	81.23	79.8	79.8	79.8	79.8	84.26	86.11	86.91	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	218.89	193.63	205.25	188.28	190.67	173.61	166.9	182.91	182.51	194.37	200.92	213.43	

Total = Sum(219a)$_{1...12}$ = 2311.39 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2089.82
Water heating fuel used		2311.39
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)

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Electricity for lighting					320.43	(232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	451.4	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	499.26	(264)
Space and water heating	(261) + (262) + (263) + (264) =				950.66	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	166.3	(268)
Total CO2, kg/year		sum of (265)…(271) =			1155.89	(272)

TER = 16.36 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 8 GF

Address : P 2 8, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	61.04 (1a)	x	2.55 (2a)	=	155.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	61.04 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	155.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.64	x	1/[1/(1.4)+ 0.04]	=	14.11			(27)
Floor			61.04	x	0.13	=	7.9352			(28)
Walls Type1	24.58	10.64	13.94	x	0.18	=	2.51			(29)
Walls Type2	13.97	2.1	11.87	x	0.18	=	2.14			(29)
Walls Type3	17.54	0	17.54	x	0.18	=	3.16			(29)
Total area of elements, m²			117.13							(31)
Party wall			33.18	x	0	=	0			(32)
Party ceiling			61.04							(32b)
Internal wall **			112.07							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.94 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11186.81 (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 7.9 (36)

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

Total fabric heat loss (33) + (36) = 39.84 (37)

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

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

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(38)m=	30	29.84	29.67	28.9	28.75	28.08	28.08	27.96	28.34	28.75	29.05	29.35	(38)

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

(39)m=	69.85	69.68	69.52	68.74	68.6	67.93	67.93	67.8	68.18	68.6	68.89	69.2	

Average = Sum(39)$_{1...12}$ /12= 68.74 (39)

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

(40)m=	1.14	1.14	1.14	1.13	1.12	1.11	1.11	1.11	1.12	1.12	1.13	1.13	

Average = Sum(40)$_{1...12}$ /12= 1.13 (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 2.01 (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 81.96 (43)

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

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

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

(44)m=	90.15	86.88	83.6	80.32	77.04	73.76	73.76	77.04	80.32	83.6	86.88	90.15	

Total = Sum(44)$_{1...12}$ = 983.5 (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=	133.7	116.93	120.66	105.2	100.94	87.1	80.71	92.62	93.73	109.23	119.23	129.48	

Total = Sum(45)$_{1...12}$ = 1289.53 (45)

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

(46)m=	20.05	17.54	18.1	15.78	15.14	13.07	12.11	13.89	14.06	16.38	17.88	19.42	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	180.29	159.02	167.26	150.29	147.53	132.19	127.31	139.21	138.82	155.82	164.32	176.07	(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=	180.29	159.02	167.26	150.29	147.53	132.19	127.31	139.21	138.82	155.82	164.32	176.07	

Output from water heater (annual)$_{1...12}$ | 1838.14 | (64)

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

(65)m=	81.73	72.55	77.4	71.05	70.84	65.04	64.11	68.07	67.24	73.59	75.72	80.33	(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=	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	(66)

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

(67)m=	16.07	14.27	11.61	8.79	6.57	5.55	5.99	7.79	10.46	13.28	15.49	16.52	(67)

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

(68)m=	175.56	177.38	172.79	163.02	150.68	139.09	131.34	129.52	134.11	143.88	156.22	167.82	(68)

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

(69)m=	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	(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=	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	(71)

Water heating gains (Table 5)

(72)m=	109.85	107.96	104.03	98.68	95.21	90.33	86.17	91.49	93.39	98.92	105.16	107.97	(72)

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

(73)m=	357.65	355.78	344.59	326.65	308.63	291.12	279.67	284.97	294.11	312.24	333.04	348.46	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest$_{0.9x}$	0.77	x	10.64	x	36.79		0.63	x	0.7	=	119.64	(79)
Southwest$_{0.9x}$	0.77	x	10.64	x	62.67		0.63	x	0.7	=	203.8	(79)

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Southwest 0.9x	0.77	x	10.64	x	85.75		0.63	x	0.7	=	278.84	(79)
Southwest 0.9x	0.77	x	10.64	x	106.25		0.63	x	0.7	=	345.5	(79)
Southwest 0.9x	0.77	x	10.64	x	119.01		0.63	x	0.7	=	386.99	(79)
Southwest 0.9x	0.77	x	10.64	x	118.15		0.63	x	0.7	=	384.19	(79)
Southwest 0.9x	0.77	x	10.64	x	113.91		0.63	x	0.7	=	370.4	(79)
Southwest 0.9x	0.77	x	10.64	x	104.39		0.63	x	0.7	=	339.45	(79)
Southwest 0.9x	0.77	x	10.64	x	92.85		0.63	x	0.7	=	301.93	(79)
Southwest 0.9x	0.77	x	10.64	x	69.27		0.63	x	0.7	=	225.24	(79)
Southwest 0.9x	0.77	x	10.64	x	44.07		0.63	x	0.7	=	143.31	(79)
Southwest 0.9x	0.77	x	10.64	x	31.49		0.63	x	0.7	=	102.39	(79)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	119.64	203.8	278.84	345.5	386.99	384.19	370.4	339.45	301.93	225.24	143.31	102.39	(83)

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

(84)m=	477.29	559.58	623.44	672.15	695.62	675.31	650.07	624.42	596.04	537.48	476.35	450.85	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.8	0.62	0.46	0.49	0.73	0.93	0.99	1	(86)

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

(87)m=	19.93	20.12	20.37	20.66	20.87	20.97	21	20.99	20.94	20.67	20.25	19.9	(87)

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

(88)m=	19.96	19.97	19.97	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.98	19.97	(88)

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

(89)m=	0.99	0.98	0.95	0.88	0.74	0.53	0.35	0.39	0.64	0.9	0.98	0.99	(89)

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

(90)m=	18.56	18.84	19.2	19.6	19.86	19.97	19.99	19.99	19.94	19.62	19.03	18.52	(90)

fLA = Living area ÷ (4) = 0.38 (91)

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

(92)m=	19.08	19.32	19.64	20	20.24	20.35	20.37	20.37	20.32	20.02	19.49	19.04	(92)

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

(93)m=	19.08	19.32	19.64	20	20.24	20.35	20.37	20.37	20.32	20.02	19.49	19.04	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.88	0.76	0.56	0.39	0.43	0.67	0.9	0.98	0.99	(94)

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

(95)m=	472.01	546.34	591.72	594.53	527.01	380.53	254.72	267.07	399.89	485.35	465.28	446.98	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	1032.42	1004.81	913.5	763.09	586.13	390.65	255.99	269.06	424.13	646.01	853.35	1026.84	(97)

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

(98)m=	416.94	308.1	239.4	121.37	43.98	0	0	0	0	119.53	279.4	431.42	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1960.15 (98)

Space heating requirement in kWh/m²/year 32.11 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	416.94	308.1	239.4	121.37	43.98	0	0	0	0	119.53	279.4	431.42	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	445.93	329.51	256.05	129.8	47.04	0	0	0	0	127.84	298.83	461.41	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2096.41 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	180.29	159.02	167.26	150.29	147.53	132.19	127.31	139.21	138.82	155.82	164.32	176.07	

Efficiency of water heater 79.8 (216)

(217)m=	86.98	86.55	85.77	84.25	82.03	79.8	79.8	79.8	79.8	84.12	86.22	87.11	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	207.28	183.73	195.01	178.38	179.86	165.66	159.53	174.45	173.96	185.25	190.59	202.12	

Total = Sum(219a)$_{1...12}$ = 2195.81 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2096.41
Water heating fuel used		2195.81
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		283.82 (232)

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

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	452.83	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	474.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =				927.12	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	147.3	(268)
Total CO2, kg/year		sum of (265)…(271) =			1113.35	(272)

TER = 18.24 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 8 TF

Address : P 2 8, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	61.04 (1a)	x	2.55 (2a)	=	155.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	61.04 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	155.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.64	x	1/[1/(1.4)+ 0.04]	=	14.11			(27)
Walls Type1	24.58	10.64	13.94	x	0.18	=	2.51			(29)
Walls Type2	13.97	2.1	11.87	x	0.18	=	2.14			(29)
Walls Type3	17.54	0	17.54	x	0.18	=	3.16			(29)
Roof	61.04	0	61.04	x	0.13	=	7.94			(30)
Total area of elements, m²			117.13							(31)
Party wall			33.18	x	0	=	0			(32)
Party floor			61.04							(32a)
Internal wall **			112.07							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.94 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9599.77 (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 17.01 (36)

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

Total fabric heat loss (33) + (36) = 48.95 (37)

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

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

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(38)m=	30	29.84	29.67	28.9	28.75	28.08	28.08	27.96	28.34	28.75	29.05	29.35	(38)

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

(39)m=	78.96	78.79	78.63	77.85	77.71	77.04	77.04	76.91	77.29	77.71	78	78.31	

Average = Sum(39)$_{1...12}$ /12= 77.85 (39)

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

(40)m=	1.29	1.29	1.29	1.28	1.27	1.26	1.26	1.26	1.27	1.27	1.28	1.28	

Average = Sum(40)$_{1...12}$ /12= 1.28 (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 2.01 (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 81.96 (43)

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

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

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

(44)m=	90.15	86.88	83.6	80.32	77.04	73.76	73.76	77.04	80.32	83.6	86.88	90.15	

Total = Sum(44)$_{1...12}$ = 983.5 (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=	133.7	116.93	120.66	105.2	100.94	87.1	80.71	92.62	93.73	109.23	119.23	129.48	

Total = Sum(45)$_{1...12}$ = 1289.53 (45)

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

(46)m=	20.05	17.54	18.1	15.78	15.14	13.07	12.11	13.89	14.06	16.38	17.88	19.42	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	180.29	159.02	167.26	150.29	147.53	132.19	127.31	139.21	138.82	155.82	164.32	176.07	(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=	180.29	159.02	167.26	150.29	147.53	132.19	127.31	139.21	138.82	155.82	164.32	176.07	

Output from water heater (annual)$_{1...12}$ | 1838.14 | (64)

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

(65)m=	81.73	72.55	77.4	71.05	70.84	65.04	64.11	68.07	67.24	73.59	75.72	80.33	(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=	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	(66)

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

(67)m=	16.07	14.27	11.61	8.79	6.57	5.55	5.99	7.79	10.46	13.28	15.49	16.52	(67)

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

(68)m=	175.56	177.38	172.79	163.02	150.68	139.09	131.34	129.52	134.11	143.88	156.22	167.82	(68)

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

(69)m=	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	(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=	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	(71)

Water heating gains (Table 5)

(72)m=	109.85	107.96	104.03	98.68	95.21	90.33	86.17	91.49	93.39	98.92	105.16	107.97	(72)

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

(73)m=	357.65	355.78	344.59	326.65	308.63	291.12	279.67	284.97	294.11	312.24	333.04	348.46	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest$_{0.9x}$	0.77	x	10.64	x	36.79		0.63	x	0.7	=	119.64	(79)
Southwest$_{0.9x}$	0.77	x	10.64	x	62.67		0.63	x	0.7	=	203.8	(79)

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Southwest	0.9x	0.77	x	10.64	x	85.75		0.63	x	0.7	=	278.84	(79)
Southwest	0.9x	0.77	x	10.64	x	106.25		0.63	x	0.7	=	345.5	(79)
Southwest	0.9x	0.77	x	10.64	x	119.01		0.63	x	0.7	=	386.99	(79)
Southwest	0.9x	0.77	x	10.64	x	118.15		0.63	x	0.7	=	384.19	(79)
Southwest	0.9x	0.77	x	10.64	x	113.91		0.63	x	0.7	=	370.4	(79)
Southwest	0.9x	0.77	x	10.64	x	104.39		0.63	x	0.7	=	339.45	(79)
Southwest	0.9x	0.77	x	10.64	x	92.85		0.63	x	0.7	=	301.93	(79)
Southwest	0.9x	0.77	x	10.64	x	69.27		0.63	x	0.7	=	225.24	(79)
Southwest	0.9x	0.77	x	10.64	x	44.07		0.63	x	0.7	=	143.31	(79)
Southwest	0.9x	0.77	x	10.64	x	31.49		0.63	x	0.7	=	102.39	(79)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	119.64	203.8	278.84	345.5	386.99	384.19	370.4	339.45	301.93	225.24	143.31	102.39	(83)

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

(84)m=	477.29	559.58	623.44	672.15	695.62	675.31	650.07	624.42	596.04	537.48	476.35	450.85	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.93	0.84	0.68	0.51	0.55	0.77	0.94	0.99	1	(86)

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

(87)m=	19.73	19.93	20.2	20.52	20.79	20.94	20.99	20.98	20.89	20.55	20.08	19.7	(87)

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

(88)m=	19.85	19.85	19.85	19.86	19.86	19.87	19.87	19.87	19.87	19.86	19.86	19.85	(88)

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

(89)m=	0.99	0.98	0.96	0.9	0.78	0.58	0.38	0.42	0.69	0.92	0.98	0.99	(89)

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

(90)m=	18.19	18.47	18.86	19.32	19.66	19.84	19.87	19.87	19.79	19.36	18.7	18.14	(90)

fLA = Living area ÷ (4) = 0.38 (91)

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

(92)m=	18.77	19.02	19.36	19.77	20.09	20.25	20.29	20.29	20.2	19.81	19.22	18.73	(92)

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

(93)m=	18.77	19.02	19.36	19.77	20.09	20.25	20.29	20.29	20.2	19.81	19.22	18.73	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.9	0.79	0.61	0.43	0.47	0.72	0.92	0.98	0.99	(94)

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

(95)m=	472.15	547.41	595.69	606.71	552.93	413.79	280.86	293.93	426.68	493.2	466.19	447.01	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	1142.74	1112.38	1011.47	846.58	651.88	435.56	284.25	299	471.86	715.76	945.22	1137.78	(97)

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

(98)m=	498.92	379.65	309.34	172.71	73.62	0	0	0	0	165.59	344.9	513.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2458.66 (98)

Space heating requirement in kWh/m²/year 40.28 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	498.92	379.65	309.34	172.71	73.62	0	0	0	0	165.59	344.9	513.93	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	533.6	406.05	330.85	184.71	78.74	0	0	0	0	177.1	368.88	549.66	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2629.58 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	180.29	159.02	167.26	150.29	147.53	132.19	127.31	139.21	138.82	155.82	164.32	176.07	

Efficiency of water heater 79.8 (216)

(217)m=	87.39	87.05	86.43	85.19	83.07	79.8	79.8	79.8	79.8	84.98	86.75	87.51	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	206.31	182.66	193.51	176.43	177.6	165.66	159.53	174.45	173.96	183.37	189.43	201.21	

Total = Sum(219a)$_{1...12}$ = 2184.13 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2629.58
Water heating fuel used		2184.13
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		283.82 (232)

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

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	567.99	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	471.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1039.76	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	147.3	(268)
Total CO2, kg/year		sum of (265)…(271) =			1225.99	(272)

TER = 20.09 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 8

Address : P 2 8, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	61.04	(1a) x	2.55	(2a) =	155.65	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	61.04	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		155.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

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

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

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

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.64	x	1/[1/(1.4)+ 0.04]	=	14.11			(27)
Walls Type1	24.58	10.64	13.94	x	0.18	=	2.51			(29)
Walls Type2	13.97	2.1	11.87	x	0.18	=	2.14			(29)
Walls Type3	17.54	0	17.54	x	0.18	=	3.16			(29)
Total area of elements, m²			56.09							(31)
Party wall			33.18	x	0	=	0			(32)
Party floor			61.04							(32a)
Party ceiling			61.04							(32b)
Internal wall **			112.07							(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 24.01 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10881.61 (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 4.67 (36)

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

Total fabric heat loss (33) + (36) = 28.68 (37)

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

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

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(38)m=	30	29.84	29.67	28.9	28.75	28.08	28.08	27.96	28.34	28.75	29.05	29.35	(38)

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

(39)m=	58.68	58.51	58.35	57.58	57.43	56.76	56.76	56.63	57.02	57.43	57.72	58.03	

Average = Sum(39)$_{1...12}$ /12= 57.58 (39)

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

(40)m=	0.96	0.96	0.96	0.94	0.94	0.93	0.93	0.93	0.93	0.94	0.95	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.94 (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 2.01 (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 81.96 (43)

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

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

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

(44)m=	90.15	86.88	83.6	80.32	77.04	73.76	73.76	77.04	80.32	83.6	86.88	90.15	

Total = Sum(44)$_{1...12}$ = 983.5 (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=	133.7	116.93	120.66	105.2	100.94	87.1	80.71	92.62	93.73	109.23	119.23	129.48	

Total = Sum(45)$_{1...12}$ = 1289.53 (45)

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

(46)m=	20.05	17.54	18.1	15.78	15.14	13.07	12.11	13.89	14.06	16.38	17.88	19.42	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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

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

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

(62)m=	180.29	159.02	167.26	150.29	147.53	132.19	127.31	139.21	138.82	155.82	164.32	176.07	(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=	180.29	159.02	167.26	150.29	147.53	132.19	127.31	139.21	138.82	155.82	164.32	176.07	

Output from water heater (annual)$_{1...12}$ | 1838.14 | (64)

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

(65)m=	81.73	72.55	77.4	71.05	70.84	65.04	64.11	68.07	67.24	73.59	75.72	80.33	(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=	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	100.54	(66)

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

(67)m=	16.07	14.27	11.61	8.79	6.57	5.55	5.99	7.79	10.46	13.28	15.49	16.52	(67)

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

(68)m=	175.56	177.38	172.79	163.02	150.68	139.09	131.34	129.52	134.11	143.88	156.22	167.82	(68)

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

(69)m=	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	33.05	(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=	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	-80.44	(71)

Water heating gains (Table 5)

(72)m=	109.85	107.96	104.03	98.68	95.21	90.33	86.17	91.49	93.39	98.92	105.16	107.97	(72)

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

(73)m=	357.65	355.78	344.59	326.65	308.63	291.12	279.67	284.97	294.11	312.24	333.04	348.46	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest$_{0.9x}$	0.77	x	10.64	x	36.79		0.63	x	0.7	=	119.64	(79)
Southwest$_{0.9x}$	0.77	x	10.64	x	62.67		0.63	x	0.7	=	203.8	(79)

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Southwest	0.9x	0.77	x	10.64	x	85.75		0.63	x	0.7	=	278.84	(79)
Southwest	0.9x	0.77	x	10.64	x	106.25		0.63	x	0.7	=	345.5	(79)
Southwest	0.9x	0.77	x	10.64	x	119.01		0.63	x	0.7	=	386.99	(79)
Southwest	0.9x	0.77	x	10.64	x	118.15		0.63	x	0.7	=	384.19	(79)
Southwest	0.9x	0.77	x	10.64	x	113.91		0.63	x	0.7	=	370.4	(79)
Southwest	0.9x	0.77	x	10.64	x	104.39		0.63	x	0.7	=	339.45	(79)
Southwest	0.9x	0.77	x	10.64	x	92.85		0.63	x	0.7	=	301.93	(79)
Southwest	0.9x	0.77	x	10.64	x	69.27		0.63	x	0.7	=	225.24	(79)
Southwest	0.9x	0.77	x	10.64	x	44.07		0.63	x	0.7	=	143.31	(79)
Southwest	0.9x	0.77	x	10.64	x	31.49		0.63	x	0.7	=	102.39	(79)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	119.64	203.8	278.84	345.5	386.99	384.19	370.4	339.45	301.93	225.24	143.31	102.39	(83)

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

(84)m=	477.29	559.58	623.44	672.15	695.62	675.31	650.07	624.42	596.04	537.48	476.35	450.85	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.72	0.53	0.38	0.42	0.64	0.9	0.98	0.99	(86)

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

(87)m=	20.19	20.37	20.59	20.82	20.95	20.99	21	21	20.98	20.82	20.46	20.16	(87)

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

(88)m=	20.12	20.12	20.12	20.13	20.13	20.14	20.14	20.14	20.14	20.13	20.13	20.12	(88)

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

(89)m=	0.99	0.97	0.94	0.84	0.67	0.46	0.31	0.34	0.57	0.86	0.97	0.99	(89)

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

(90)m=	19.05	19.31	19.63	19.94	20.09	20.14	20.14	20.14	20.13	19.94	19.45	19.01	(90)

fLA = Living area ÷ (4) = 0.38 (91)

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

(92)m=	19.48	19.71	19.99	20.27	20.41	20.46	20.47	20.47	20.45	20.27	19.84	19.44	(92)

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

(93)m=	19.48	19.71	19.99	20.27	20.41	20.46	20.47	20.47	20.45	20.27	19.84	19.44	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.84	0.69	0.49	0.34	0.37	0.59	0.87	0.97	0.99	(94)

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

(95)m=	471.33	543.28	581.81	567.11	478.2	330.19	219.18	229.92	354.45	467.11	462.68	446.58	(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)

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

(97)m=	890.95	866.7	787.24	654.65	500.47	332.66	219.4	230.29	361.97	555.29	735.16	884.59	(97)

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

(98)m=	312.2	217.34	152.84	63.03	16.57	0	0	0	0	65.61	196.19	325.88	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1349.65 (98)

Space heating requirement in kWh/m²/year 22.11 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	312.2	217.34	152.84	63.03	16.57	0	0	0	0	65.61	196.19	325.88	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	333.9	232.45	163.46	67.41	17.72	0	0	0	0	70.17	209.83	348.54	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1443.48 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	180.29	159.02	167.26	150.29	147.53	132.19	127.31	139.21	138.82	155.82	164.32	176.07	

Efficiency of water heater 79.8 (216)

(217)m=	86.27	85.65	84.57	82.69	80.76	79.8	79.8	79.8	79.8	82.7	85.29	86.43	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	209	185.66	197.76	181.75	182.67	165.66	159.53	174.45	173.96	188.43	192.67	203.71	

Total = Sum(219a)$_{1...12}$ = 2215.25 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1443.48
Water heating fuel used		2215.25
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		283.82 (232)

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

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	311.79	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	478.49	(264)
Space and water heating	(261) + (262) + (263) + (264) =				790.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	147.3	(268)
Total CO2, kg/year		sum of (265)…(271) =			976.52	(272)

TER = 16 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 10 GF

Address : P 2 10, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.07	(1a) x	2.55	(2a) =	193.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.07	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		193.98	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

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

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

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

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

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

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

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

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			10.99	x1/[1/(1.4)+ 0.04]		=	14.57			(27)
Windows Type 2			5.23	x1/[1/(1.4)+ 0.04]		=	6.93			(27)
Floor			76.07	x	0.13	=	9.889099			(28)
Walls Type1	42.51	16.22	26.29	x	0.18	=	4.73			(29)
Walls Type2	3.8	2.1	1.7	x	0.18	=	0.31			(29)
Walls Type3	14.25	0	14.25	x	0.18	=	2.57			(29)
Total area of elements, m²			136.63							(31)
Party wall			41.06	x	0	=	0			(32)
Party ceiling			76.07							(32b)
Internal wall **			139.66							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 41.1 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12683.92 (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 9.12 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 50.21 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.16	37.92	37.69	36.59	36.38	35.42	35.42	35.25	35.79	36.38	36.8	37.23	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.38	88.14	87.9	86.8	86.6	85.64	85.64	85.46	86.01	86.6	87.01	87.45	

Average = Sum(39)$_{1...12}$ /12= 86.8 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.16	1.16	1.16	1.14	1.14	1.13	1.13	1.12	1.13	1.14	1.14	1.15	

Average = Sum(40)$_{1...12}$ /12= 1.14 (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 2.38 (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 90.82 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.9	96.27	92.64	89.01	85.37	81.74	81.74	85.37	89.01	92.64	96.27	99.9	

Total = Sum(44)$_{1...12}$ = 1089.86 (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=	148.15	129.58	133.71	116.57	111.85	96.52	89.44	102.64	103.86	121.04	132.13	143.48	

Total = Sum(45)$_{1...12}$ = 1428.98 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.22	19.44	20.06	17.49	16.78	14.48	13.42	15.4	15.58	18.16	19.82	21.52	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.75	171.66	180.31	161.66	158.45	141.61	136.04	149.23	148.95	167.64	177.22	190.07	(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=	194.75	171.66	180.31	161.66	158.45	141.61	136.04	149.23	148.95	167.64	177.22	190.07	

Output from water heater (annual)$_{1...12}$ — 1977.59 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.54	76.75	81.74	74.83	74.47	68.17	67.02	71.4	70.61	77.52	80.01	84.98	(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=	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.85	16.74	13.61	10.31	7.7	6.5	7.03	9.14	12.26	15.57	18.17	19.37	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	211.03	213.22	207.7	195.96	181.13	167.19	157.88	155.69	161.21	172.95	187.78	201.72	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	(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=	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	(71)

Water heating gains (Table 5)

(72)m=	116.31	114.22	109.86	103.94	100.09	94.68	90.07	95.97	98.07	104.2	111.12	114.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	407.95	405.94	392.94	371.96	350.68	330.13	316.74	322.55	333.29	354.48	378.83	397.08	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southwest	0.9x	0.77	x	5.23	x	36.79		0.63	x	0.7	=	58.81	(79)
Southwest	0.9x	0.77	x	5.23	x	62.67		0.63	x	0.7	=	100.17	(79)
Southwest	0.9x	0.77	x	5.23	x	85.75		0.63	x	0.7	=	137.06	(79)
Southwest	0.9x	0.77	x	5.23	x	106.25		0.63	x	0.7	=	169.83	(79)
Southwest	0.9x	0.77	x	5.23	x	119.01		0.63	x	0.7	=	190.22	(79)
Southwest	0.9x	0.77	x	5.23	x	118.15		0.63	x	0.7	=	188.85	(79)
Southwest	0.9x	0.77	x	5.23	x	113.91		0.63	x	0.7	=	182.07	(79)
Southwest	0.9x	0.77	x	5.23	x	104.39		0.63	x	0.7	=	166.85	(79)
Southwest	0.9x	0.77	x	5.23	x	92.85		0.63	x	0.7	=	148.41	(79)
Southwest	0.9x	0.77	x	5.23	x	69.27		0.63	x	0.7	=	110.71	(79)
Southwest	0.9x	0.77	x	5.23	x	44.07		0.63	x	0.7	=	70.44	(79)
Southwest	0.9x	0.77	x	5.23	x	31.49		0.63	x	0.7	=	50.33	(79)
Northwest	0.9x	0.77	x	10.99	x	11.28	x	0.63	x	0.7	=	37.9	(81)
Northwest	0.9x	0.77	x	10.99	x	22.97	x	0.63	x	0.7	=	77.14	(81)
Northwest	0.9x	0.77	x	10.99	x	41.38	x	0.63	x	0.7	=	138.98	(81)
Northwest	0.9x	0.77	x	10.99	x	67.96	x	0.63	x	0.7	=	228.24	(81)
Northwest	0.9x	0.77	x	10.99	x	91.35	x	0.63	x	0.7	=	306.8	(81)
Northwest	0.9x	0.77	x	10.99	x	97.38	x	0.63	x	0.7	=	327.08	(81)
Northwest	0.9x	0.77	x	10.99	x	91.1	x	0.63	x	0.7	=	305.98	(81)
Northwest	0.9x	0.77	x	10.99	x	72.63	x	0.63	x	0.7	=	243.93	(81)
Northwest	0.9x	0.77	x	10.99	x	50.42	x	0.63	x	0.7	=	169.35	(81)
Northwest	0.9x	0.77	x	10.99	x	28.07	x	0.63	x	0.7	=	94.27	(81)
Northwest	0.9x	0.77	x	10.99	x	14.2	x	0.63	x	0.7	=	47.68	(81)
Northwest	0.9x	0.77	x	10.99	x	9.21	x	0.63	x	0.7	=	30.95	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	96.71	177.31	276.04	398.07	497.02	515.93	488.05	410.78	317.76	204.98	118.12	81.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	504.66	583.25	668.98	770.03	847.71	846.06	804.79	733.34	651.05	559.46	496.96	478.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.62	0.46	0.53	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.8	19.96	20.24	20.59	20.86	20.97	20.99	20.99	20.91	20.55	20.12	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.95	19.95	19.96	19.97	19.97	19.98	19.98	19.98	19.98	19.97	19.97	19.96	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.76	0.53	0.36	0.41	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.36	18.6	19	19.5	19.84	19.96	19.98	19.98	19.9	19.46	18.83	18.33	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.91	19.12	19.47	19.91	20.22	20.34	20.36	20.36	20.28	19.87	19.32	18.88	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.91	19.12	19.47	19.91	20.22	20.34	20.36	20.36	20.28	19.87	19.32	18.88	(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	0.97	0.91	0.77	0.57	0.4	0.46	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	501.8	576.34	648.97	701.31	654.74	478.54	320.39	334.96	482.73	528.85	491.2	476.25	(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=	1290.81	1252.99	1139.68	955.87	737.93	491.89	322.19	338.47	531.75	802.99	1062.92	1283.43	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	587.02	454.71	365.08	183.28	61.89	0	0	0	0	203.96	411.64	600.54	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2868.13 (98)

Space heating requirement in kWh/m²/year 37.7 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	587.02	454.71	365.08	183.28	61.89	0	0	0	0	203.96	411.64	600.54	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	627.83	486.32	390.46	196.02	66.2	0	0	0	0	218.14	440.26	642.29	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3067.52 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	194.75	171.66	180.31	161.66	158.45	141.61	136.04	149.23	148.95	167.64	177.22	190.07

Efficiency of water heater 79.8 (216)

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(217)m=	87.57	87.29	86.66	85.15	82.54	79.8	79.8	79.8	79.8	85.34	86.99	87.67	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.38	196.65	208.07	189.86	191.96	177.46	170.47	187.01	186.66	196.44	203.72	216.8	

Total = Sum(219a)$_{1...12}$ = 2347.48 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3067.52	
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		332.84	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	662.58	(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) =				1169.64	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	172.74	(268)
Total CO2, kg/year	sum of (265)…(271) =				1381.31	(272)

TER = 18.16 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 10 TF

Address : P 2 10, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.07 (1a)	x	2.55 (2a)	=	193.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.07 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	193.98	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			10.99	x1/[1/(1.4)+ 0.04]		=	14.57			(27)
Windows Type 2			5.23	x1/[1/(1.4)+ 0.04]		=	6.93			(27)
Walls Type1	42.51	16.22	26.29	x	0.18	=	4.73			(29)
Walls Type2	3.8	2.1	1.7	x	0.18	=	0.31			(29)
Walls Type3	14.25	0	14.25	x	0.18	=	2.57			(29)
Roof	76.07	0	76.07	x	0.13	=	9.89			(30)
Total area of elements, m²			136.63							(31)
Party wall			41.06	x	0	=	0			(32)
Party floor			76.07							(32a)
Internal wall **			139.66							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 41.1 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10706.1 (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 19.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 60.36 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.16	37.92	37.69	36.59	36.38	35.42	35.42	35.25	35.79	36.38	36.8	37.23	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	98.52	98.28	98.05	96.95	96.74	95.78	95.78	95.61	96.15	96.74	97.16	97.59	

Average = Sum(39)$_{1...12}$ /12= 96.95 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.3	1.29	1.29	1.27	1.27	1.26	1.26	1.26	1.26	1.27	1.28	1.28	

Average = Sum(40)$_{1...12}$ /12= 1.27 (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 2.38 (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 90.82 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.9	96.27	92.64	89.01	85.37	81.74	81.74	85.37	89.01	92.64	96.27	99.9	

Total = Sum(44)$_{1...12}$ = 1089.86 (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=	148.15	129.58	133.71	116.57	111.85	96.52	89.44	102.64	103.86	121.04	132.13	143.48	

Total = Sum(45)$_{1...12}$ = 1428.98 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.22	19.44	20.06	17.49	16.78	14.48	13.42	15.4	15.58	18.16	19.82	21.52	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.75	171.66	180.31	161.66	158.45	141.61	136.04	149.23	148.95	167.64	177.22	190.07	(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=	194.75	171.66	180.31	161.66	158.45	141.61	136.04	149.23	148.95	167.64	177.22	190.07	

Output from water heater (annual)$_{1...12}$ — 1977.59 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.54	76.75	81.74	74.83	74.47	68.17	67.02	71.4	70.61	77.52	80.01	84.98	(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=	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.85	16.74	13.61	10.31	7.7	6.5	7.03	9.14	12.26	15.57	18.17	19.37	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	211.03	213.22	207.7	195.96	181.13	167.19	157.88	155.69	161.21	172.95	187.78	201.72	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	(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=	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	(71)

Water heating gains (Table 5)

(72)m=	116.31	114.22	109.86	103.94	100.09	94.68	90.07	95.97	98.07	104.2	111.12	114.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	407.95	405.94	392.94	371.96	350.68	330.13	316.74	322.55	333.29	354.48	378.83	397.08	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southwest 0.9x	0.77	x	5.23	x	36.79		0.63	x	0.7	=	58.81	(79)
Southwest 0.9x	0.77	x	5.23	x	62.67		0.63	x	0.7	=	100.17	(79)
Southwest 0.9x	0.77	x	5.23	x	85.75		0.63	x	0.7	=	137.06	(79)
Southwest 0.9x	0.77	x	5.23	x	106.25		0.63	x	0.7	=	169.83	(79)
Southwest 0.9x	0.77	x	5.23	x	119.01		0.63	x	0.7	=	190.22	(79)
Southwest 0.9x	0.77	x	5.23	x	118.15		0.63	x	0.7	=	188.85	(79)
Southwest 0.9x	0.77	x	5.23	x	113.91		0.63	x	0.7	=	182.07	(79)
Southwest 0.9x	0.77	x	5.23	x	104.39		0.63	x	0.7	=	166.85	(79)
Southwest 0.9x	0.77	x	5.23	x	92.85		0.63	x	0.7	=	148.41	(79)
Southwest 0.9x	0.77	x	5.23	x	69.27		0.63	x	0.7	=	110.71	(79)
Southwest 0.9x	0.77	x	5.23	x	44.07		0.63	x	0.7	=	70.44	(79)
Southwest 0.9x	0.77	x	5.23	x	31.49		0.63	x	0.7	=	50.33	(79)
Northwest 0.9x	0.77	x	10.99	x	11.28	x	0.63	x	0.7	=	37.9	(81)
Northwest 0.9x	0.77	x	10.99	x	22.97	x	0.63	x	0.7	=	77.14	(81)
Northwest 0.9x	0.77	x	10.99	x	41.38	x	0.63	x	0.7	=	138.98	(81)
Northwest 0.9x	0.77	x	10.99	x	67.96	x	0.63	x	0.7	=	228.24	(81)
Northwest 0.9x	0.77	x	10.99	x	91.35	x	0.63	x	0.7	=	306.8	(81)
Northwest 0.9x	0.77	x	10.99	x	97.38	x	0.63	x	0.7	=	327.08	(81)
Northwest 0.9x	0.77	x	10.99	x	91.1	x	0.63	x	0.7	=	305.98	(81)
Northwest 0.9x	0.77	x	10.99	x	72.63	x	0.63	x	0.7	=	243.93	(81)
Northwest 0.9x	0.77	x	10.99	x	50.42	x	0.63	x	0.7	=	169.35	(81)
Northwest 0.9x	0.77	x	10.99	x	28.07	x	0.63	x	0.7	=	94.27	(81)
Northwest 0.9x	0.77	x	10.99	x	14.2	x	0.63	x	0.7	=	47.68	(81)
Northwest 0.9x	0.77	x	10.99	x	9.21	x	0.63	x	0.7	=	30.95	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	96.71	177.31	276.04	398.07	497.02	515.93	488.05	410.78	317.76	204.98	118.12	81.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	504.66	583.25	668.98	770.03	847.71	846.06	804.79	733.34	651.05	559.46	496.96	478.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.85	0.67	0.51	0.58	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.63	19.79	20.08	20.46	20.78	20.95	20.99	20.98	20.85	20.44	19.97	19.6	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	19.84	19.85	19.85	19.86	19.86	19.87	19.87	19.87	19.87	19.86	19.86	19.85	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.45	0.75	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.03	18.28	18.69	19.24	19.65	19.84	19.87	19.87	19.75	19.22	18.54	18	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.63	18.85	19.22	19.7	20.08	20.26	20.29	20.29	20.17	19.68	19.08	18.6	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.63	18.85	19.22	19.7	20.08	20.26	20.29	20.29	20.17	19.68	19.08	18.6	(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	0.97	0.92	0.8	0.61	0.43	0.5	0.78	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	501.72	576.53	650.64	710.47	681.41	515.51	349.32	363.88	504.91	532.32	491.34	476.15	(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=	1412.23	1370.99	1246.93	1047.41	810.64	541.86	353.59	371.64	583.5	878.66	1163.75	1405.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	677.42	533.88	443.63	242.6	96.15	0	0	0	0	257.68	484.13	691.56	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3427.05 (98)

Space heating requirement in kWh/m²/year 45.05 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	677.42	533.88	443.63	242.6	96.15	0	0	0	0	257.68	484.13	691.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	724.51	571	474.48	259.46	102.83	0	0	0	0	275.59	517.79	739.63	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3665.29 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	194.75	171.66	180.31	161.66	158.45	141.61	136.04	149.23	148.95	167.64	177.22	190.07

Efficiency of water heater 79.8 (216)

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(217)m=	87.87	87.64	87.12	85.89	83.53	79.8	79.8	79.8	79.8	85.96	87.36	87.96

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	221.64	195.87	206.95	188.21	189.69	177.46	170.47	187.01	186.66	195.02	202.86	216.1

Total = Sum(219a)$_{1...12}$ = 2337.94 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3665.29	
Water heating fuel used		2337.94	
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		332.84	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	791.7	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	504.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1296.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	172.74	(268)
Total CO2, kg/year	sum of (265)…(271) =				1508.37	(272)

TER = 19.83 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 10

Address : P 2 10, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	76.07	(1a) x	2.55	(2a) =	193.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	76.07	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		193.98	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			10.99	x1/[1/(1.4)+ 0.04]		=	14.57			(27)
Windows Type 2			5.23	x1/[1/(1.4)+ 0.04]		=	6.93			(27)
Walls Type1	42.51	16.22	26.29	x	0.18	=	4.73			(29)
Walls Type2	3.8	2.1	1.7	x	0.18	=	0.31			(29)
Walls Type3	14.25	0	14.25	x	0.18	=	2.57			(29)
Total area of elements, m²			60.56							(31)
Party wall			41.06	x	0	=	0			(32)
Party floor			76.07							(32a)
Party ceiling			76.07							(32b)
Internal wall **			139.66							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12303.57 (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 5.5 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.7 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.16	37.92	37.69	36.59	36.38	35.42	35.42	35.25	35.79	36.38	36.8	37.23	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	74.86	74.63	74.39	73.29	73.08	72.13	72.13	71.95	72.5	73.08	73.5	73.94	

Average = Sum(39)$_{1...12}$ /12= 73.29 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.98	0.98	0.98	0.96	0.96	0.95	0.95	0.95	0.95	0.96	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.96 (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 2.38 (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 90.82 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.9	96.27	92.64	89.01	85.37	81.74	81.74	85.37	89.01	92.64	96.27	99.9	

Total = Sum(44)$_{1...12}$ = 1089.86 (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=	148.15	129.58	133.71	116.57	111.85	96.52	89.44	102.64	103.86	121.04	132.13	143.48	

Total = Sum(45)$_{1...12}$ = 1428.98 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.22	19.44	20.06	17.49	16.78	14.48	13.42	15.4	15.58	18.16	19.82	21.52	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.75	171.66	180.31	161.66	158.45	141.61	136.04	149.23	148.95	167.64	177.22	190.07	(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=	194.75	171.66	180.31	161.66	158.45	141.61	136.04	149.23	148.95	167.64	177.22	190.07	

Output from water heater (annual)$_{1...12}$ — 1977.59 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.54	76.75	81.74	74.83	74.47	68.17	67.02	71.4	70.61	77.52	80.01	84.98	(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=	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	119.2	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.85	16.74	13.61	10.31	7.7	6.5	7.03	9.14	12.26	15.57	18.17	19.37	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	211.03	213.22	207.7	195.96	181.13	167.19	157.88	155.69	161.21	172.95	187.78	201.72	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	34.92	(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=	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	-95.36	(71)

Water heating gains (Table 5)

(72)m=	116.31	114.22	109.86	103.94	100.09	94.68	90.07	95.97	98.07	104.2	111.12	114.22	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	407.95	405.94	392.94	371.96	350.68	330.13	316.74	322.55	333.29	354.48	378.83	397.08	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Southwest 0.9x	0.77	x	5.23	x	36.79		0.63	x	0.7	=	58.81	(79)
Southwest 0.9x	0.77	x	5.23	x	62.67		0.63	x	0.7	=	100.17	(79)
Southwest 0.9x	0.77	x	5.23	x	85.75		0.63	x	0.7	=	137.06	(79)
Southwest 0.9x	0.77	x	5.23	x	106.25		0.63	x	0.7	=	169.83	(79)
Southwest 0.9x	0.77	x	5.23	x	119.01		0.63	x	0.7	=	190.22	(79)
Southwest 0.9x	0.77	x	5.23	x	118.15		0.63	x	0.7	=	188.85	(79)
Southwest 0.9x	0.77	x	5.23	x	113.91		0.63	x	0.7	=	182.07	(79)
Southwest 0.9x	0.77	x	5.23	x	104.39		0.63	x	0.7	=	166.85	(79)
Southwest 0.9x	0.77	x	5.23	x	92.85		0.63	x	0.7	=	148.41	(79)
Southwest 0.9x	0.77	x	5.23	x	69.27		0.63	x	0.7	=	110.71	(79)
Southwest 0.9x	0.77	x	5.23	x	44.07		0.63	x	0.7	=	70.44	(79)
Southwest 0.9x	0.77	x	5.23	x	31.49		0.63	x	0.7	=	50.33	(79)
Northwest 0.9x	0.77	x	10.99	x	11.28	x	0.63	x	0.7	=	37.9	(81)
Northwest 0.9x	0.77	x	10.99	x	22.97	x	0.63	x	0.7	=	77.14	(81)
Northwest 0.9x	0.77	x	10.99	x	41.38	x	0.63	x	0.7	=	138.98	(81)
Northwest 0.9x	0.77	x	10.99	x	67.96	x	0.63	x	0.7	=	228.24	(81)
Northwest 0.9x	0.77	x	10.99	x	91.35	x	0.63	x	0.7	=	306.8	(81)
Northwest 0.9x	0.77	x	10.99	x	97.38	x	0.63	x	0.7	=	327.08	(81)
Northwest 0.9x	0.77	x	10.99	x	91.1	x	0.63	x	0.7	=	305.98	(81)
Northwest 0.9x	0.77	x	10.99	x	72.63	x	0.63	x	0.7	=	243.93	(81)
Northwest 0.9x	0.77	x	10.99	x	50.42	x	0.63	x	0.7	=	169.35	(81)
Northwest 0.9x	0.77	x	10.99	x	28.07	x	0.63	x	0.7	=	94.27	(81)
Northwest 0.9x	0.77	x	10.99	x	14.2	x	0.63	x	0.7	=	47.68	(81)
Northwest 0.9x	0.77	x	10.99	x	9.21	x	0.63	x	0.7	=	30.95	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	96.71	177.31	276.04	398.07	497.02	515.93	488.05	410.78	317.76	204.98	118.12	81.28	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	504.66	583.25	668.98	770.03	847.71	846.06	804.79	733.34	651.05	559.46	496.96	478.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.75	0.54	0.39	0.45	0.72	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	20.05	20.21	20.46	20.76	20.94	20.99	21	21	20.96	20.71	20.32	20.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	1	0.99	0.97	0.88	0.69	0.47	0.32	0.37	0.65	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.83	19.06	19.42	19.84	20.06	20.12	20.13	20.13	20.09	19.79	19.24	18.8	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.29	19.49	19.81	20.19	20.39	20.45	20.46	20.46	20.42	20.13	19.65	19.26	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.29	19.49	19.81	20.19	20.39	20.45	20.46	20.46	20.42	20.13	19.65	19.26	(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	0.96	0.88	0.71	0.49	0.35	0.4	0.67	0.93	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	501.73	575.51	644.32	679.05	600.75	418.43	277.77	291.09	439.27	519.86	490.48	476.25	(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=	1122.17	1088.98	990.24	827.36	635.3	422	278.12	291.86	458.36	696.83	922.51	1113.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	461.6	345.05	257.36	106.78	25.71	0	0	0	0	131.66	311.06	474.23	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2113.46 (98)

Space heating requirement in kWh/m²/year 27.78 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	461.6	345.05	257.36	106.78	25.71	0	0	0	0	131.66	311.06	474.23	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	493.69	369.04	275.25	114.2	27.49	0	0	0	0	140.82	332.69	507.2	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2260.38 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	194.75	171.66	180.31	161.66	158.45	141.61	136.04	149.23	148.95	167.64	177.22	190.07

Efficiency of water heater 79.8 (216)

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(217)m=	87.04	86.64	85.76	83.74	81.14	79.8	79.8	79.8	79.8	84.18	86.3	87.16

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	223.75	198.13	210.24	193.06	195.28	177.46	170.47	187.01	186.66	199.14	205.35	218.08

Total = Sum(219a)$_{1...12}$ = 2364.64 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2260.38	
Water heating fuel used		2364.64	
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		332.84	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	488.24	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	510.76	(264)
Space and water heating	(261) + (262) + (263) + (264) =				999.01	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	172.74	(268)
Total CO2, kg/year	sum of (265)…(271) =				1210.67	(272)

TER = 15.92 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 11 GF

Address : P 2 11, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	62.19 (1a)	x	2.55 (2a)	=	158.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.19 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	158.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.3	0.32	0.34	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.64	x	1/[1/(1.4)+ 0.04]	=	14.11			(27)
Floor			62.19	x	0.13	=	8.0847			(28)
Walls Type1	25.12	10.64	14.48	x	0.18	=	2.61			(29)
Walls Type2	26.85	2.1	24.75	x	0.18	=	4.46			(29)
Total area of elements, m²			114.16							(31)
Party wall			32.08	x	0	=	0			(32)
Party ceiling			62.19							(32b)
Internal wall **			114.18							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8940.33 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.96 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.31 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	30.51	30.35	30.18	29.4	29.26	28.58	28.58	28.45	28.84	29.26	29.55	29.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.82	68.65	68.49	67.71	67.56	66.89	66.89	66.76	67.15	67.56	67.86	68.17	

Average = Sum(39)$_{1...12}$ /12= 67.71 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.1	1.1	1.09	1.09	1.08	1.08	1.07	1.08	1.09	1.09	1.1

Average = Sum(40)$_{1...12}$ /12= 1.09 (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 2.04 (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 82.72 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	90.99	87.68	84.37	81.06	77.75	74.45	74.45	77.75	81.06	84.37	87.68	90.99

Total = Sum(44)$_{1...12}$ = 992.61 (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=	134.93	118.01	121.78	106.17	101.87	87.91	81.46	93.48	94.59	110.24	120.34	130.68

Total = Sum(45)$_{1...12}$ = 1301.46 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.24	17.7	18.27	15.93	15.28	13.19	12.22	14.02	14.19	16.54	18.05	19.6

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	181.53	160.1	168.37	151.26	148.47	133	128.06	140.07	139.69	156.83	165.43	177.27	(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=	181.53	160.1	168.37	151.26	148.47	133	128.06	140.07	139.69	156.83	165.43	177.27	

Output from water heater (annual)$_{1...12}$ 1850.08 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	82.14	72.91	77.77	71.38	71.15	65.3	64.36	68.36	67.53	73.93	76.08	80.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.39	14.56	11.84	8.96	6.7	5.66	6.11	7.94	10.66	13.54	15.8	16.84	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	178.43	180.29	175.62	165.69	153.15	141.36	133.49	131.64	136.3	146.24	158.78	170.56	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	(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=	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	(71)

Water heating gains (Table 5)

(72)m=	110.41	108.49	104.53	99.13	95.63	90.7	86.51	91.88	93.79	99.37	105.67	108.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	361.87	359.98	348.63	330.42	312.12	294.36	282.75	288.1	297.39	315.79	336.89	352.55	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	10.64	x	11.28	x	0.63	x	0.7	=	36.69	(81)
Northwest 0.9x	0.77	x	10.64	x	22.97	x	0.63	x	0.7	=	74.68	(81)
Northwest 0.9x	0.77	x	10.64	x	41.38	x	0.63	x	0.7	=	134.55	(81)
Northwest 0.9x	0.77	x	10.64	x	67.96	x	0.63	x	0.7	=	220.97	(81)
Northwest 0.9x	0.77	x	10.64	x	91.35	x	0.63	x	0.7	=	297.03	(81)

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Northwest 0.9x	0.77	x	10.64	x	97.38	x	0.63	x	0.7	=	316.67	(81)
Northwest 0.9x	0.77	x	10.64	x	91.1	x	0.63	x	0.7	=	296.24	(81)
Northwest 0.9x	0.77	x	10.64	x	72.63	x	0.63	x	0.7	=	236.16	(81)
Northwest 0.9x	0.77	x	10.64	x	50.42	x	0.63	x	0.7	=	163.95	(81)
Northwest 0.9x	0.77	x	10.64	x	28.07	x	0.63	x	0.7	=	91.27	(81)
Northwest 0.9x	0.77	x	10.64	x	14.2	x	0.63	x	0.7	=	46.16	(81)
Northwest 0.9x	0.77	x	10.64	x	9.21	x	0.63	x	0.7	=	29.96	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	36.69	74.68	134.55	220.97	297.03	316.67	296.24	236.16	163.95	91.27	46.16	29.96	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	398.56	434.66	483.18	551.4	609.15	611.03	578.99	524.26	461.35	407.05	383.06	382.51	(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	0.96	0.85	0.67	0.5	0.57	0.84	0.98	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.86	19.98	20.21	20.55	20.83	20.97	20.99	20.99	20.89	20.53	20.14	19.84	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20	20	20	20.01	20.01	20.02	20.02	20.02	20.02	20.01	20.01	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	1	0.99	0.98	0.94	0.8	0.58	0.39	0.46	0.77	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.47	18.65	19	19.49	19.85	20	20.02	20.02	19.93	19.47	18.9	18.45	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19	19.15	19.46	19.89	20.22	20.37	20.39	20.39	20.29	19.87	19.37	18.98	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19	19.15	19.46	19.89	20.22	20.37	20.39	20.39	20.29	19.87	19.37	18.98	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	1	0.99	0.98	0.94	0.82	0.61	0.43	0.5	0.79	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	396.62	431.07	473.66	516.46	496.97	372.59	251.63	262.49	366.34	391.23	379.5	381	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1011.5	978.46	887.51	744.18	575.94	385.7	253.41	266.11	415.64	626.4	832.7	1007.19	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	457.47	367.85	307.91	163.96	58.76	0	0	0	0	174.97	326.3	465.89	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2323.1	(98)
Space heating requirement in kWh/m²/year	37.35	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	457.47	367.85	307.91	163.96	58.76	0	0	0	0	174.97	326.3	465.89	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	489.27	393.42	329.31	175.36	62.84	0	0	0	0	187.13	348.99	498.28	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2484.6 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	181.53	160.1	168.37	151.26	148.47	133	128.06	140.07	139.69	156.83	165.43	177.27

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.18	86.96	86.4	85.03	82.57	79.8	79.8	79.8	79.8	85.11	86.59	87.27	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	208.22	184.1	194.87	177.9	179.81	166.67	160.47	175.53	175.04	184.28	191.04	203.12

Total = Sum(219a)$_{1...12}$ = 2201.05 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2484.6	
Water heating fuel used		2201.05	
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		289.41	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	536.67	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	475.43	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1012.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	150.2	(268)
Total CO2, kg/year	sum of (265)…(271) =			1201.23	(272)

TER = 19.32 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 11 TF

Address : P 2 11, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	62.19 (1a)	x	2.55 (2a)	=	158.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.19 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	158.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.3	0.32	0.34	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.64	x	1/[1/(1.4)+ 0.04]	=	14.11			(27)
Walls Type1	25.12	10.64	14.48	x	0.18	=	2.61			(29)
Walls Type2	26.85	2.1	24.75	x	0.18	=	4.46			(29)
Roof	62.19	0	62.19	x	0.13	=	8.08			(30)
Total area of elements, m²			114.16							(31)
Party wall			32.08	x	0	=	0			(32)
Party floor			62.19							(32a)
Internal wall **			114.18							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7323.39 (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 15.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 47.23 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	30.51	30.35	30.18	29.4	29.26	28.58	28.58	28.45	28.84	29.26	29.55	29.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.75	77.58	77.41	76.64	76.49	75.81	75.81	75.69	76.07	76.49	76.78	77.09	

Average = Sum(39)$_{1...12}$ /12= 76.63 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.25	1.25	1.24	1.23	1.23	1.22	1.22	1.22	1.22	1.23	1.23	1.24

Average = Sum(40)$_{1...12}$ /12= 1.23 (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 2.04 (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 82.72 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	90.99	87.68	84.37	81.06	77.75	74.45	74.45	77.75	81.06	84.37	87.68	90.99

Total = Sum(44)$_{1...12}$ = 992.61 (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=	134.93	118.01	121.78	106.17	101.87	87.91	81.46	93.48	94.59	110.24	120.34	130.68

Total = Sum(45)$_{1...12}$ = 1301.46 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.24	17.7	18.27	15.93	15.28	13.19	12.22	14.02	14.19	16.54	18.05	19.6

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	181.53	160.1	168.37	151.26	148.47	133	128.06	140.07	139.69	156.83	165.43	177.27	(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=	181.53	160.1	168.37	151.26	148.47	133	128.06	140.07	139.69	156.83	165.43	177.27	

Output from water heater (annual)$_{1...12}$ 1850.08 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	82.14	72.91	77.77	71.38	71.15	65.3	64.36	68.36	67.53	73.93	76.08	80.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.39	14.56	11.84	8.96	6.7	5.66	6.11	7.94	10.66	13.54	15.8	16.84	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	178.43	180.29	175.62	165.69	153.15	141.36	133.49	131.64	136.3	146.24	158.78	170.56	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	(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=	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	(71)

Water heating gains (Table 5)

(72)m=	110.41	108.49	104.53	99.13	95.63	90.7	86.51	91.88	93.79	99.37	105.67	108.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	361.87	359.98	348.63	330.42	312.12	294.36	282.75	288.1	297.39	315.79	336.89	352.55	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	10.64	x	11.28	x	0.63	x	0.7	=	36.69	(81)
Northwest 0.9x	0.77	x	10.64	x	22.97	x	0.63	x	0.7	=	74.68	(81)
Northwest 0.9x	0.77	x	10.64	x	41.38	x	0.63	x	0.7	=	134.55	(81)
Northwest 0.9x	0.77	x	10.64	x	67.96	x	0.63	x	0.7	=	220.97	(81)
Northwest 0.9x	0.77	x	10.64	x	91.35	x	0.63	x	0.7	=	297.03	(81)

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Northwest	0.9x	0.77	x	10.64	x	97.38	x	0.63	x	0.7	=	316.67	(81)
Northwest	0.9x	0.77	x	10.64	x	91.1	x	0.63	x	0.7	=	296.24	(81)
Northwest	0.9x	0.77	x	10.64	x	72.63	x	0.63	x	0.7	=	236.16	(81)
Northwest	0.9x	0.77	x	10.64	x	50.42	x	0.63	x	0.7	=	163.95	(81)
Northwest	0.9x	0.77	x	10.64	x	28.07	x	0.63	x	0.7	=	91.27	(81)
Northwest	0.9x	0.77	x	10.64	x	14.2	x	0.63	x	0.7	=	46.16	(81)
Northwest	0.9x	0.77	x	10.64	x	9.21	x	0.63	x	0.7	=	29.96	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	36.69	74.68	134.55	220.97	297.03	316.67	296.24	236.16	163.95	91.27	46.16	29.96	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	398.56	434.66	483.18	551.4	609.15	611.03	578.99	524.26	461.35	407.05	383.06	382.51	(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	0.96	0.88	0.72	0.56	0.63	0.88	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.66	19.79	20.04	20.41	20.74	20.93	20.98	20.97	20.82	20.41	19.98	19.64	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.88	19.88	19.88	19.89	19.9	19.9	19.9	19.91	19.9	19.9	19.89	19.89	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.95	0.84	0.63	0.43	0.5	0.81	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=	18.11	18.3	18.67	19.2	19.64	19.86	19.9	19.9	19.75	19.21	18.58	18.09	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.7	18.86	19.19	19.66	20.06	20.27	20.31	20.3	20.16	19.66	19.11	18.68	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.7	18.86	19.19	19.66	20.06	20.27	20.31	20.3	20.16	19.66	19.11	18.68	(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	0.95	0.85	0.66	0.48	0.55	0.83	0.97	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	396.56	431.12	474.4	521.51	515.31	402.61	276.74	286.99	381.37	393.1	379.59	380.93	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1119.6	1083.14	982.29	824.53	639.45	429.67	281.34	295.51	460.8	693.18	922.32	1116.05	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	537.94	438.16	377.87	218.18	92.36	0	0	0	0	223.26	390.77	546.93	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2825.47	(98)
Space heating requirement in kWh/m²/year	45.43	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	537.94	438.16	377.87	218.18	92.36	0	0	0	0	223.26	390.77	546.93	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	575.34	468.62	404.14	233.34	98.78	0	0	0	0	238.78	417.94	584.95	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3021.89 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	181.53	160.1	168.37	151.26	148.47	133	128.06	140.07	139.69	156.83	165.43	177.27	

Efficiency of water heater 79.8 (216)

(217)m=	87.54	87.37	86.91	85.79	83.59	79.8	79.8	79.8	79.8	85.76	87.03	87.62	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	207.37	183.25	193.74	176.32	177.61	166.67	160.47	175.53	175.04	182.89	190.08	202.31	

Total = Sum(219a)$_{1...12}$ = 2191.28 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3021.89
Water heating fuel used		2191.28
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		289.41 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	652.73 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	473.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1126.05	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	150.2	(268)
Total CO2, kg/year	sum of (265)…(271) =			1315.18	(272)

TER = 21.15 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 11

Address : P 2 11, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	62.19 (1a)	x	2.55 (2a)	=	158.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.19 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	158.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.3	0.32	0.34	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.64	x	1/[1/(1.4)+ 0.04]	=	14.11			(27)
Walls Type1	25.12	10.64	14.48	x	0.18	=	2.61			(29)
Walls Type2	26.85	2.1	24.75	x	0.18	=	4.46			(29)
Total area of elements, m²			51.97							(31)
Party wall			32.08	x	0	=	0			(32)
Party floor			62.19							(32a)
Party ceiling			62.19							(32b)
Internal wall **			114.18							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 23.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8629.38 (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 4.59 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 27.86 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	30.51	30.35	30.18	29.4	29.26	28.58	28.58	28.45	28.84	29.26	29.55	29.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	58.38	58.21	58.04	57.26	57.12	56.44	56.44	56.32	56.7	57.12	57.41	57.72	

Average = Sum(39)$_{1...12}$ /12= 57.26 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.94	0.94	0.93	0.92	0.92	0.91	0.91	0.91	0.91	0.92	0.92	0.93

Average = Sum(40)$_{1...12}$ /12= 0.92 (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 2.04 (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 82.72 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	90.99	87.68	84.37	81.06	77.75	74.45	74.45	77.75	81.06	84.37	87.68	90.99

Total = Sum(44)$_{1...12}$ = 992.61 (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=	134.93	118.01	121.78	106.17	101.87	87.91	81.46	93.48	94.59	110.24	120.34	130.68

Total = Sum(45)$_{1...12}$ = 1301.46 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.24	17.7	18.27	15.93	15.28	13.19	12.22	14.02	14.19	16.54	18.05	19.6

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	181.53	160.1	168.37	151.26	148.47	133	128.06	140.07	139.69	156.83	165.43	177.27	(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=	181.53	160.1	168.37	151.26	148.47	133	128.06	140.07	139.69	156.83	165.43	177.27	

Output from water heater (annual)$_{1...12}$ 1850.08 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	82.14	72.91	77.77	71.38	71.15	65.3	64.36	68.36	67.53	73.93	76.08	80.73	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	102.14	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.39	14.56	11.84	8.96	6.7	5.66	6.11	7.94	10.66	13.54	15.8	16.84	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	178.43	180.29	175.62	165.69	153.15	141.36	133.49	131.64	136.3	146.24	158.78	170.56	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	33.21	(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=	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	-81.71	(71)

Water heating gains (Table 5)

(72)m=	110.41	108.49	104.53	99.13	95.63	90.7	86.51	91.88	93.79	99.37	105.67	108.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	361.87	359.98	348.63	330.42	312.12	294.36	282.75	288.1	297.39	315.79	336.89	352.55	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northwest 0.9x	0.77	x	10.64	x	11.28	x	0.63	x	0.7	=	36.69	(81)
Northwest 0.9x	0.77	x	10.64	x	22.97	x	0.63	x	0.7	=	74.68	(81)
Northwest 0.9x	0.77	x	10.64	x	41.38	x	0.63	x	0.7	=	134.55	(81)
Northwest 0.9x	0.77	x	10.64	x	67.96	x	0.63	x	0.7	=	220.97	(81)
Northwest 0.9x	0.77	x	10.64	x	91.35	x	0.63	x	0.7	=	297.03	(81)

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Northwest	0.9x	0.77	x	10.64	x	97.38	x	0.63	x	0.7	=	316.67	(81)
Northwest	0.9x	0.77	x	10.64	x	91.1	x	0.63	x	0.7	=	296.24	(81)
Northwest	0.9x	0.77	x	10.64	x	72.63	x	0.63	x	0.7	=	236.16	(81)
Northwest	0.9x	0.77	x	10.64	x	50.42	x	0.63	x	0.7	=	163.95	(81)
Northwest	0.9x	0.77	x	10.64	x	28.07	x	0.63	x	0.7	=	91.27	(81)
Northwest	0.9x	0.77	x	10.64	x	14.2	x	0.63	x	0.7	=	46.16	(81)
Northwest	0.9x	0.77	x	10.64	x	9.21	x	0.63	x	0.7	=	29.96	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	36.69	74.68	134.55	220.97	297.03	316.67	296.24	236.16	163.95	91.27	46.16	29.96	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	398.56	434.66	483.18	551.4	609.15	611.03	578.99	524.26	461.35	407.05	383.06	382.51	(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	0.99	0.98	0.94	0.79	0.58	0.43	0.49	0.78	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.09	20.21	20.42	20.72	20.92	20.99	21	21	20.95	20.68	20.34	20.07	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.13	20.14	20.14	20.15	20.15	20.16	20.16	20.16	20.16	20.15	20.15	20.14	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.74	0.51	0.35	0.4	0.71	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.09	19.41	19.83	20.08	20.15	20.16	20.16	20.12	19.79	19.3	18.9	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.37	19.51	19.79	20.17	20.4	20.47	20.48	20.48	20.43	20.13	19.69	19.35	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.37	19.51	19.79	20.17	20.4	20.47	20.48	20.48	20.43	20.13	19.69	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=	0.99	0.99	0.98	0.92	0.76	0.54	0.38	0.44	0.73	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	396.56	430.7	471.63	504.87	461.84	327.75	218.56	228.87	338.24	386.65	379.06	380.98	(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=	879.5	850.58	771.5	645.18	497.01	331.43	218.92	229.7	359.17	544.12	723	874.27	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	359.31	282.16	223.1	101.02	26.16	0	0	0	0	117.16	247.63	367.01	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1723.55	(98)
Space heating requirement in kWh/m²/year	27.71	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	359.31	282.16	223.1	101.02	26.16	0	0	0	0	117.16	247.63	367.01	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	384.29	301.78	238.61	108.04	27.98	0	0	0	0	125.3	264.85	392.52	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1843.37 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	181.53	160.1	168.37	151.26	148.47	133	128.06	140.07	139.69	156.83	165.43	177.27	

Efficiency of water heater 79.8 (216)

(217)m=	86.6	86.31	85.57	83.77	81.24	79.8	79.8	79.8	79.8	84.05	85.89	86.71	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	209.61	185.49	196.78	180.58	182.75	166.67	160.47	175.53	175.04	186.6	192.61	204.43	

Total = Sum(219a)$_{1...12}$ = 2216.57 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1843.37
Water heating fuel used		2216.57
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		289.41 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	398.17 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	478.78	(264)
Space and water heating	(261) + (262) + (263) + (264) =			876.95	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	150.2	(268)
Total CO2, kg/year	sum of (265)…(271) =			1066.08	(272)

TER = 17.14 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 12 GF

Address : P 2 12, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	64.15 (1a)	x	2.55 (2a)	=	163.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.15 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	163.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.64	x	1/[1/(1.4)+ 0.04]	=	14.11			(27)
Floor			64.15	x	0.13	=	8.339499			(28)
Walls Type1	21.27	10.64	10.63	x	0.18	=	1.91			(29)
Walls Type2	21.22	2.1	19.12	x	0.18	=	3.44			(29)
Total area of elements, m²			106.64							(31)
Party wall			39.3	x	0	=	0			(32)
Party ceiling			64.15							(32b)
Internal wall **			117.78							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.9 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9144.88 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.86 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.76 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	31.38	31.21	31.05	30.26	30.11	29.43	29.43	29.3	29.69	30.11	30.41	30.72	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.15	67.98	67.81	67.02	66.88	66.19	66.19	66.07	66.46	66.88	67.18	67.49	

Average = Sum(39)$_{1...12}$ /12= 67.02 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.06	1.06	1.06	1.04	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05

Average = Sum(40)$_{1...12}$ /12= 1.04 (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 2.1 (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 83.99 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	92.38	89.02	85.66	82.31	78.95	75.59	75.59	78.95	82.31	85.66	89.02	92.38

Total = Sum(44)$_{1...12}$ = 1007.82 (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=	137	119.82	123.65	107.8	103.43	89.26	82.71	94.91	96.04	111.93	122.18	132.68

Total = Sum(45)$_{1...12}$ = 1321.41 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.55	17.97	18.55	16.17	15.52	13.39	12.41	14.24	14.41	16.79	18.33	19.9

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	183.6	161.91	170.24	152.89	150.03	134.35	129.3	141.5	141.14	158.52	167.27	179.27	(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=	183.6	161.91	170.24	152.89	150.03	134.35	129.3	141.5	141.14	158.52	167.27	179.27	

Output from water heater (annual)$_{1...12}$ 1870.03 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	82.83	73.51	78.39	71.92	71.67	65.75	64.78	68.83	68.01	74.49	76.7	81.39	(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=	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.93	15.04	12.23	9.26	6.92	5.84	6.31	8.21	11.01	13.98	16.32	17.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	183.28	185.18	180.39	170.19	157.31	145.2	137.11	135.21	140.01	150.21	163.09	175.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	(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=	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	(71)

Water heating gains (Table 5)

(72)m=	111.33	109.39	105.36	99.88	96.33	91.32	87.07	92.52	94.46	100.12	106.53	109.4	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	368.98	367.05	355.42	336.77	318	299.81	287.94	293.38	302.92	321.76	343.38	359.43	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	10.64	x	36.79	x	0.63	x	0.7	=	119.64	(77)
Southeast 0.9x	0.77	x	10.64	x	62.67	x	0.63	x	0.7	=	203.8	(77)
Southeast 0.9x	0.77	x	10.64	x	85.75	x	0.63	x	0.7	=	278.84	(77)
Southeast 0.9x	0.77	x	10.64	x	106.25	x	0.63	x	0.7	=	345.5	(77)
Southeast 0.9x	0.77	x	10.64	x	119.01	x	0.63	x	0.7	=	386.99	(77)

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Southeast 0.9x	0.77	x	10.64	x	118.15	x	0.63	x	0.7	=	384.19	(77)
Southeast 0.9x	0.77	x	10.64	x	113.91	x	0.63	x	0.7	=	370.4	(77)
Southeast 0.9x	0.77	x	10.64	x	104.39	x	0.63	x	0.7	=	339.45	(77)
Southeast 0.9x	0.77	x	10.64	x	92.85	x	0.63	x	0.7	=	301.93	(77)
Southeast 0.9x	0.77	x	10.64	x	69.27	x	0.63	x	0.7	=	225.24	(77)
Southeast 0.9x	0.77	x	10.64	x	44.07	x	0.63	x	0.7	=	143.31	(77)
Southeast 0.9x	0.77	x	10.64	x	31.49	x	0.63	x	0.7	=	102.39	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	119.64	203.8	278.84	345.5	386.99	384.19	370.4	339.45	301.93	225.24	143.31	102.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	488.62	570.85	634.26	682.27	704.99	684	658.34	632.83	604.85	547	486.68	461.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.91	0.79	0.6	0.44	0.48	0.71	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.03	20.21	20.45	20.71	20.9	20.98	21	21	20.96	20.72	20.32	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.04	20.05	20.05	20.06	20.06	20.06	20.05	20.05	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.52	0.35	0.38	0.63	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.75	19.01	19.35	19.73	19.96	20.05	20.06	20.06	20.02	19.74	19.19	18.71	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.23	19.46	19.77	20.1	20.31	20.4	20.41	20.41	20.38	20.11	19.62	19.2	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.23	19.46	19.77	20.1	20.31	20.4	20.41	20.41	20.38	20.11	19.62	19.2	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.88	0.75	0.55	0.38	0.42	0.66	0.9	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	483.59	557.89	602.28	601.65	527.8	376.64	251.51	263.76	398.41	492.76	475.78	458.17	(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=	1017.78	990.03	899.6	750.63	576.03	383.89	252.32	265.06	417.04	636.06	840.8	1011.95	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	397.43	290.4	221.2	107.26	35.89	0	0	0	0	106.61	262.81	412.02	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1833.63	(98)
Space heating requirement in kWh/m²/year	28.58	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	397.43	290.4	221.2	107.26	35.89	0	0	0	0	106.61	262.81	412.02	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	425.06	310.59	236.58	114.72	38.38	0	0	0	0	114.02	281.08	440.66	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1961.1 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	183.6	161.91	170.24	152.89	150.03	134.35	129.3	141.5	141.14	158.52	167.27	179.27	

Efficiency of water heater 79.8 (216)

(217)m=	86.82	86.36	85.51	83.89	81.66	79.8	79.8	79.8	79.8	83.78	86.01	86.96	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	211.47	187.49	199.08	182.25	183.72	168.36	162.04	177.32	176.86	189.21	194.47	206.15	

Total = Sum(219a)$_{1...12}$ = 2238.41 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1961.1
Water heating fuel used		2238.41
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		298.97 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	423.6 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	483.5	(264)
Space and water heating	(261) + (262) + (263) + (264) =			907.09	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	155.16	(268)
Total CO2, kg/year	sum of (265)…(271) =			1101.18	(272)

TER = 17.17 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 12 TF

Address : P 2 12, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	64.15 (1a)	x	2.55 (2a)	=	163.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.15 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	163.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.64	x	1/[1/(1.4)+ 0.04]	=	14.11			(27)
Walls Type1	21.27	10.64	10.63	x	0.18	=	1.91			(29)
Walls Type2	21.22	2.1	19.12	x	0.18	=	3.44			(29)
Roof	54.15	0	54.15	x	0.13	=	7.04			(30)
Total area of elements, m²			96.64							(31)
Party wall			39.3	x	0	=	0			(32)
Party floor			64.15							(32a)
Internal wall **			117.78							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.6 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7386.98 (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 13.93 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 42.53 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	31.38	31.21	31.05	30.26	30.11	29.43	29.43	29.3	29.69	30.11	30.41	30.72	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.92	73.75	73.58	72.8	72.65	71.96	71.96	71.84	72.23	72.65	72.95	73.26	

Average = Sum(39)$_{1...12}$ /12= 72.79 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.15	1.15	1.13	1.13	1.12	1.12	1.12	1.13	1.13	1.14	1.14

Average = Sum(40)$_{1...12}$ /12= 1.13 (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 2.1 (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 83.99 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	92.38	89.02	85.66	82.31	78.95	75.59	75.59	78.95	82.31	85.66	89.02	92.38

Total = Sum(44)$_{1...12}$ = 1007.82 (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=	137	119.82	123.65	107.8	103.43	89.26	82.71	94.91	96.04	111.93	122.18	132.68

Total = Sum(45)$_{1...12}$ = 1321.41 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.55	17.97	18.55	16.17	15.52	13.39	12.41	14.24	14.41	16.79	18.33	19.9

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	183.6	161.91	170.24	152.89	150.03	134.35	129.3	141.5	141.14	158.52	167.27	179.27	(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=	183.6	161.91	170.24	152.89	150.03	134.35	129.3	141.5	141.14	158.52	167.27	179.27	

Output from water heater (annual)$_{1...12}$ 1870.03 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	82.83	73.51	78.39	71.92	71.67	65.75	64.78	68.83	68.01	74.49	76.7	81.39	(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=	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.93	15.04	12.23	9.26	6.92	5.84	6.31	8.21	11.01	13.98	16.32	17.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	183.28	185.18	180.39	170.19	157.31	145.2	137.11	135.21	140.01	150.21	163.09	175.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	(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=	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	(71)

Water heating gains (Table 5)

(72)m=	111.33	109.39	105.36	99.88	96.33	91.32	87.07	92.52	94.46	100.12	106.53	109.4	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	368.98	367.05	355.42	336.77	318	299.81	287.94	293.38	302.92	321.76	343.38	359.43	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	10.64	x	36.79	x	0.63	x	0.7	=	119.64	(77)
Southeast 0.9x	0.77	x	10.64	x	62.67	x	0.63	x	0.7	=	203.8	(77)
Southeast 0.9x	0.77	x	10.64	x	85.75	x	0.63	x	0.7	=	278.84	(77)
Southeast 0.9x	0.77	x	10.64	x	106.25	x	0.63	x	0.7	=	345.5	(77)
Southeast 0.9x	0.77	x	10.64	x	119.01	x	0.63	x	0.7	=	386.99	(77)

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Southeast 0.9x	0.77	x	10.64	x	118.15	x	0.63	x	0.7	=	384.19	(77)
Southeast 0.9x	0.77	x	10.64	x	113.91	x	0.63	x	0.7	=	370.4	(77)
Southeast 0.9x	0.77	x	10.64	x	104.39	x	0.63	x	0.7	=	339.45	(77)
Southeast 0.9x	0.77	x	10.64	x	92.85	x	0.63	x	0.7	=	301.93	(77)
Southeast 0.9x	0.77	x	10.64	x	69.27	x	0.63	x	0.7	=	225.24	(77)
Southeast 0.9x	0.77	x	10.64	x	44.07	x	0.63	x	0.7	=	143.31	(77)
Southeast 0.9x	0.77	x	10.64	x	31.49	x	0.63	x	0.7	=	102.39	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	119.64	203.8	278.84	345.5	386.99	384.19	370.4	339.45	301.93	225.24	143.31	102.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	488.62	570.85	634.26	682.27	704.99	684	658.34	632.83	604.85	547	486.68	461.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.82	0.64	0.48	0.51	0.75	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.9	20.09	20.34	20.63	20.85	20.97	20.99	20.99	20.93	20.64	20.22	19.87	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	19.96	19.96	19.96	19.97	19.97	19.98	19.98	19.98	19.98	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.98	0.96	0.9	0.76	0.55	0.37	0.4	0.66	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.52	18.78	19.14	19.55	19.84	19.96	19.98	19.98	19.93	19.58	18.98	18.47	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.04	19.27	19.59	19.96	20.22	20.34	20.36	20.36	20.31	19.98	19.45	19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.04	19.27	19.59	19.96	20.22	20.34	20.36	20.36	20.31	19.98	19.45	19	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.98	0.95	0.9	0.78	0.59	0.41	0.45	0.69	0.91	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	483.77	558.83	605.57	611.54	547.87	400.34	269.2	282.11	418.47	499.24	476.58	458.25	(95)

Monthly average external temperature from Table 8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1089.67	1060.12	963.5	805.23	619.13	413.29	270.89	284.72	448.39	681.74	900.74	1084.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	450.79	336.87	266.3	139.45	53.02	0	0	0	0	135.78	305.39	465.74	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2153.35	(98)
Space heating requirement in kWh/m²/year	33.57	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	450.79	336.87	266.3	139.45	53.02	0	0	0	0	135.78	305.39	465.74	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	482.13	360.29	284.81	149.14	56.71	0	0	0	0	145.22	326.63	498.12	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2303.05 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	183.6	161.91	170.24	152.89	150.03	134.35	129.3	141.5	141.14	158.52	167.27	179.27

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.12	86.73	86	84.57	82.34	79.8	79.8	79.8	79.8	84.4	86.4	87.25

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	210.74	186.69	197.95	180.79	182.2	168.36	162.04	177.32	176.86	187.82	193.6	205.48

Total = Sum(219a)$_{1...12}$ = 2229.84 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2303.05
Water heating fuel used		2229.84
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		298.97 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	497.46 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	481.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =			979.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	155.16	(268)
Total CO2, kg/year	sum of (265)…(271) =			1173.19	(272)

TER = 18.29 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 12

Address : P 2 12, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	64.15 (1a)	x	2.55 (2a)	=	163.58	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64.15 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	163.58	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			10.64	x	1/[1/(1.4)+ 0.04]	=	14.11			(27)
Walls Type1	21.27	10.64	10.63	x	0.18	=	1.91			(29)
Walls Type2	21.22	2.1	19.12	x	0.18	=	3.44			(29)
Total area of elements, m²			42.49							(31)
Party wall			39.3	x	0	=	0			(32)
Party floor			64.15							(32a)
Party ceiling			64.15							(32b)
Internal wall **			117.78							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.56 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8824.13 (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 3.92 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 25.48 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	31.38	31.21	31.05	30.26	30.11	29.43	29.43	29.3	29.69	30.11	30.41	30.72	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	56.87	56.7	56.53	55.74	55.6	54.91	54.91	54.79	55.18	55.6	55.89	56.2	

Average = Sum(39)$_{1...12}$ /12= 55.74 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.89	0.88	0.88	0.87	0.87	0.86	0.86	0.85	0.86	0.87	0.87	0.88

Average = Sum(40)$_{1...12}$ /12= 0.87 (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 2.1 (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 83.99 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	92.38	89.02	85.66	82.31	78.95	75.59	75.59	78.95	82.31	85.66	89.02	92.38

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1007.82 (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=	137	119.82	123.65	107.8	103.43	89.26	82.71	94.91	96.04	111.93	122.18	132.68

Total = Sum(45)$_{1...12}$ = 1321.41 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.55	17.97	18.55	16.17	15.52	13.39	12.41	14.24	14.41	16.79	18.33	19.9

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	183.6	161.91	170.24	152.89	150.03	134.35	129.3	141.5	141.14	158.52	167.27	179.27	(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=	183.6	161.91	170.24	152.89	150.03	134.35	129.3	141.5	141.14	158.52	167.27	179.27	

Output from water heater (annual)$_{1...12}$ 1870.03 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	82.83	73.51	78.39	71.92	71.67	65.75	64.78	68.83	68.01	74.49	76.7	81.39	(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=	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	104.81	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.93	15.04	12.23	9.26	6.92	5.84	6.31	8.21	11.01	13.98	16.32	17.4	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	183.28	185.18	180.39	170.19	157.31	145.2	137.11	135.21	140.01	150.21	163.09	175.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	33.48	(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=	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	-83.85	(71)

Water heating gains (Table 5)

(72)m=	111.33	109.39	105.36	99.88	96.33	91.32	87.07	92.52	94.46	100.12	106.53	109.4	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	368.98	367.05	355.42	336.77	318	299.81	287.94	293.38	302.92	321.76	343.38	359.43	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	10.64	x	36.79	x	0.63	x	0.7	=	119.64	(77)
Southeast 0.9x	0.77	x	10.64	x	62.67	x	0.63	x	0.7	=	203.8	(77)
Southeast 0.9x	0.77	x	10.64	x	85.75	x	0.63	x	0.7	=	278.84	(77)
Southeast 0.9x	0.77	x	10.64	x	106.25	x	0.63	x	0.7	=	345.5	(77)
Southeast 0.9x	0.77	x	10.64	x	119.01	x	0.63	x	0.7	=	386.99	(77)

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Southeast 0.9x	0.77	x	10.64	x	118.15	x	0.63	x	0.7	=	384.19	(77)
Southeast 0.9x	0.77	x	10.64	x	113.91	x	0.63	x	0.7	=	370.4	(77)
Southeast 0.9x	0.77	x	10.64	x	104.39	x	0.63	x	0.7	=	339.45	(77)
Southeast 0.9x	0.77	x	10.64	x	92.85	x	0.63	x	0.7	=	301.93	(77)
Southeast 0.9x	0.77	x	10.64	x	69.27	x	0.63	x	0.7	=	225.24	(77)
Southeast 0.9x	0.77	x	10.64	x	44.07	x	0.63	x	0.7	=	143.31	(77)
Southeast 0.9x	0.77	x	10.64	x	31.49	x	0.63	x	0.7	=	102.39	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	119.64	203.8	278.84	345.5	386.99	384.19	370.4	339.45	301.93	225.24	143.31	102.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	488.62	570.85	634.26	682.27	704.99	684	658.34	632.83	604.85	547	486.68	461.82	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.86	0.7	0.51	0.37	0.4	0.62	0.89	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.29	20.46	20.66	20.86	20.97	21	21	21	20.99	20.86	20.54	20.25	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.18	20.18	20.18	20.19	20.2	20.21	20.21	20.21	20.2	20.2	20.19	20.19	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.83	0.65	0.45	0.3	0.33	0.55	0.85	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.48	19.77	20.05	20.17	20.2	20.2	20.21	20.19	20.04	19.61	19.19	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.63	19.85	20.11	20.35	20.47	20.5	20.51	20.51	20.49	20.35	19.96	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.63	19.85	20.11	20.35	20.47	20.5	20.51	20.51	20.49	20.35	19.96	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.83	0.67	0.47	0.33	0.36	0.58	0.86	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	482.68	554.05	590.07	568.54	472	322.71	214.35	224.78	347.99	470.37	472.46	457.61	(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=	871.86	847.58	769.27	638.52	487.53	324.14	214.46	224.97	352.79	542.14	718.78	865.24	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	289.55	197.25	133.33	50.38	11.56	0	0	0	0	53.39	177.35	303.27	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1216.09	(98)
Space heating requirement in kWh/m²/year	18.96	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	289.55	197.25	133.33	50.38	11.56	0	0	0	0	53.39	177.35	303.27	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	309.68	210.96	142.6	53.89	12.36	0	0	0	0	57.11	189.68	324.36	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1300.63 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	183.6	161.91	170.24	152.89	150.03	134.35	129.3	141.5	141.14	158.52	167.27	179.27	

Efficiency of water heater 79.8 (216)

(217)m=	86.02	85.34	84.17	82.21	80.48	79.8	79.8	79.8	79.8	82.25	84.97	86.21	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	213.43	189.72	202.26	185.98	186.42	168.36	162.04	177.32	176.86	192.73	196.86	207.96	

Total = Sum(219a)$_{1...12}$ = 2259.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1300.63
Water heating fuel used		2259.93
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		298.97 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	280.94 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	488.14	(264)
Space and water heating	(261) + (262) + (263) + (264) =			769.08	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	155.16	(268)
Total CO2, kg/year	sum of (265)…(271) =			963.17	(272)

TER = 15.01 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 13 GF

Address : P 2 13 , 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	69.89	(1a) x	2.55	(2a) =	178.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.89	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		178.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.31 (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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Floor			69.89	x	0.13	=	9.0857			(28)
Walls Type1	28.38	12.56	15.82	x	0.18	=	2.85			(29)
Walls Type2	28.41	2.1	26.31	x	0.18	=	4.74			(29)
Total area of elements, m²			126.68							(31)
Party wall			32.03	x	0	=	0			(32)
Party ceiling			69.89							(32b)
Internal wall **			128.32							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.42 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9929.07 (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 7.97 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.39 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.94	33.76	33.59	32.78	32.63	31.92	31.92	31.79	32.19	32.63	32.93	33.25	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.32	77.15	76.98	76.17	76.01	75.31	75.31	75.18	75.58	76.01	76.32	76.64	

Average = Sum(39)$_{1...12}$ /12= 76.17 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.1	1.1	1.09	1.09	1.08	1.08	1.08	1.08	1.09	1.09	1.1

Average = Sum(40)$_{1...12}$ /12= 1.09 (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 2.24 (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 87.48 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.23	92.73	89.23	85.73	82.23	78.73	78.73	82.23	85.73	89.23	92.73	96.23

Total = Sum(44)$_{1...12}$ = 1049.78 (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=	142.71	124.81	128.79	112.29	107.74	92.97	86.15	98.86	100.04	116.59	127.27	138.2

Total = Sum(45)$_{1...12}$ = 1376.43 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.41	18.72	19.32	16.84	16.16	13.95	12.92	14.83	15.01	17.49	19.09	20.73

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	189.3	166.9	175.39	157.38	154.34	138.06	132.75	145.46	145.13	163.18	172.36	184.8	(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=	189.3	166.9	175.39	157.38	154.34	138.06	132.75	145.46	145.13	163.18	172.36	184.8	

Output from water heater (annual)$_{1...12}$ 1925.05 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.73	75.17	80.1	73.41	73.1	66.99	65.92	70.15	69.34	76.04	78.39	83.23	(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=	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.95	15.94	12.96	9.81	7.34	6.19	6.69	8.7	11.68	14.82	17.3	18.44	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	197.04	199.08	193.93	182.96	169.12	156.1	147.41	145.36	150.52	161.49	175.33	188.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	(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=	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	(71)

Water heating gains (Table 5)

(72)m=	113.88	111.86	107.66	101.96	98.25	93.04	88.6	94.28	96.3	102.21	108.87	111.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	388.52	386.53	374.21	354.39	334.36	314.99	302.36	308	318.15	338.17	361.16	378.31	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	12.56	x	36.79	x	0.63	x	0.7	=	141.23	(77)
Southeast 0.9x	0.77	x	12.56	x	62.67	x	0.63	x	0.7	=	240.57	(77)
Southeast 0.9x	0.77	x	12.56	x	85.75	x	0.63	x	0.7	=	329.16	(77)
Southeast 0.9x	0.77	x	12.56	x	106.25	x	0.63	x	0.7	=	407.85	(77)
Southeast 0.9x	0.77	x	12.56	x	119.01	x	0.63	x	0.7	=	456.82	(77)

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Southeast 0.9x	0.77	x	12.56	x	118.15	x	0.63	x	0.7	=	453.52	(77)
Southeast 0.9x	0.77	x	12.56	x	113.91	x	0.63	x	0.7	=	437.24	(77)
Southeast 0.9x	0.77	x	12.56	x	104.39	x	0.63	x	0.7	=	400.7	(77)
Southeast 0.9x	0.77	x	12.56	x	92.85	x	0.63	x	0.7	=	356.41	(77)
Southeast 0.9x	0.77	x	12.56	x	69.27	x	0.63	x	0.7	=	265.88	(77)
Southeast 0.9x	0.77	x	12.56	x	44.07	x	0.63	x	0.7	=	169.16	(77)
Southeast 0.9x	0.77	x	12.56	x	31.49	x	0.63	x	0.7	=	120.87	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	141.23	240.57	329.16	407.85	456.82	453.52	437.24	400.7	356.41	265.88	169.16	120.87	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	529.75	627.11	703.37	762.23	791.18	768.5	739.6	708.7	674.56	604.05	530.33	499.18	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.91	0.79	0.61	0.44	0.48	0.72	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.96	20.15	20.41	20.69	20.89	20.98	21	20.99	20.95	20.69	20.27	19.93	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20.01	20.01	20.02	20.02	20.02	20.02	20.01	20.01	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.73	0.52	0.35	0.38	0.64	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.63	18.91	19.27	19.66	19.91	20.01	20.02	20.02	19.98	19.67	19.08	18.58	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.14	19.38	19.7	20.05	20.28	20.38	20.39	20.39	20.35	20.06	19.54	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.14	19.38	19.7	20.05	20.28	20.38	20.39	20.39	20.35	20.06	19.54	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.88	0.75	0.55	0.38	0.42	0.66	0.9	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	524.52	613.01	667.83	672.1	593.1	425.46	284.33	298.17	448.13	545.83	518.94	495.42	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1147.39	1117.27	1016.21	849.42	652.31	434.99	285.47	299.99	472.24	719.02	949.07	1141.57	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	463.42	338.86	259.2	127.67	44.05	0	0	0	0	128.86	309.7	480.74	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2152.49	(98)
Space heating requirement in kWh/m²/year	30.8	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	463.42	338.86	259.2	127.67	44.05	0	0	0	0	128.86	309.7	480.74	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	495.64	362.42	277.22	136.54	47.12	0	0	0	0	137.81	331.23	514.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2302.13 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	189.3	166.9	175.39	157.38	154.34	138.06	132.75	145.46	145.13	163.18	172.36	184.8

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.11	86.67	85.85	84.26	81.95	79.8	79.8	79.8	79.8	84.19	86.36	87.25

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	217.31	192.58	204.29	186.77	188.33	173.01	166.35	182.28	181.87	193.82	199.58	211.8

Total = Sum(219a)$_{1...12}$ = 2297.99 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2302.13
Water heating fuel used		2297.99
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		316.93 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	497.26 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	496.37	(264)
Space and water heating	(261) + (262) + (263) + (264) =			993.63	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.49	(268)
Total CO2, kg/year	sum of (265)…(271) =			1197.04	(272)

TER = 17.13 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 13 TF

Address : P 2 13 , 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	69.89 (1a)	x	2.55 (2a)	=	178.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.89 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	178.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.11	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Walls Type1	28.38	12.56	15.82	x	0.18	=	2.85			(29)
Walls Type2	28.41	2.1	26.31	x	0.18	=	4.74			(29)
Roof	69.89	0	69.89	x	0.13	=	9.09			(30)
Total area of elements, m²			126.68							(31)
Party wall			32.03	x	0	=	0			(32)
Party floor			69.89							(32a)
Internal wall **			128.32							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.42 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8111.93 (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 17.17 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 52.59 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.94	33.76	33.59	32.78	32.63	31.92	31.92	31.79	32.19	32.63	32.93	33.25	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	86.53	86.35	86.18	85.37	85.22	84.51	84.51	84.38	84.78	85.22	85.52	85.84	

Average = Sum(39)$_{1...12}$ /12= 85.37 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.24	1.24	1.23	1.22	1.22	1.21	1.21	1.21	1.21	1.22	1.22	1.23

Average = Sum(40)$_{1...12}$ /12= 1.22 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.24 (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 87.48 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.23	92.73	89.23	85.73	82.23	78.73	78.73	82.23	85.73	89.23	92.73	96.23

Total = Sum(44)$_{1...12}$ = 1049.78 (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=	142.71	124.81	128.79	112.29	107.74	92.97	86.15	98.86	100.04	116.59	127.27	138.2

Total = Sum(45)$_{1...12}$ = 1376.43 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.41	18.72	19.32	16.84	16.16	13.95	12.92	14.83	15.01	17.49	19.09	20.73

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	189.3	166.9	175.39	157.38	154.34	138.06	132.75	145.46	145.13	163.18	172.36	184.8	(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=	189.3	166.9	175.39	157.38	154.34	138.06	132.75	145.46	145.13	163.18	172.36	184.8	

Output from water heater (annual)$_{1...12}$ 1925.05 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.73	75.17	80.1	73.41	73.1	66.99	65.92	70.15	69.34	76.04	78.39	83.23	(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=	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.95	15.94	12.96	9.81	7.34	6.19	6.69	8.7	11.68	14.82	17.3	18.44	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	197.04	199.08	193.93	182.96	169.12	156.1	147.41	145.36	150.52	161.49	175.33	188.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	(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=	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	(71)

Water heating gains (Table 5)

(72)m=	113.88	111.86	107.66	101.96	98.25	93.04	88.6	94.28	96.3	102.21	108.87	111.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	388.52	386.53	374.21	354.39	334.36	314.99	302.36	308	318.15	338.17	361.16	378.31	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	12.56	x	36.79	x	0.63	x	0.7	=	141.23	(77)
Southeast 0.9x	0.77	x	12.56	x	62.67	x	0.63	x	0.7	=	240.57	(77)
Southeast 0.9x	0.77	x	12.56	x	85.75	x	0.63	x	0.7	=	329.16	(77)
Southeast 0.9x	0.77	x	12.56	x	106.25	x	0.63	x	0.7	=	407.85	(77)
Southeast 0.9x	0.77	x	12.56	x	119.01	x	0.63	x	0.7	=	456.82	(77)

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Southeast 0.9x	0.77	x	12.56	x	118.15	x	0.63	x	0.7	=	453.52	(77)
Southeast 0.9x	0.77	x	12.56	x	113.91	x	0.63	x	0.7	=	437.24	(77)
Southeast 0.9x	0.77	x	12.56	x	104.39	x	0.63	x	0.7	=	400.7	(77)
Southeast 0.9x	0.77	x	12.56	x	92.85	x	0.63	x	0.7	=	356.41	(77)
Southeast 0.9x	0.77	x	12.56	x	69.27	x	0.63	x	0.7	=	265.88	(77)
Southeast 0.9x	0.77	x	12.56	x	44.07	x	0.63	x	0.7	=	169.16	(77)
Southeast 0.9x	0.77	x	12.56	x	31.49	x	0.63	x	0.7	=	120.87	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	141.23	240.57	329.16	407.85	456.82	453.52	437.24	400.7	356.41	265.88	169.16	120.87	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	529.75	627.11	703.37	762.23	791.18	768.5	739.6	708.7	674.56	604.05	530.33	499.18	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.93	0.83	0.66	0.49	0.53	0.76	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.79	19.98	20.25	20.57	20.82	20.96	20.99	20.99	20.91	20.58	20.12	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.89	19.89	19.89	19.9	19.9	19.91	19.91	19.91	19.91	19.9	19.9	19.9	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.9	0.77	0.57	0.38	0.41	0.68	0.92	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.3	18.58	18.97	19.41	19.73	19.88	19.91	19.91	19.84	19.44	18.79	18.25	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.86	19.11	19.45	19.85	20.15	20.29	20.32	20.32	20.25	19.88	19.29	18.82	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.86	19.11	19.45	19.85	20.15	20.29	20.32	20.32	20.25	19.88	19.29	18.82	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.9	0.79	0.6	0.42	0.46	0.71	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	524.66	614.17	672.26	685.9	622.02	461	311.57	326.25	477.18	554.4	519.86	495.45	(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, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1260.07	1227.18	1116.4	934.94	719.79	481.04	314.5	330.74	521.22	790.41	1042.93	1254.84	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	547.15	411.94	330.44	179.3	72.75	0	0	0	0	175.59	376.61	564.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2658.77	(98)
Space heating requirement in kWh/m²/year	38.04	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	547.15	411.94	330.44	179.3	72.75	0	0	0	0	175.59	376.61	564.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	585.18	440.58	353.41	191.77	77.8	0	0	0	0	187.8	402.79	604.26	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2843.6 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	189.3	166.9	175.39	157.38	154.34	138.06	132.75	145.46	145.13	163.18	172.36	184.8	

Efficiency of water heater 79.8 (216)

(217)m=	87.48	87.13	86.48	85.16	82.94	79.8	79.8	79.8	79.8	85.01	86.84	87.6	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	216.38	191.55	202.81	184.8	186.08	173.01	166.35	182.28	181.87	191.96	198.47	210.95	

Total = Sum(219a)$_{1...12}$ = 2286.51 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2843.6
Water heating fuel used		2286.51
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		316.93 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	614.22 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	493.89	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1108.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.49	(268)
Total CO2, kg/year	sum of (265)…(271) =			1311.52	(272)

TER = 18.77 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 2 13

Address : P 2 13 , 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	69.89 (1a)	x	2.55 (2a)	=	178.22	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.89 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	178.22	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.11	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.36	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Walls Type1	28.38	12.56	15.82	x	0.18	=	2.85			(29)
Walls Type2	28.41	2.1	26.31	x	0.18	=	4.74			(29)
Total area of elements, m²			56.79							(31)
Party wall			32.03	x	0	=	0			(32)
Party floor			69.89							(32a)
Party ceiling			69.89							(32b)
Internal wall **			128.32							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.33 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9579.62 (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 4.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 31.08 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.94	33.76	33.59	32.78	32.63	31.92	31.92	31.79	32.19	32.63	32.93	33.25	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	65.02	64.84	64.67	63.86	63.71	63	63	62.87	63.28	63.71	64.02	64.34	

Average = Sum(39)$_{1...12}$ /12= 63.86 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.93	0.93	0.93	0.91	0.91	0.9	0.9	0.9	0.91	0.91	0.92	0.92

Average = Sum(40)$_{1...12}$ /12= 0.91 (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 2.24 (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 87.48 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.23	92.73	89.23	85.73	82.23	78.73	78.73	82.23	85.73	89.23	92.73	96.23

Total = Sum(44)$_{1...12}$ = 1049.78 (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=	142.71	124.81	128.79	112.29	107.74	92.97	86.15	98.86	100.04	116.59	127.27	138.2

Total = Sum(45)$_{1...12}$ = 1376.43 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.41	18.72	19.32	16.84	16.16	13.95	12.92	14.83	15.01	17.49	19.09	20.73

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	189.3	166.9	175.39	157.38	154.34	138.06	132.75	145.46	145.13	163.18	172.36	184.8	(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=	189.3	166.9	175.39	157.38	154.34	138.06	132.75	145.46	145.13	163.18	172.36	184.8	

Output from water heater (annual)$_{1...12}$ 1925.05 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.73	75.17	80.1	73.41	73.1	66.99	65.92	70.15	69.34	76.04	78.39	83.23	(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=	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	112.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.95	15.94	12.96	9.81	7.34	6.19	6.69	8.7	11.68	14.82	17.3	18.44	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	197.04	199.08	193.93	182.96	169.12	156.1	147.41	145.36	150.52	161.49	175.33	188.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	34.22	(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=	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	-89.74	(71)

Water heating gains (Table 5)

(72)m=	113.88	111.86	107.66	101.96	98.25	93.04	88.6	94.28	96.3	102.21	108.87	111.87	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	388.52	386.53	374.21	354.39	334.36	314.99	302.36	308	318.15	338.17	361.16	378.31	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	12.56	x	36.79	x	0.63	x	0.7	=	141.23	(77)
Southeast 0.9x	0.77	x	12.56	x	62.67	x	0.63	x	0.7	=	240.57	(77)
Southeast 0.9x	0.77	x	12.56	x	85.75	x	0.63	x	0.7	=	329.16	(77)
Southeast 0.9x	0.77	x	12.56	x	106.25	x	0.63	x	0.7	=	407.85	(77)
Southeast 0.9x	0.77	x	12.56	x	119.01	x	0.63	x	0.7	=	456.82	(77)

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Southeast 0.9x	0.77	x	12.56	x	118.15	x	0.63	x	0.7	=	453.52	(77)
Southeast 0.9x	0.77	x	12.56	x	113.91	x	0.63	x	0.7	=	437.24	(77)
Southeast 0.9x	0.77	x	12.56	x	104.39	x	0.63	x	0.7	=	400.7	(77)
Southeast 0.9x	0.77	x	12.56	x	92.85	x	0.63	x	0.7	=	356.41	(77)
Southeast 0.9x	0.77	x	12.56	x	69.27	x	0.63	x	0.7	=	265.88	(77)
Southeast 0.9x	0.77	x	12.56	x	44.07	x	0.63	x	0.7	=	169.16	(77)
Southeast 0.9x	0.77	x	12.56	x	31.49	x	0.63	x	0.7	=	120.87	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	141.23	240.57	329.16	407.85	456.82	453.52	437.24	400.7	356.41	265.88	169.16	120.87	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	529.75	627.11	703.37	762.23	791.18	768.5	739.6	708.7	674.56	604.05	530.33	499.18	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.86	0.71	0.52	0.37	0.41	0.63	0.9	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.22	20.4	20.62	20.84	20.96	20.99	21	21	20.98	20.83	20.48	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.14	20.14	20.15	20.16	20.16	20.17	20.17	20.17	20.16	20.16	20.15	20.15	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.83	0.66	0.45	0.3	0.33	0.56	0.86	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.11	19.37	19.68	19.98	20.12	20.16	20.17	20.17	20.15	19.98	19.5	19.06	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.53	19.76	20.04	20.31	20.44	20.48	20.48	20.48	20.47	20.3	19.87	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.53	19.76	20.04	20.31	20.44	20.48	20.48	20.48	20.47	20.3	19.87	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.84	0.68	0.48	0.33	0.36	0.59	0.87	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	523.81	609.53	656.03	639.05	535.56	368.26	244.49	256.47	395.86	524.54	516.11	495.02	(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=	990.19	963.73	875.72	728.58	556.83	370.45	244.67	256.79	403	618.05	817.74	983.54	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	346.98	238.02	163.45	64.46	15.82	0	0	0	0	69.57	217.17	363.46	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1478.94	(98)
Space heating requirement in kWh/m²/year	21.16	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	346.98	238.02	163.45	64.46	15.82	0	0	0	0	69.57	217.17	363.46	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	371.11	254.57	174.81	68.94	16.92	0	0	0	0	74.41	232.27	388.72	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1581.75 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	189.3	166.9	175.39	157.38	154.34	138.06	132.75	145.46	145.13	163.18	172.36	184.8	

Efficiency of water heater 79.8 (216)

(217)m=	86.41	85.76	84.63	82.64	80.69	79.8	79.8	79.8	79.8	82.72	85.43	86.59	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	219.07	194.61	207.25	190.44	191.28	173.01	166.35	182.28	181.87	197.27	201.75	213.43	

Total = Sum(219a)$_{1...12}$ = 2318.61 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1581.75
Water heating fuel used		2318.61
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		316.93 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	341.66 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	500.82	(264)
Space and water heating	(261) + (262) + (263) + (264) =			842.48	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.49	(268)
Total CO2, kg/year	sum of (265)…(271) =			1045.89	(272)

TER = 14.96 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 3 2 GF

Address : P 3 2, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	82.88 (1a)	x	2.55 (2a)	=	211.34	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.88 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	211.34	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			14.3	x	1/[1/(1.4)+ 0.04]	=	18.96			(27)
Floor			82.88	x	0.13	=	10.7744			(28)
Walls Type1	33.63	14.3	19.33	x	0.18	=	3.48			(29)
Walls Type2	30.14	2.1	28.04	x	0.18	=	5.05			(29)
Total area of elements, m²			146.65							(31)
Party wall			35.24	x	0	=	0			(32)
Party ceiling			82.88							(32b)
Internal wall **			152.17							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11666.14 (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 9.12 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 49.48 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.16	40.92	40.68	39.56	39.34	38.36	38.36	38.18	38.74	39.34	39.77	40.22	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.64	90.4	90.16	89.03	88.82	87.84	87.84	87.66	88.22	88.82	89.25	89.7	

Average = Sum(39)$_{1...12}$ /12= 89.03 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.09	1.07	1.07	1.06	1.06	1.06	1.06	1.07	1.08	1.08

Average = Sum(40)$_{1...12}$ /12= 1.07 (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 2.52 (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 93.94 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	103.33	99.57	95.82	92.06	88.3	84.54	84.54	88.3	92.06	95.82	99.57	103.33

Total = Sum(44)$_{1...12}$ = 1127.24 (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=	153.24	134.02	138.3	120.57	115.69	99.83	92.51	106.16	107.42	125.19	136.66	148.4

Total = Sum(45)$_{1...12}$ = 1477.99 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.99	20.1	20.74	18.09	17.35	14.97	13.88	15.92	16.11	18.78	20.5	22.26

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	199.83	176.11	184.89	165.66	162.29	144.92	139.1	152.75	152.52	171.79	181.75	195	(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=	199.83	176.11	184.89	165.66	162.29	144.92	139.1	152.75	152.52	171.79	181.75	195	

Output from water heater (annual)$_{1...12}$ 2026.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.23	78.23	83.26	76.16	75.74	69.27	68.04	72.57	71.79	78.9	81.51	86.62	(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=	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.67	18.36	14.93	11.3	8.45	7.13	7.71	10.02	13.44	17.07	19.92	21.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	225.35	227.69	221.8	209.25	193.42	178.53	168.59	166.25	172.15	184.69	200.53	215.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	(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=	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	(71)

Water heating gains (Table 5)

(72)m=	118.58	116.41	111.91	105.78	101.81	96.21	91.45	97.54	99.71	106.05	113.21	116.42	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	428.33	426.19	412.36	390.07	367.4	345.6	331.47	337.54	349.03	371.54	397.39	416.8	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest$_{0.9x}$	0.77	x	14.3	x	36.79	x	0.63	x	0.7	=	160.8	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	62.67	x	0.63	x	0.7	=	273.9	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	85.75	x	0.63	x	0.7	=	374.76	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	106.25	x	0.63	x	0.7	=	464.35	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	119.01	x	0.63	x	0.7	=	520.11	(79)

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Southwest 0.9x	0.77	x	14.3	x	118.15		0.63	x	0.7	=	516.35	(79)
Southwest 0.9x	0.77	x	14.3	x	113.91		0.63	x	0.7	=	497.81	(79)
Southwest 0.9x	0.77	x	14.3	x	104.39		0.63	x	0.7	=	456.21	(79)
Southwest 0.9x	0.77	x	14.3	x	92.85		0.63	x	0.7	=	405.79	(79)
Southwest 0.9x	0.77	x	14.3	x	69.27		0.63	x	0.7	=	302.72	(79)
Southwest 0.9x	0.77	x	14.3	x	44.07		0.63	x	0.7	=	192.6	(79)
Southwest 0.9x	0.77	x	14.3	x	31.49		0.63	x	0.7	=	137.61	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	160.8	273.9	374.76	464.35	520.11	516.35	497.81	456.21	405.79	302.72	192.6	137.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	589.13	700.09	787.13	854.41	887.51	861.95	829.29	793.76	754.82	674.26	589.99	554.41	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.92	0.81	0.63	0.46	0.5	0.74	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.94	20.13	20.38	20.67	20.88	20.98	21	20.99	20.94	20.67	20.25	19.91	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.02	20.02	20.03	20.03	20.04	20.03	20.02	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.9	0.76	0.54	0.36	0.4	0.66	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.6	18.87	19.24	19.64	19.91	20.02	20.03	20.03	19.99	19.66	19.06	18.56	(90)

fLA = Living area ÷ (4) = 0.34 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.06	19.3	19.63	20	20.24	20.35	20.36	20.36	20.32	20	19.47	19.02	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.06	19.3	19.63	20	20.24	20.35	20.36	20.36	20.32	20	19.47	19.02	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.9	0.77	0.57	0.4	0.43	0.69	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	584.6	687.33	753.62	765.37	682.65	492.59	329.14	345.09	517.09	618.16	579.86	551.2	(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=	1337.9	1302.08	1183.66	987.88	758.68	504.84	330.57	347.4	548.34	835.25	1103.67	1329.4	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	560.46	413.11	319.95	160.21	56.57	0	0	0	0	161.51	377.15	578.98	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2627.93	(98)
Space heating requirement in kWh/m²/year	31.71	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	560.46	413.11	319.95	160.21	56.57	0	0	0	0	161.51	377.15	578.98	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	599.42	441.83	342.19	171.35	60.5	0	0	0	0	172.74	403.37	619.23	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2810.62 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	199.83	176.11	184.89	165.66	162.29	144.92	139.1	152.75	152.52	171.79	181.75	195

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.42	87.01	86.26	84.72	82.32	79.8	79.8	79.8	79.8	84.65	86.72	87.54	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	228.59	202.39	214.33	195.53	197.15	181.61	174.32	191.42	191.12	202.94	209.58	222.74

Total = Sum(219a)$_{1...12}$ = 2411.73 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2810.62
Water heating fuel used		2411.73
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		364.97 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	607.09 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	520.93	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1128.03	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.42	(268)
Total CO2, kg/year	sum of (265)…(271) =			1356.37	(272)

TER = 16.37 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 3 2

Address : P 3 2, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	82.88 (1a)	x	2.55 (2a)	=	211.34	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.88 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	211.34	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			14.3	x	1/[1/(1.4)+ 0.04]	=	18.96			(27)
Walls Type1	33.63	14.3	19.33	x	0.18	=	3.48			(29)
Walls Type2	30.14	2.1	28.04	x	0.18	=	5.05			(29)
Total area of elements, m²			63.77							(31)
Party wall			35.24	x	0	=	0			(32)
Party floor			82.88							(32a)
Party ceiling			82.88							(32b)
Internal wall **			152.17							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.58 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11251.74 (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 5.55 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.14 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.16	40.92	40.68	39.56	39.34	38.36	38.36	38.18	38.74	39.34	39.77	40.22	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.3	76.06	75.82	74.69	74.48	73.5	73.5	73.32	73.88	74.48	74.91	75.35	

Average = Sum(39)$_{1...12}$ /12= 74.69 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.91	0.9	0.9	0.89	0.89	0.88	0.89	0.9	0.9	0.91

Average = Sum(40)$_{1...12}$ /12= 0.9 (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 2.52 (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 93.94 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	103.33	99.57	95.82	92.06	88.3	84.54	84.54	88.3	92.06	95.82	99.57	103.33

Total = Sum(44)$_{1...12}$ = 1127.24 (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=	153.24	134.02	138.3	120.57	115.69	99.83	92.51	106.16	107.42	125.19	136.66	148.4

Total = Sum(45)$_{1...12}$ = 1477.99 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.99	20.1	20.74	18.09	17.35	14.97	13.88	15.92	16.11	18.78	20.5	22.26

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	199.83	176.11	184.89	165.66	162.29	144.92	139.1	152.75	152.52	171.79	181.75	195	(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=	199.83	176.11	184.89	165.66	162.29	144.92	139.1	152.75	152.52	171.79	181.75	195	

Output from water heater (annual)$_{1...12}$ 2026.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.23	78.23	83.26	76.16	75.74	69.27	68.04	72.57	71.79	78.9	81.51	86.62	(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=	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.67	18.36	14.93	11.3	8.45	7.13	7.71	10.02	13.44	17.07	19.92	21.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	225.35	227.69	221.8	209.25	193.42	178.53	168.59	166.25	172.15	184.69	200.53	215.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	(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=	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	(71)

Water heating gains (Table 5)

(72)m=	118.58	116.41	111.91	105.78	101.81	96.21	91.45	97.54	99.71	106.05	113.21	116.42	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	428.33	426.19	412.36	390.07	367.4	345.6	331.47	337.54	349.03	371.54	397.39	416.8	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest$_{0.9x}$	0.77	x	14.3	x	36.79	x	0.63	x	0.7	=	160.8	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	62.67	x	0.63	x	0.7	=	273.9	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	85.75	x	0.63	x	0.7	=	374.76	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	106.25	x	0.63	x	0.7	=	464.35	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	119.01	x	0.63	x	0.7	=	520.11	(79)

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Southwest 0.9x	0.77	x	14.3	x	118.15		0.63	x	0.7	=	516.35	(79)
Southwest 0.9x	0.77	x	14.3	x	113.91		0.63	x	0.7	=	497.81	(79)
Southwest 0.9x	0.77	x	14.3	x	104.39		0.63	x	0.7	=	456.21	(79)
Southwest 0.9x	0.77	x	14.3	x	92.85		0.63	x	0.7	=	405.79	(79)
Southwest 0.9x	0.77	x	14.3	x	69.27		0.63	x	0.7	=	302.72	(79)
Southwest 0.9x	0.77	x	14.3	x	44.07		0.63	x	0.7	=	192.6	(79)
Southwest 0.9x	0.77	x	14.3	x	31.49		0.63	x	0.7	=	137.61	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	160.8	273.9	374.76	464.35	520.11	516.35	497.81	456.21	405.79	302.72	192.6	137.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	589.13	700.09	787.13	854.41	887.51	861.95	829.29	793.76	754.82	674.26	589.99	554.41	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.88	0.74	0.54	0.39	0.42	0.65	0.91	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.19	20.37	20.59	20.82	20.95	20.99	21	21	20.98	20.81	20.46	20.15	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.17	20.17	20.18	20.18	20.18	20.17	20.17	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.68	0.47	0.32	0.35	0.58	0.88	0.98	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.07	19.33	19.65	19.97	20.13	20.17	20.18	20.18	20.16	19.96	19.47	19.03	(90)

fLA = Living area ÷ (4) = 0.34 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.45	19.69	19.97	20.26	20.41	20.46	20.46	20.46	20.44	20.25	19.81	19.42	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.45	19.69	19.97	20.26	20.41	20.46	20.46	20.46	20.44	20.25	19.81	19.42	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.86	0.7	0.5	0.34	0.37	0.61	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	584.13	684.49	742.91	732.25	620.33	427.56	283.5	297.36	459.05	597.59	577.59	550.97	(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=	1156.16	1124.7	1021.63	848.77	648.74	430.45	283.74	297.77	468.64	719.13	951.96	1146.58	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	425.6	295.82	207.36	83.89	21.14	0	0	0	0	90.42	269.55	443.13	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1836.91	(98)
Space heating requirement in kWh/m²/year	22.16	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
425.6	295.82	207.36	83.89	21.14	0	0	0	0	90.42	269.55	443.13	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
455.18	316.39	221.78	89.72	22.61	0	0	0	0	96.71	288.29	473.94	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1964.61 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

199.83	176.11	184.89	165.66	162.29	144.92	139.1	152.75	152.52	171.79	181.75	195

Efficiency of water heater 79.8 (216)

(217)m=	86.78	86.19	85.12	83.1	80.9	79.8	79.8	79.8	79.8	83.19	85.86	86.94

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	230.27	204.33	217.21	199.35	200.6	181.61	174.32	191.42	191.12	206.5	211.67	224.29

Total = Sum(219a)$_{1...12}$ = 2432.68 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1964.61
Water heating fuel used		2432.68
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		364.97 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	424.36 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	525.46	(264)
Space and water heating	(261) + (262) + (263) + (264) =			949.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.42	(268)
Total CO2, kg/year	sum of (265)…(271) =			1178.16	(272)

TER = 14.22 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P 3 2 TF

Address : P 3 2, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	82.88 (1a)	x	2.55 (2a)	=	211.34	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	82.88 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	211.34	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			14.3	x	1/[1/(1.4)+ 0.04]	=	18.96			(27)
Walls Type1	33.63	14.3	19.33	x	0.18	=	3.48			(29)
Walls Type2	30.14	2.1	28.04	x	0.18	=	5.05			(29)
Roof	82.88	0	82.88	x	0.13	=	10.77			(30)
Total area of elements, m²			146.65							(31)
Party wall			35.24	x	0	=	0			(32)
Party floor			82.88							(32a)
Internal wall **			152.17							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9511.26 (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 19.47 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 59.83 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.16	40.92	40.68	39.56	39.34	38.36	38.36	38.18	38.74	39.34	39.77	40.22	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	100.99	100.75	100.51	99.38	99.17	98.19	98.19	98.01	98.57	99.17	99.6	100.04	

Average = Sum(39)$_{1...12}$ /12= 99.38 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.22	1.22	1.21	1.2	1.2	1.18	1.18	1.18	1.19	1.2	1.2	1.21

Average = Sum(40)$_{1...12}$ /12= 1.2 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.52 (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 93.94 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	103.33	99.57	95.82	92.06	88.3	84.54	84.54	88.3	92.06	95.82	99.57	103.33

Total = Sum(44)$_{1...12}$ = 1127.24 (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=	153.24	134.02	138.3	120.57	115.69	99.83	92.51	106.16	107.42	125.19	136.66	148.4

Total = Sum(45)$_{1...12}$ = 1477.99 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.99	20.1	20.74	18.09	17.35	14.97	13.88	15.92	16.11	18.78	20.5	22.26

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	199.83	176.11	184.89	165.66	162.29	144.92	139.1	152.75	152.52	171.79	181.75	195	(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=	199.83	176.11	184.89	165.66	162.29	144.92	139.1	152.75	152.52	171.79	181.75	195	

Output from water heater (annual)$_{1...12}$ 2026.61 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.23	78.23	83.26	76.16	75.74	69.27	68.04	72.57	71.79	78.9	81.51	86.62	(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=	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	125.76	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.67	18.36	14.93	11.3	8.45	7.13	7.71	10.02	13.44	17.07	19.92	21.24	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	225.35	227.69	221.8	209.25	193.42	178.53	168.59	166.25	172.15	184.69	200.53	215.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	35.58	(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=	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	-100.61	(71)

Water heating gains (Table 5)

(72)m=	118.58	116.41	111.91	105.78	101.81	96.21	91.45	97.54	99.71	106.05	113.21	116.42	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	428.33	426.19	412.36	390.07	367.4	345.6	331.47	337.54	349.03	371.54	397.39	416.8	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest$_{0.9x}$	0.77	x	14.3	x	36.79	x	0.63	x	0.7	=	160.8	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	62.67	x	0.63	x	0.7	=	273.9	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	85.75	x	0.63	x	0.7	=	374.76	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	106.25	x	0.63	x	0.7	=	464.35	(79)
Southwest$_{0.9x}$	0.77	x	14.3	x	119.01	x	0.63	x	0.7	=	520.11	(79)

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Southwest 0.9x	0.77	x	14.3	x	118.15		0.63	x	0.7	=	516.35	(79)
Southwest 0.9x	0.77	x	14.3	x	113.91		0.63	x	0.7	=	497.81	(79)
Southwest 0.9x	0.77	x	14.3	x	104.39		0.63	x	0.7	=	456.21	(79)
Southwest 0.9x	0.77	x	14.3	x	92.85		0.63	x	0.7	=	405.79	(79)
Southwest 0.9x	0.77	x	14.3	x	69.27		0.63	x	0.7	=	302.72	(79)
Southwest 0.9x	0.77	x	14.3	x	44.07		0.63	x	0.7	=	192.6	(79)
Southwest 0.9x	0.77	x	14.3	x	31.49		0.63	x	0.7	=	137.61	(79)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	160.8	273.9	374.76	464.35	520.11	516.35	497.81	456.21	405.79	302.72	192.6	137.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	589.13	700.09	787.13	854.41	887.51	861.95	829.29	793.76	754.82	674.26	589.99	554.41	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.85	0.68	0.51	0.55	0.78	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	19.96	20.23	20.55	20.81	20.95	20.99	20.99	20.9	20.56	20.1	19.73	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.91	19.91	19.91	19.92	19.92	19.93	19.93	19.93	19.93	19.92	19.92	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.79	0.59	0.39	0.43	0.7	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.28	18.56	18.95	19.4	19.74	19.9	19.93	19.93	19.85	19.43	18.78	18.24	(90)

fLA = Living area ÷ (4) = 0.34 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.79	19.04	19.39	19.8	20.11	20.26	20.29	20.29	20.21	19.82	19.23	18.75	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.79	19.04	19.39	19.8	20.11	20.26	20.29	20.29	20.21	19.82	19.23	18.75	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.91	0.8	0.62	0.43	0.47	0.73	0.93	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	584.65	688.21	757.46	778.53	712.3	531.15	359.09	375.93	547.66	626.04	580.54	551.18	(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=	1463.61	1424.64	1295.24	1082.93	833.55	555.95	362.64	381.4	602.6	914.52	1208.3	1455.85	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	653.95	494.88	400.1	219.17	90.2	0	0	0	0	214.63	451.99	673.08	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3198.01	(98)
Space heating requirement in kWh/m²/year	38.59	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	653.95	494.88	400.1	219.17	90.2	0	0	0	0	214.63	451.99	673.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	699.41	529.29	427.92	234.41	96.48	0	0	0	0	229.55	483.42	719.87	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3420.33 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	199.83	176.11	184.89	165.66	162.29	144.92	139.1	152.75	152.52	171.79	181.75	195

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.75	87.42	86.82	85.56	83.32	79.8	79.8	79.8	79.8	85.41	87.15	87.85	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	227.74	201.44	212.96	193.62	194.78	181.61	174.32	191.42	191.12	201.14	208.55	221.96

Total = Sum(219a)$_{1...12}$ = 2400.64 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3420.33
Water heating fuel used		2400.64
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		364.97 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	738.79 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	518.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1257.33	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.42	(268)
Total CO2, kg/year	sum of (265)…(271) =			1485.67	(272)

TER = 17.93 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P S 2 GF

Address : P S 2, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.24 (1a)	x	2.55 (2a)	=	100.06	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	39.24 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	100.06	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.45	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.38	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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	0.42	0.41	0.36	0.36	0.35	0.38	0.41	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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			5.23	x	1/[1/(1.4)+ 0.04]	=	6.93			(27)
Floor			39.24	x	0.13	=	5.1012			(28)
Walls Type1	12.09	5.23	6.86	x	0.18	=	1.23			(29)
Walls Type2	12.09	2.1	9.99	x	0.18	=	1.8			(29)
Total area of elements, m²			63.42							(31)
Party wall			42.18	x	0	=	0			(32)
Party ceiling			39.24							(32b)
Internal wall **			40.02							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5640.4 (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 4.72 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.89 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.43	20.28	20.13	19.43	19.3	18.69	18.69	18.58	18.92	19.3	19.57	19.84	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	42.32	42.17	42.02	41.32	41.19	40.58	40.58	40.46	40.81	41.19	41.45	41.73	

Average = Sum(39)$_{1...12}$ /12= 41.32 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.07	1.07	1.05	1.05	1.03	1.03	1.03	1.04	1.05	1.06	1.06

Average = Sum(40)$_{1...12}$ /12= 1.05 (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 1.39 (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 67.12 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	73.84	71.15	68.47	65.78	63.1	60.41	60.41	63.1	65.78	68.47	71.15	73.84

Total = Sum(44)$_{1...12}$ = 805.49 (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=	109.5	95.77	98.82	86.16	82.67	71.34	66.1	75.86	76.76	89.46	97.65	106.04

Total = Sum(45)$_{1...12}$ = 1056.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.42	14.37	14.82	12.92	12.4	10.7	9.92	11.38	11.51	13.42	14.65	15.91

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	156.09	137.85	145.42	131.25	129.26	116.43	112.7	122.45	121.85	136.05	142.74	152.64	(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=	156.09	137.85	145.42	131.25	129.26	116.43	112.7	122.45	121.85	136.05	142.74	152.64	

Output from water heater (annual)$_{1...12}$ 1604.74 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.68	65.51	70.13	64.72	64.76	59.79	59.26	62.5	61.6	67.02	68.54	72.54	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	11.57	10.27	8.35	6.32	4.73	3.99	4.31	5.61	7.52	9.55	11.15	11.89	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	119.63	120.87	117.74	111.08	102.67	94.77	89.5	88.25	91.38	98.04	106.45	114.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	(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=	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	(71)

Water heating gains (Table 5)

(72)m=	99.04	97.49	94.27	89.89	87.05	83.05	79.64	84	85.55	90.08	95.2	97.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	277.02	275.42	267.16	254.09	241.24	228.6	220.25	224.66	231.25	244.47	259.59	270.52	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.23	x	11.28	x	0.63	x	0.7	=	18.03	(75)
Northeast 0.9x	0.77	x	5.23	x	22.97	x	0.63	x	0.7	=	36.71	(75)
Northeast 0.9x	0.77	x	5.23	x	41.38	x	0.63	x	0.7	=	66.14	(75)
Northeast 0.9x	0.77	x	5.23	x	67.96	x	0.63	x	0.7	=	108.62	(75)
Northeast 0.9x	0.77	x	5.23	x	91.35	x	0.63	x	0.7	=	146	(75)

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Northeast 0.9x	0.77	x	5.23	x	97.38	x	0.63	x	0.7	=	155.66	(75)
Northeast 0.9x	0.77	x	5.23	x	91.1	x	0.63	x	0.7	=	145.61	(75)
Northeast 0.9x	0.77	x	5.23	x	72.63	x	0.63	x	0.7	=	116.08	(75)
Northeast 0.9x	0.77	x	5.23	x	50.42	x	0.63	x	0.7	=	80.59	(75)
Northeast 0.9x	0.77	x	5.23	x	28.07	x	0.63	x	0.7	=	44.86	(75)
Northeast 0.9x	0.77	x	5.23	x	14.2	x	0.63	x	0.7	=	22.69	(75)
Northeast 0.9x	0.77	x	5.23	x	9.21	x	0.63	x	0.7	=	14.73	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.03	36.71	66.14	108.62	146	155.66	145.61	116.08	80.59	44.86	22.69	14.73	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	295.06	312.13	333.29	362.71	387.25	384.26	365.86	340.74	311.84	289.33	282.28	285.25	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.94	0.84	0.65	0.48	0.54	0.8	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20	20.1	20.31	20.62	20.86	20.97	21	20.99	20.92	20.63	20.28	19.99	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.46	20.46	20.46	20.47	20.48	20.48	20.48	20.48	20.48	20.48	20.47	20.47	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.93	0.81	0.6	0.43	0.48	0.76	0.95	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.51	19.62	19.83	20.13	20.36	20.47	20.48	20.48	20.42	20.15	19.8	19.51	(90)

fLA = Living area ÷ (4) = 0.83 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.91	20.02	20.23	20.53	20.77	20.89	20.91	20.9	20.84	20.55	20.2	19.9	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.91	20.02	20.23	20.53	20.77	20.89	20.91	20.9	20.84	20.55	20.2	19.9	(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	0.94	0.83	0.64	0.47	0.53	0.79	0.95	0.99	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	292.75	308.5	325.47	339.39	320.88	245.32	173.17	179.5	245.47	274.84	278.21	283.36	(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, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	660.86	637.64	577.03	480.71	373.73	255.11	174.78	182.28	274.89	409.8	542.85	655.34	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	273.87	221.19	187.16	101.75	39.32	0	0	0	0	100.41	190.54	276.75	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1390.98	(98)
Space heating requirement in kWh/m²/year	35.45	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	273.87	221.19	187.16	101.75	39.32	0	0	0	0	100.41	190.54	276.75	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	292.91	236.56	200.17	108.82	42.05	0	0	0	0	107.39	203.79	295.99	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1487.68 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	156.09	137.85	145.42	131.25	129.26	116.43	112.7	122.45	121.85	136.05	142.74	152.64

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	86.3	86.07	85.49	84.14	82.06	79.8	79.8	79.8	79.8	84.02	85.59	86.38	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	180.87	160.17	170.1	155.98	157.52	145.9	141.23	153.45	152.7	161.93	166.78	176.7

Total = Sum(219a)$_{1...12}$ = 1923.33 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1487.68
Water heating fuel used		1923.33
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		204.25 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	321.34 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	415.44	(264)
Space and water heating	(261) + (262) + (263) + (264) =			736.78	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	106.01	(268)
Total CO2, kg/year	sum of (265)…(271) =			881.71	(272)

TER = 22.47 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P S 2 TF

Address : P S 2, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.24	(1a) x	2.55	(2a) =	100.06	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	39.24	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		100.06	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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	0.42	0.41	0.36	0.36	0.35	0.38	0.41	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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			5.23	x	1/[1/(1.4)+ 0.04]	=	6.93			(27)
Walls Type1	12.09	5.23	6.86	x	0.18	=	1.23			(29)
Walls Type2	12.09	2.1	9.99	x	0.18	=	1.8			(29)
Roof	39.24	0	39.24	x	0.13	=	5.1			(30)
Total area of elements, m²			63.42							(31)
Party wall			42.18	x	0	=	0			(32)
Party floor			39.24							(32a)
Internal wall **			40.02							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4620.16 (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 7.28 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 24.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.43	20.28	20.13	19.43	19.3	18.69	18.69	18.58	18.92	19.3	19.57	19.84	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	44.89	44.73	44.59	43.88	43.75	43.14	43.14	43.03	43.38	43.75	44.02	44.3	

Average = Sum(39)$_{1...12}$ /12= 43.88 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.14	1.12	1.11	1.1	1.1	1.1	1.11	1.11	1.12	1.13

Average = Sum(40)$_{1...12}$ /12= 1.12 (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 1.39 (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 67.12 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	73.84	71.15	68.47	65.78	63.1	60.41	60.41	63.1	65.78	68.47	71.15	73.84

Total = Sum(44)$_{1...12}$ = 805.49 (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=	109.5	95.77	98.82	86.16	82.67	71.34	66.1	75.86	76.76	89.46	97.65	106.04

Total = Sum(45)$_{1...12}$ = 1056.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.42	14.37	14.82	12.92	12.4	10.7	9.92	11.38	11.51	13.42	14.65	15.91

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	156.09	137.85	145.42	131.25	129.26	116.43	112.7	122.45	121.85	136.05	142.74	152.64	(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=	156.09	137.85	145.42	131.25	129.26	116.43	112.7	122.45	121.85	136.05	142.74	152.64	

Output from water heater (annual)$_{1...12}$ 1604.74 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.68	65.51	70.13	64.72	64.76	59.79	59.26	62.5	61.6	67.02	68.54	72.54	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	11.57	10.27	8.35	6.32	4.73	3.99	4.31	5.61	7.52	9.55	11.15	11.89	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	119.63	120.87	117.74	111.08	102.67	94.77	89.5	88.25	91.38	98.04	106.45	114.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	(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=	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	(71)

Water heating gains (Table 5)

(72)m=	99.04	97.49	94.27	89.89	87.05	83.05	79.64	84	85.55	90.08	95.2	97.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	277.02	275.42	267.16	254.09	241.24	228.6	220.25	224.66	231.25	244.47	259.59	270.52	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.23	x	11.28	x	0.63	x	0.7	=	18.03	(75)
Northeast 0.9x	0.77	x	5.23	x	22.97	x	0.63	x	0.7	=	36.71	(75)
Northeast 0.9x	0.77	x	5.23	x	41.38	x	0.63	x	0.7	=	66.14	(75)
Northeast 0.9x	0.77	x	5.23	x	67.96	x	0.63	x	0.7	=	108.62	(75)
Northeast 0.9x	0.77	x	5.23	x	91.35	x	0.63	x	0.7	=	146	(75)

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Northeast 0.9x	0.77	x	5.23	x	97.38	x	0.63	x	0.7	=	155.66	(75)
Northeast 0.9x	0.77	x	5.23	x	91.1	x	0.63	x	0.7	=	145.61	(75)
Northeast 0.9x	0.77	x	5.23	x	72.63	x	0.63	x	0.7	=	116.08	(75)
Northeast 0.9x	0.77	x	5.23	x	50.42	x	0.63	x	0.7	=	80.59	(75)
Northeast 0.9x	0.77	x	5.23	x	28.07	x	0.63	x	0.7	=	44.86	(75)
Northeast 0.9x	0.77	x	5.23	x	14.2	x	0.63	x	0.7	=	22.69	(75)
Northeast 0.9x	0.77	x	5.23	x	9.21	x	0.63	x	0.7	=	14.73	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.03	36.71	66.14	108.62	146	155.66	145.61	116.08	80.59	44.86	22.69	14.73	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	295.06	312.13	333.29	362.71	387.25	384.26	365.86	340.74	311.84	289.33	282.28	285.25	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.95	0.86	0.68	0.51	0.57	0.82	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.02	20.23	20.55	20.82	20.96	20.99	20.99	20.9	20.57	20.2	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.43	20.43	20.43	20.44	20.44	20.45	20.45	20.45	20.45	20.44	20.44	20.44	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.94	0.83	0.63	0.45	0.5	0.78	0.95	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.4	19.51	19.73	20.04	20.3	20.43	20.45	20.45	20.37	20.07	19.7	19.39	(90)

fLA = Living area ÷ (4) = 0.83 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.82	19.93	20.15	20.46	20.73	20.87	20.9	20.89	20.81	20.49	20.11	19.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.82	19.93	20.15	20.46	20.73	20.87	20.9	20.89	20.81	20.49	20.11	19.81	(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	0.94	0.85	0.67	0.5	0.55	0.81	0.95	0.99	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	292.82	308.65	326	341.61	327.51	255.99	182.78	188.93	251.92	276.16	278.43	283.41	(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=	696.62	672.27	608.48	507.5	395.09	270.48	185.47	193.41	290.87	432.63	572.85	691.35	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	300.43	244.35	210.16	119.44	50.28	0	0	0	0	116.41	211.98	303.51	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1556.57	(98)
Space heating requirement in kWh/m²/year	39.67	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	300.43	244.35	210.16	119.44	50.28	0	0	0	0	116.41	211.98	303.51	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	321.31	261.34	224.78	127.74	53.78	0	0	0	0	124.5	226.72	324.61	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1664.78 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	156.09	137.85	145.42	131.25	129.26	116.43	112.7	122.45	121.85	136.05	142.74	152.64

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	86.53	86.33	85.8	84.56	82.53	79.8	79.8	79.8	79.8	84.4	85.87	86.61	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	180.39	159.69	169.49	155.21	156.62	145.9	141.23	153.45	152.7	161.2	166.24	176.23

Total = Sum(219a)$_{1...12}$ = 1918.34 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1664.78
Water heating fuel used		1918.34
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		204.25 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	359.59 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	414.36	(264)
Space and water heating	(261) + (262) + (263) + (264) =			773.95	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	106.01	(268)
Total CO2, kg/year	sum of (265)…(271) =			918.88	(272)

TER = 23.42 (273)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: P S 2

Address : P S 2, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.24	(1a) x	2.55	(2a) =	100.06	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	39.24	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		100.06	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.2 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.45 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.38 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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	0.42	0.41	0.36	0.36	0.35	0.38	0.41	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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.62	0.61	0.61	0.59	0.58	0.57	0.57	0.56	0.57	0.58	0.59	0.6	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			5.23	x	1/[1/(1.4)+ 0.04]	=	6.93			(27)
Walls Type1	12.09	5.23	6.86	x	0.18	=	1.23			(29)
Walls Type2	12.09	2.1	9.99	x	0.18	=	1.8			(29)
Total area of elements, m²			24.18							(31)
Party wall			42.18	x	0	=	0			(32)
Party floor			39.24							(32a)
Party ceiling			39.24							(32b)
Internal wall **			40.02							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 12.07 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5444.2 (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 2.33 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 14.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	20.43	20.28	20.13	19.43	19.3	18.69	18.69	18.58	18.92	19.3	19.57	19.84	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	34.84	34.68	34.53	33.83	33.7	33.09	33.09	32.98	33.33	33.7	33.97	34.24	

Average = Sum(39)$_{1...12}$ /12= 33.83 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.89	0.88	0.88	0.86	0.86	0.84	0.84	0.84	0.85	0.86	0.87	0.87

Average = Sum(40)$_{1...12}$ /12= 0.86 (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 1.39 (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 67.12 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	73.84	71.15	68.47	65.78	63.1	60.41	60.41	63.1	65.78	68.47	71.15	73.84

Total = Sum(44)$_{1...12}$ = 805.49 (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=	109.5	95.77	98.82	86.16	82.67	71.34	66.1	75.86	76.76	89.46	97.65	106.04

Total = Sum(45)$_{1...12}$ = 1056.13 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.42	14.37	14.82	12.92	12.4	10.7	9.92	11.38	11.51	13.42	14.65	15.91

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	156.09	137.85	145.42	131.25	129.26	116.43	112.7	122.45	121.85	136.05	142.74	152.64	(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=	156.09	137.85	145.42	131.25	129.26	116.43	112.7	122.45	121.85	136.05	142.74	152.64	

Output from water heater (annual)$_{1...12}$ 1604.74 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.68	65.51	70.13	64.72	64.76	59.79	59.26	62.5	61.6	67.02	68.54	72.54	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	69.31	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	11.57	10.27	8.35	6.32	4.73	3.99	4.31	5.61	7.52	9.55	11.15	11.89	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	119.63	120.87	117.74	111.08	102.67	94.77	89.5	88.25	91.38	98.04	106.45	114.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	(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=	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	-55.45	(71)

Water heating gains (Table 5)

(72)m=	99.04	97.49	94.27	89.89	87.05	83.05	79.64	84	85.55	90.08	95.2	97.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	277.02	275.42	267.16	254.09	241.24	228.6	220.25	224.66	231.25	244.47	259.59	270.52	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.23	x	11.28	x	0.63	x	0.7	=	18.03	(75)
Northeast 0.9x	0.77	x	5.23	x	22.97	x	0.63	x	0.7	=	36.71	(75)
Northeast 0.9x	0.77	x	5.23	x	41.38	x	0.63	x	0.7	=	66.14	(75)
Northeast 0.9x	0.77	x	5.23	x	67.96	x	0.63	x	0.7	=	108.62	(75)
Northeast 0.9x	0.77	x	5.23	x	91.35	x	0.63	x	0.7	=	146	(75)

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Northeast 0.9x	0.77	x	5.23	x	97.38	x	0.63	x	0.7	=	155.66	(75)
Northeast 0.9x	0.77	x	5.23	x	91.1	x	0.63	x	0.7	=	145.61	(75)
Northeast 0.9x	0.77	x	5.23	x	72.63	x	0.63	x	0.7	=	116.08	(75)
Northeast 0.9x	0.77	x	5.23	x	50.42	x	0.63	x	0.7	=	80.59	(75)
Northeast 0.9x	0.77	x	5.23	x	28.07	x	0.63	x	0.7	=	44.86	(75)
Northeast 0.9x	0.77	x	5.23	x	14.2	x	0.63	x	0.7	=	22.69	(75)
Northeast 0.9x	0.77	x	5.23	x	9.21	x	0.63	x	0.7	=	14.73	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.03	36.71	66.14	108.62	146	155.66	145.61	116.08	80.59	44.86	22.69	14.73	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	295.06	312.13	333.29	362.71	387.25	384.26	365.86	340.74	311.84	289.33	282.28	285.25	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.91	0.76	0.55	0.4	0.44	0.71	0.93	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.37	20.56	20.8	20.95	20.99	21	21	20.98	20.8	20.51	20.26	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.56	20.56	20.56	20.57	20.57	20.58	20.58	20.58	20.58	20.57	20.57	20.56	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.9	0.73	0.51	0.36	0.4	0.67	0.92	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.87	19.97	20.15	20.39	20.53	20.58	20.58	20.58	20.56	20.39	20.11	19.87	(90)

fLA = Living area ÷ (4) = 0.83 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.2	20.3	20.49	20.73	20.88	20.92	20.93	20.93	20.9	20.73	20.44	20.2	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.2	20.3	20.49	20.73	20.88	20.92	20.93	20.93	20.9	20.73	20.44	20.2	(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	0.97	0.9	0.75	0.54	0.39	0.44	0.7	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	292.28	307.49	322.43	327.51	291.05	207.36	142.99	148.9	218.03	267.59	276.84	283	(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=	554.04	534.19	482.99	400.26	309.34	209.23	143.19	149.29	226.77	341.3	453.17	547.77	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	194.75	152.34	119.46	52.38	13.61	0	0	0	0	54.84	126.95	196.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	911.33	(98)
Space heating requirement in kWh/m²/year	23.22	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	194.75	152.34	119.46	52.38	13.61	0	0	0	0	54.84	126.95	196.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	208.29	162.93	127.76	56.02	14.55	0	0	0	0	58.65	135.78	210.69	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 974.68 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	156.09	137.85	145.42	131.25	129.26	116.43	112.7	122.45	121.85	136.05	142.74	152.64	

Efficiency of water heater 79.8 (216)

(217)m=	85.41	85.08	84.29	82.59	80.71	79.8	79.8	79.8	79.8	82.61	84.5	85.5	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	182.77	162.03	172.51	158.92	160.16	145.9	141.23	153.45	152.7	164.7	168.92	178.53	

Total = Sum(219a)$_{1...12}$ = 1941.82 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		974.68
Water heating fuel used		1941.82
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		204.25 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	210.53 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	419.43	(264)
Space and water heating	(261) + (262) + (263) + (264) =			629.96	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	106.01	(268)
Total CO2, kg/year	sum of (265)…(271) =			774.89	(272)

TER = 19.75 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 1 1 GF

Address : R 1 1 , 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.01	(1a) x	2.55	(2a) =	127.53	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		127.53	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.41 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.35 (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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			8.89	x	1/[1/(1.4)+ 0.04]	=	11.79			(27)
Floor			50.01	x	0.13	=	6.501299			(28)
Walls Type1	16.55	8.89	7.66	x	0.18	=	1.38			(29)
Walls Type2	16.58	2.1	14.48	x	0.18	=	2.61			(29)
Total area of elements, m²			83.14							(31)
Party wall			39.27	x	0	=	0			(32)
Party ceiling			50.01							(32b)
Internal wall **			91.82							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 24.37 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7282.65 (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 5.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 30.12 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.13	24.97	24.82	24.09	23.95	23.31	23.31	23.19	23.56	23.95	24.23	24.52	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	55.25	55.09	54.94	54.21	54.07	53.43	53.43	53.32	53.68	54.07	54.35	54.64	

Average = Sum(39)$_{1...12}$ /12= 54.21 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.08	1.08	1.07	1.07	1.07	1.07	1.08	1.09	1.09

Average = Sum(40)$_{1...12}$ /12= 1.08 (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 1.69 (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 74.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	81.78	78.81	75.83	72.86	69.89	66.91	66.91	69.89	72.86	75.83	78.81	81.78

Total = Sum(44)$_{1...12}$ = 892.16 (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=	121.28	106.07	109.46	95.43	91.56	79.01	73.22	84.02	85.02	99.08	108.16	117.45

Total = Sum(45)$_{1...12}$ = 1169.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.19	15.91	16.42	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.62

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	167.87	148.16	156.05	140.52	138.16	124.11	119.81	130.61	130.11	145.68	153.25	164.05	(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=	167.87	148.16	156.05	140.52	138.16	124.11	119.81	130.61	130.11	145.68	153.25	164.05	

Output from water heater (annual)$_{1...12}$ 1718.38 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.6	68.94	73.67	67.8	67.72	62.35	61.62	65.21	64.34	70.22	72.04	76.33	(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=	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.44	11.93	9.71	7.35	5.49	4.64	5.01	6.51	8.74	11.1	12.95	13.81	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.26	148.79	144.94	136.74	126.39	116.67	110.17	108.64	112.49	120.69	131.04	140.76	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(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=	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	(71)

Water heating gains (Table 5)

(72)m=	104.3	102.59	99.02	94.17	91.02	86.59	82.82	87.65	89.37	94.38	100.05	102.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	316.35	314.66	305.02	289.61	274.26	259.25	249.36	254.16	261.95	277.53	295.4	308.52	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	8.89	x	36.79	x	0.63	x	0.7	=	99.97	(77)
Southeast 0.9x	0.77	x	8.89	x	62.67	x	0.63	x	0.7	=	170.28	(77)
Southeast 0.9x	0.77	x	8.89	x	85.75	x	0.63	x	0.7	=	232.98	(77)
Southeast 0.9x	0.77	x	8.89	x	106.25	x	0.63	x	0.7	=	288.67	(77)
Southeast 0.9x	0.77	x	8.89	x	119.01	x	0.63	x	0.7	=	323.34	(77)

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Southeast 0.9x	0.77	x	8.89	x	118.15	x	0.63	x	0.7	=	321	(77)
Southeast 0.9x	0.77	x	8.89	x	113.91	x	0.63	x	0.7	=	309.48	(77)
Southeast 0.9x	0.77	x	8.89	x	104.39	x	0.63	x	0.7	=	283.62	(77)
Southeast 0.9x	0.77	x	8.89	x	92.85	x	0.63	x	0.7	=	252.27	(77)
Southeast 0.9x	0.77	x	8.89	x	69.27	x	0.63	x	0.7	=	188.19	(77)
Southeast 0.9x	0.77	x	8.89	x	44.07	x	0.63	x	0.7	=	119.74	(77)
Southeast 0.9x	0.77	x	8.89	x	31.49	x	0.63	x	0.7	=	85.55	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	99.97	170.28	232.98	288.67	323.34	321	309.48	283.62	252.27	188.19	119.74	85.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.32	484.94	538	578.29	597.6	580.25	558.84	537.78	514.22	465.72	415.13	394.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.89	0.76	0.57	0.42	0.45	0.68	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.03	20.22	20.46	20.73	20.91	20.98	21	21	20.96	20.74	20.34	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20.01	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.86	0.7	0.49	0.33	0.36	0.6	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.73	19	19.35	19.72	19.93	20.02	20.03	20.03	20	19.73	19.18	18.69	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.49	19.8	20.13	20.33	20.41	20.42	20.42	20.38	20.14	19.65	19.22	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.26	19.49	19.8	20.13	20.33	20.41	20.42	20.42	20.38	20.14	19.65	19.22	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.86	0.72	0.53	0.36	0.4	0.63	0.88	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	410.35	470.44	504.18	497.98	431.38	305.03	203.38	213.26	324.05	410.02	402.64	389.63	(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=	826.44	803.97	730.51	608.48	466.42	310.25	203.98	214.21	337.33	515.71	681.99	820.61	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	309.57	224.13	168.39	79.56	26.07	0	0	0	0	78.63	201.13	320.65	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1408.13	(98)
Space heating requirement in kWh/m²/year	28.16	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	309.57	224.13	168.39	79.56	26.07	0	0	0	0	78.63	201.13	320.65	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	331.09	239.71	180.1	85.09	27.88	0	0	0	0	84.1	215.11	342.94	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1506.02 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	167.87	148.16	156.05	140.52	138.16	124.11	119.81	130.61	130.11	145.68	153.25	164.05	

Efficiency of water heater 79.8 (216)

(217)m=	86.43	85.92	85.02	83.36	81.33	79.8	79.8	79.8	79.8	83.25	85.54	86.57	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	194.24	172.45	183.55	168.56	169.88	155.52	150.14	163.68	163.05	174.99	179.16	189.49	

Total = Sum(219a)$_{1...12}$ = 2064.71 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1506.02
Water heating fuel used		2064.71
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		237.28 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	325.3 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	445.98	(264)
Space and water heating	(261) + (262) + (263) + (264) =			771.28	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	123.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			933.35	(272)

TER = 18.66 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 1 1 TF

Address : R 1 1 , 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.01	(1a) x	2.55	(2a) =	127.53	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		127.53	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			8.89	x	1/[1/(1.4)+ 0.04]	=	11.79			(27)
Walls Type1	16.55	8.89	7.66	x	0.18	=	1.38			(29)
Walls Type2	16.58	2.1	14.48	x	0.18	=	2.61			(29)
Roof	50.01	0	50.01	x	0.13	=	6.5			(30)
Total area of elements, m²			83.14							(31)
Party wall			39.27	x	0	=	0			(32)
Party floor			50.01							(32a)
Internal wall **			91.82							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 24.37 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5982.39 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.35 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.72 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.13	24.97	24.82	24.09	23.95	23.31	23.31	23.19	23.56	23.95	24.23	24.52	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	60.85	60.7	60.54	59.81	59.67	59.04	59.04	58.92	59.28	59.67	59.95	60.24	

Average = Sum(39)$_{1...12}$ /12= 59.81 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.22	1.21	1.21	1.2	1.19	1.18	1.18	1.18	1.19	1.19	1.2	1.2

Average = Sum(40)$_{1...12}$ /12= 1.2 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.69 (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) + 74.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	81.78	78.81	75.83	72.86	69.89	66.91	66.91	69.89	72.86	75.83	78.81	81.78

Total = Sum(44)$_{1...12}$ = 892.16 (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=	121.28	106.07	109.46	95.43	91.56	79.01	73.22	84.02	85.02	99.08	108.16	117.45

Total = Sum(45)$_{1...12}$ = 1169.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.19	15.91	16.42	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.62

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	167.87	148.16	156.05	140.52	138.16	124.11	119.81	130.61	130.11	145.68	153.25	164.05	(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=	167.87	148.16	156.05	140.52	138.16	124.11	119.81	130.61	130.11	145.68	153.25	164.05	

Output from water heater (annual)$_{1...12}$ 1718.38 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.6	68.94	73.67	67.8	67.72	62.35	61.62	65.21	64.34	70.22	72.04	76.33	(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=	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.44	11.93	9.71	7.35	5.49	4.64	5.01	6.51	8.74	11.1	12.95	13.81	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.26	148.79	144.94	136.74	126.39	116.67	110.17	108.64	112.49	120.69	131.04	140.76	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(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=	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	(71)

Water heating gains (Table 5)

(72)m=	104.3	102.59	99.02	94.17	91.02	86.59	82.82	87.65	89.37	94.38	100.05	102.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	316.35	314.66	305.02	289.61	274.26	259.25	249.36	254.16	261.95	277.53	295.4	308.52	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	8.89	x	36.79	x	0.63	x	0.7	=	99.97	(77)
Southeast 0.9x	0.77	x	8.89	x	62.67	x	0.63	x	0.7	=	170.28	(77)
Southeast 0.9x	0.77	x	8.89	x	85.75	x	0.63	x	0.7	=	232.98	(77)
Southeast 0.9x	0.77	x	8.89	x	106.25	x	0.63	x	0.7	=	288.67	(77)
Southeast 0.9x	0.77	x	8.89	x	119.01	x	0.63	x	0.7	=	323.34	(77)

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Southeast 0.9x	0.77	x	8.89	x	118.15	x	0.63	x	0.7	=	321	(77)
Southeast 0.9x	0.77	x	8.89	x	113.91	x	0.63	x	0.7	=	309.48	(77)
Southeast 0.9x	0.77	x	8.89	x	104.39	x	0.63	x	0.7	=	283.62	(77)
Southeast 0.9x	0.77	x	8.89	x	92.85	x	0.63	x	0.7	=	252.27	(77)
Southeast 0.9x	0.77	x	8.89	x	69.27	x	0.63	x	0.7	=	188.19	(77)
Southeast 0.9x	0.77	x	8.89	x	44.07	x	0.63	x	0.7	=	119.74	(77)
Southeast 0.9x	0.77	x	8.89	x	31.49	x	0.63	x	0.7	=	85.55	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	99.97	170.28	232.98	288.67	323.34	321	309.48	283.62	252.27	188.19	119.74	85.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.32	484.94	538	578.29	597.6	580.25	558.84	537.78	514.22	465.72	415.13	394.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.8	0.62	0.46	0.5	0.72	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.88	20.07	20.33	20.63	20.85	20.97	20.99	20.99	20.93	20.65	20.21	19.85	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.91	19.91	19.91	19.92	19.93	19.94	19.94	19.94	19.93	19.93	19.92	19.92	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.88	0.74	0.53	0.35	0.39	0.64	0.89	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.44	18.72	19.09	19.51	19.79	19.92	19.93	19.93	19.88	19.54	18.93	18.4	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.02	19.26	19.59	19.96	20.22	20.34	20.36	20.36	20.31	19.99	19.45	18.98	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.02	19.26	19.59	19.96	20.22	20.34	20.36	20.36	20.31	19.99	19.45	18.98	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.94	0.88	0.76	0.57	0.39	0.43	0.67	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	410.65	471.73	508.22	509.09	452.21	328.43	220.6	231.17	344.37	417.58	403.79	389.8	(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=	896	871.87	792.53	661.64	508.42	338.85	222.03	233.33	367.87	560.21	740.11	890.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	361.1	268.89	211.53	109.83	41.82	0	0	0	0	106.11	242.15	372.58	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1714.02	(98)
Space heating requirement in kWh/m²/year	34.27	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	361.1	268.89	211.53	109.83	41.82	0	0	0	0	106.11	242.15	372.58	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	386.21	287.58	226.23	117.47	44.73	0	0	0	0	113.49	258.98	398.49	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1833.18 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	167.87	148.16	156.05	140.52	138.16	124.11	119.81	130.61	130.11	145.68	153.25	164.05	

Efficiency of water heater 79.8 (216)

(217)m=	86.81	86.39	85.63	84.17	82.05	79.8	79.8	79.8	79.8	83.98	86.03	86.94	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	193.39	171.51	182.25	166.96	168.38	155.52	150.14	163.68	163.05	173.46	178.14	188.7	

Total = Sum(219a)$_{1...12}$ = 2055.16 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1833.18
Water heating fuel used		2055.16
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		237.28 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	395.97 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	443.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =			839.88	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	123.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			1001.96	(272)

TER = 20.04 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 1 1

Address : R 1 1 , 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.01 (1a)	x	2.55 (2a)	=	127.53	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.01 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	127.53	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			8.89	x	1/[1/(1.4)+ 0.04]	=	11.79			(27)
Walls Type1	16.55	8.89	7.66	x	0.18	=	1.38			(29)
Walls Type2	16.58	2.1	14.48	x	0.18	=	2.61			(29)
Total area of elements, m²			33.13							(31)
Party wall			39.27	x	0	=	0			(32)
Party floor			50.01							(32a)
Party ceiling			50.01							(32b)
Internal wall **			91.82							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17.87 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7032.6 (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 3.14 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.01 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.13	24.97	24.82	24.09	23.95	23.31	23.31	23.19	23.56	23.95	24.23	24.52	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	46.14	45.98	45.83	45.09	44.96	44.32	44.32	44.2	44.57	44.96	45.23	45.52	

Average = Sum(39)$_{1...12}$ /12= 45.09 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.92	0.92	0.92	0.9	0.9	0.89	0.89	0.88	0.89	0.9	0.9	0.91

Average = Sum(40)$_{1...12}$ /12= 0.9 (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 1.69 (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 74.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	81.78	78.81	75.83	72.86	69.89	66.91	66.91	69.89	72.86	75.83	78.81	81.78

Total = Sum(44)$_{1...12}$ = 892.16 (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=	121.28	106.07	109.46	95.43	91.56	79.01	73.22	84.02	85.02	99.08	108.16	117.45

Total = Sum(45)$_{1...12}$ = 1169.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.19	15.91	16.42	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.62

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	167.87	148.16	156.05	140.52	138.16	124.11	119.81	130.61	130.11	145.68	153.25	164.05	(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=	167.87	148.16	156.05	140.52	138.16	124.11	119.81	130.61	130.11	145.68	153.25	164.05	

Output from water heater (annual)$_{1...12}$ 1718.38 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.6	68.94	73.67	67.8	67.72	62.35	61.62	65.21	64.34	70.22	72.04	76.33	(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=	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	84.52	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.44	11.93	9.71	7.35	5.49	4.64	5.01	6.51	8.74	11.1	12.95	13.81	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.26	148.79	144.94	136.74	126.39	116.67	110.17	108.64	112.49	120.69	131.04	140.76	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(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=	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	-67.62	(71)

Water heating gains (Table 5)

(72)m=	104.3	102.59	99.02	94.17	91.02	86.59	82.82	87.65	89.37	94.38	100.05	102.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	316.35	314.66	305.02	289.61	274.26	259.25	249.36	254.16	261.95	277.53	295.4	308.52	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	8.89	x	36.79	x	0.63	x	0.7	=	99.97	(77)
Southeast 0.9x	0.77	x	8.89	x	62.67	x	0.63	x	0.7	=	170.28	(77)
Southeast 0.9x	0.77	x	8.89	x	85.75	x	0.63	x	0.7	=	232.98	(77)
Southeast 0.9x	0.77	x	8.89	x	106.25	x	0.63	x	0.7	=	288.67	(77)
Southeast 0.9x	0.77	x	8.89	x	119.01	x	0.63	x	0.7	=	323.34	(77)

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Southeast 0.9x	0.77	x	8.89	x	118.15	x	0.63	x	0.7	=	321	(77)
Southeast 0.9x	0.77	x	8.89	x	113.91	x	0.63	x	0.7	=	309.48	(77)
Southeast 0.9x	0.77	x	8.89	x	104.39	x	0.63	x	0.7	=	283.62	(77)
Southeast 0.9x	0.77	x	8.89	x	92.85	x	0.63	x	0.7	=	252.27	(77)
Southeast 0.9x	0.77	x	8.89	x	69.27	x	0.63	x	0.7	=	188.19	(77)
Southeast 0.9x	0.77	x	8.89	x	44.07	x	0.63	x	0.7	=	119.74	(77)
Southeast 0.9x	0.77	x	8.89	x	31.49	x	0.63	x	0.7	=	85.55	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	99.97	170.28	232.98	288.67	323.34	321	309.48	283.62	252.27	188.19	119.74	85.55	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	416.32	484.94	538	578.29	597.6	580.25	558.84	537.78	514.22	465.72	415.13	394.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.93	0.83	0.67	0.49	0.35	0.38	0.59	0.86	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.3	20.47	20.68	20.88	20.97	21	21	21	20.99	20.87	20.56	20.27	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.17	20.17	20.18	20.18	20.18	20.18	20.17	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.96	0.91	0.8	0.62	0.42	0.28	0.31	0.52	0.82	0.96	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.23	19.48	19.77	20.03	20.14	20.18	20.18	20.18	20.17	20.03	19.61	19.19	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.66	19.88	20.14	20.37	20.48	20.51	20.51	20.51	20.5	20.37	19.99	19.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.66	19.88	20.14	20.37	20.48	20.51	20.51	20.51	20.5	20.37	19.99	19.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.91	0.81	0.64	0.45	0.31	0.34	0.55	0.83	0.96	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	409.15	466.08	491.64	467.11	383.56	260.81	173.21	181.58	281.85	388.32	398.73	388.84	(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=	708.63	688.8	624.89	517.34	394.56	261.83	173.29	181.71	285.19	439.29	583.23	702.14	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	222.81	149.67	99.14	36.16	8.18	0	0	0	0	37.92	132.84	233.09	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	919.82	(98)
Space heating requirement in kWh/m²/year	18.39	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	222.81	149.67	99.14	36.16	8.18	0	0	0	0	37.92	132.84	233.09	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	238.3	160.07	106.03	38.68	8.75	0	0	0	0	40.56	142.08	249.3	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 983.77 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	167.87	148.16	156.05	140.52	138.16	124.11	119.81	130.61	130.11	145.68	153.25	164.05	

Efficiency of water heater	79.8	(216)

(217)m=	85.57	84.84	83.64	81.78	80.33	79.8	79.8	79.8	79.8	81.8	84.44	85.75	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.18	174.63	186.57	171.83	171.99	155.52	150.14	163.68	163.05	178.1	181.5	191.31	

Total = Sum(219a)$_{1...12}$ = 2084.49 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		983.77
Water heating fuel used		2084.49
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		237.28 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	212.49 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	450.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			662.74	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	123.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			824.82	(272)

TER = 16.49 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 2 13 GF

Address : R 2 13, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.01	(1a) x	2.55	(2a) =	178.53	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		178.53	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.36	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Floor			70.01	x	0.13	=	9.1013			(28)
Walls Type1	28.46	12.56	15.9	x	0.18	=	2.86			(29)
Walls Type2	28.46	2.1	26.36	x	0.18	=	4.74			(29)
Total area of elements, m²			126.93							(31)
Party wall			32.06	x	0	=	0			(32)
Party ceiling			70.01							(32b)
Internal wall **			128.54							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9946.61 (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 7.98 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.44 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.5	35.27	35.04	33.96	33.75	32.81	32.81	32.64	33.18	33.75	34.16	34.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.94	78.7	78.47	77.39	77.19	76.25	76.25	76.07	76.61	77.19	77.6	78.03	

Average = Sum(39)$_{1...12}$ /12= 77.39 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.12	1.12	1.11	1.1	1.09	1.09	1.09	1.09	1.1	1.11	1.11

Average = Sum(40)$_{1...12}$ /12= 1.11 (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 2.25 (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 87.55 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.31	92.8	89.3	85.8	82.3	78.8	78.8	82.3	85.8	89.3	92.8	96.31

Total = Sum(44)$_{1...12}$ = 1050.61 (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=	142.82	124.91	128.9	112.38	107.83	93.05	86.22	98.94	100.12	116.68	127.37	138.31

Total = Sum(45)$_{1...12}$ = 1377.52 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.42	18.74	19.33	16.86	16.17	13.96	12.93	14.84	15.02	17.5	19.11	20.75

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	189.41	167	175.49	157.47	154.42	138.14	132.82	145.53	145.21	163.28	172.46	184.91	(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=	189.41	167	175.49	157.47	154.42	138.14	132.82	145.53	145.21	163.28	172.46	184.91	

Output from water heater (annual)$_{1...12}$ 1926.14 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.76	75.2	80.13	73.44	73.13	67.01	65.94	70.17	69.36	76.07	78.42	83.27	(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=	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.98	15.97	12.98	9.83	7.35	6.2	6.7	8.71	11.7	14.85	17.33	18.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	197.32	199.37	194.21	183.22	169.36	156.33	147.62	145.57	150.73	161.72	175.58	188.61	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	(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=	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	(71)

Water heating gains (Table 5)

(72)m=	113.93	111.91	107.71	102	98.29	93.07	88.64	94.32	96.34	102.25	108.92	111.92	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	388.92	386.94	374.6	354.75	334.69	315.3	302.65	308.3	318.46	338.51	361.53	378.7	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	12.56	x	11.28	x	0.63	x	0.7	=	43.31	(75)
Northeast 0.9x	0.77	x	12.56	x	22.97	x	0.63	x	0.7	=	88.16	(75)
Northeast 0.9x	0.77	x	12.56	x	41.38	x	0.63	x	0.7	=	158.83	(75)
Northeast 0.9x	0.77	x	12.56	x	67.96	x	0.63	x	0.7	=	260.85	(75)
Northeast 0.9x	0.77	x	12.56	x	91.35	x	0.63	x	0.7	=	350.63	(75)

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Northeast 0.9x	0.77	x	12.56	x	97.38	x	0.63	x	0.7	=	373.81	(75)
Northeast 0.9x	0.77	x	12.56	x	91.1	x	0.63	x	0.7	=	349.69	(75)
Northeast 0.9x	0.77	x	12.56	x	72.63	x	0.63	x	0.7	=	278.78	(75)
Northeast 0.9x	0.77	x	12.56	x	50.42	x	0.63	x	0.7	=	193.54	(75)
Northeast 0.9x	0.77	x	12.56	x	28.07	x	0.63	x	0.7	=	107.74	(75)
Northeast 0.9x	0.77	x	12.56	x	14.2	x	0.63	x	0.7	=	54.49	(75)
Northeast 0.9x	0.77	x	12.56	x	9.21	x	0.63	x	0.7	=	35.37	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	43.31	88.16	158.83	260.85	350.63	373.81	349.69	278.78	193.54	107.74	54.49	35.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	432.23	475.09	533.43	615.6	685.32	689.11	652.34	587.08	512	446.25	416.02	414.07	(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	0.96	0.86	0.67	0.51	0.58	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	19.93	20.18	20.53	20.82	20.96	20.99	20.99	20.88	20.5	20.1	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	20	20	20.01	20.01	20.01	20.01	20	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.94	0.81	0.58	0.4	0.46	0.78	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=	18.39	18.57	18.93	19.44	19.83	19.99	20.01	20.01	19.9	19.42	18.83	18.37	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.05	19.2	19.51	19.95	20.29	20.44	20.46	20.46	20.35	19.92	19.42	19.03	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.05	19.2	19.51	19.95	20.29	20.44	20.46	20.46	20.35	19.92	19.42	19.03	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.82	0.62	0.45	0.52	0.81	0.97	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	430.5	471.76	524.14	579.53	565.08	428.3	292.19	303.89	414.95	431.33	412.84	412.73	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1163.97	1125.59	1020.91	855.09	663.09	445.33	294.7	308.98	479.18	719.54	956.12	1156.99	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	545.7	439.38	369.6	198.41	72.92	0	0	0	0	214.43	391.16	553.73	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2785.32	(98)
Space heating requirement in kWh/m²/year	39.78	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	545.7	439.38	369.6	198.41	72.92	0	0	0	0	214.43	391.16	553.73	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	583.64	469.92	395.29	212.2	77.99	0	0	0	0	229.33	418.35	592.22	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2978.95 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	189.41	167	175.49	157.47	154.42	138.14	132.82	145.53	145.21	163.28	172.46	184.91	

Efficiency of water heater 79.8 (216)

(217)m=	87.48	87.28	86.75	85.43	82.95	79.8	79.8	79.8	79.8	85.54	86.93	87.56	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	216.53	191.34	202.28	184.32	186.17	173.11	166.44	182.37	181.97	190.87	198.38	211.18	

Total = Sum(219a)$_{1...12}$ = 2284.97 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2978.95
Water heating fuel used		2284.97
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		317.47 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	643.45 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	493.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1137.01	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.77	(268)
Total CO2, kg/year	sum of (265)…(271) =			1340.7	(272)

TER = 19.15 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 2 13 TF

Address : R 2 13, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.01	(1a) x	2.55	(2a) =	178.53	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		178.53	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.36 (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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Walls Type1	28.46	12.56	15.9	x	0.18	=	2.86			(29)
Walls Type2	28.46	2.1	26.36	x	0.18	=	4.74			(29)
Roof	70.01	0	70.01	x	0.13	=	9.1			(30)
Total area of elements, m²			126.93							(31)
Party wall			32.06	x	0	=	0			(32)
Party floor			70.01							(32a)
Internal wall **			128.54							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.46 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8126.35 (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 17.19 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 52.65 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.5	35.27	35.04	33.96	33.75	32.81	32.81	32.64	33.18	33.75	34.16	34.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.15	87.92	87.69	86.61	86.41	85.47	85.47	85.29	85.83	86.41	86.82	87.24	

Average = Sum(39)$_{1...12}$ /12= 86.61 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.26	1.26	1.25	1.24	1.23	1.22	1.22	1.22	1.23	1.23	1.24	1.25

Average = Sum(40)$_{1...12}$ /12= 1.24 (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 2.25 (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 87.55 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.31	92.8	89.3	85.8	82.3	78.8	78.8	82.3	85.8	89.3	92.8	96.31

Total = Sum(44)$_{1...12}$ = 1050.61 (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=	142.82	124.91	128.9	112.38	107.83	93.05	86.22	98.94	100.12	116.68	127.37	138.31

Total = Sum(45)$_{1...12}$ = 1377.52 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.42	18.74	19.33	16.86	16.17	13.96	12.93	14.84	15.02	17.5	19.11	20.75

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	189.41	167	175.49	157.47	154.42	138.14	132.82	145.53	145.21	163.28	172.46	184.91	(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=	189.41	167	175.49	157.47	154.42	138.14	132.82	145.53	145.21	163.28	172.46	184.91	

Output from water heater (annual)$_{1...12}$ 1926.14 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.76	75.2	80.13	73.44	73.13	67.01	65.94	70.17	69.36	76.07	78.42	83.27	(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=	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.98	15.97	12.98	9.83	7.35	6.2	6.7	8.71	11.7	14.85	17.33	18.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	197.32	199.37	194.21	183.22	169.36	156.33	147.62	145.57	150.73	161.72	175.58	188.61	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	(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=	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	(71)

Water heating gains (Table 5)

(72)m=	113.93	111.91	107.71	102	98.29	93.07	88.64	94.32	96.34	102.25	108.92	111.92	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	388.92	386.94	374.6	354.75	334.69	315.3	302.65	308.3	318.46	338.51	361.53	378.7	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	12.56	x	11.28	x	0.63	x	0.7	=	43.31	(75)
Northeast 0.9x	0.77	x	12.56	x	22.97	x	0.63	x	0.7	=	88.16	(75)
Northeast 0.9x	0.77	x	12.56	x	41.38	x	0.63	x	0.7	=	158.83	(75)
Northeast 0.9x	0.77	x	12.56	x	67.96	x	0.63	x	0.7	=	260.85	(75)
Northeast 0.9x	0.77	x	12.56	x	91.35	x	0.63	x	0.7	=	350.63	(75)

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Northeast 0.9x	0.77	x	12.56	x	97.38	x	0.63	x	0.7	=	373.81	(75)
Northeast 0.9x	0.77	x	12.56	x	91.1	x	0.63	x	0.7	=	349.69	(75)
Northeast 0.9x	0.77	x	12.56	x	72.63	x	0.63	x	0.7	=	278.78	(75)
Northeast 0.9x	0.77	x	12.56	x	50.42	x	0.63	x	0.7	=	193.54	(75)
Northeast 0.9x	0.77	x	12.56	x	28.07	x	0.63	x	0.7	=	107.74	(75)
Northeast 0.9x	0.77	x	12.56	x	14.2	x	0.63	x	0.7	=	54.49	(75)
Northeast 0.9x	0.77	x	12.56	x	9.21	x	0.63	x	0.7	=	35.37	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	43.31	88.16	158.83	260.85	350.63	373.81	349.69	278.78	193.54	107.74	54.49	35.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	432.23	475.09	533.43	615.6	685.32	689.11	652.34	587.08	512	446.25	416.02	414.07	(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	0.88	0.72	0.56	0.63	0.88	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.63	19.76	20.02	20.4	20.74	20.93	20.98	20.97	20.81	20.39	19.95	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.87	19.88	19.88	19.89	19.89	19.9	19.9	19.91	19.9	19.89	19.89	19.88	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.95	0.84	0.62	0.43	0.5	0.82	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=	18.06	18.25	18.63	19.18	19.64	19.86	19.9	19.89	19.74	19.18	18.54	18.04	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.79	18.95	19.28	19.75	20.15	20.36	20.4	20.39	20.24	19.74	19.2	18.77	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.79	18.95	19.28	19.75	20.15	20.36	20.4	20.39	20.24	19.74	19.2	18.77	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.85	0.67	0.49	0.56	0.84	0.97	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	430.43	471.76	524.73	584.25	583.3	459.42	319.07	329.75	429.36	432.86	412.87	412.66	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1277.21	1235.28	1120.32	939.52	729.98	492.08	324.95	340.71	526.99	789.87	1050.22	1271.08	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	630.01	513.08	443.12	255.79	109.13	0	0	0	0	265.61	458.89	638.67	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3314.3	(98)
Space heating requirement in kWh/m²/year	47.34	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	630.01	513.08	443.12	255.79	109.13	0	0	0	0	265.61	458.89	638.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	673.81	548.75	473.92	273.58	116.72	0	0	0	0	284.08	490.79	683.06	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3544.71 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	189.41	167	175.49	157.47	154.42	138.14	132.82	145.53	145.21	163.28	172.46	184.91	

Efficiency of water heater 79.8 (216)

(217)m=	87.78	87.62	87.18	86.1	83.91	79.8	79.8	79.8	79.8	86.1	87.3	87.86	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	215.78	190.6	201.29	182.89	184.04	173.11	166.44	182.37	181.97	189.63	197.54	210.47	

Total = Sum(219a)$_{1...12}$ = 2276.13 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3544.71
Water heating fuel used		2276.13
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		317.47 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	765.66 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	491.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1257.3	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.77	(268)
Total CO2, kg/year	sum of (265)…(271) =			1460.99	(272)

TER = 20.87 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 2 13

Address : R 2 13, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.01	(1a) x	2.55	(2a) =	178.53	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.01	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		178.53	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.42 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.36 (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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.56	x	1/[1/(1.4)+ 0.04]	=	16.65			(27)
Walls Type1	28.46	12.56	15.9	x	0.18	=	2.86			(29)
Walls Type2	28.46	2.1	26.36	x	0.18	=	4.74			(29)
Total area of elements, m²			56.92							(31)
Party wall			32.06	x	0	=	0			(32)
Party floor			70.01							(32a)
Party ceiling			70.01							(32b)
Internal wall **			128.54							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9596.56 (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 4.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 31.11 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.5	35.27	35.04	33.96	33.75	32.81	32.81	32.64	33.18	33.75	34.16	34.59	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.61	66.38	66.15	65.07	64.87	63.92	63.92	63.75	64.29	64.87	65.28	65.7	

Average = Sum(39)$_{1...12}$ /12= 65.07 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.95	0.94	0.93	0.93	0.91	0.91	0.91	0.92	0.93	0.93	0.94

Average = Sum(40)$_{1...12}$ /12= 0.93 (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 2.25 (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 87.55 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.31	92.8	89.3	85.8	82.3	78.8	78.8	82.3	85.8	89.3	92.8	96.31

Total = Sum(44)$_{1...12}$ = 1050.61 (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=	142.82	124.91	128.9	112.38	107.83	93.05	86.22	98.94	100.12	116.68	127.37	138.31

Total = Sum(45)$_{1...12}$ = 1377.52 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.42	18.74	19.33	16.86	16.17	13.96	12.93	14.84	15.02	17.5	19.11	20.75

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	189.41	167	175.49	157.47	154.42	138.14	132.82	145.53	145.21	163.28	172.46	184.91	(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=	189.41	167	175.49	157.47	154.42	138.14	132.82	145.53	145.21	163.28	172.46	184.91	

Output from water heater (annual)$_{1...12}$ 1926.14 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.76	75.2	80.13	73.44	73.13	67.01	65.94	70.17	69.36	76.07	78.42	83.27	(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=	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	112.32	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.98	15.97	12.98	9.83	7.35	6.2	6.7	8.71	11.7	14.85	17.33	18.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	197.32	199.37	194.21	183.22	169.36	156.33	147.62	145.57	150.73	161.72	175.58	188.61	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	34.23	(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=	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	-89.85	(71)

Water heating gains (Table 5)

(72)m=	113.93	111.91	107.71	102	98.29	93.07	88.64	94.32	96.34	102.25	108.92	111.92	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	388.92	386.94	374.6	354.75	334.69	315.3	302.65	308.3	318.46	338.51	361.53	378.7	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	12.56	x	11.28	x	0.63	x	0.7	=	43.31	(75)
Northeast 0.9x	0.77	x	12.56	x	22.97	x	0.63	x	0.7	=	88.16	(75)
Northeast 0.9x	0.77	x	12.56	x	41.38	x	0.63	x	0.7	=	158.83	(75)
Northeast 0.9x	0.77	x	12.56	x	67.96	x	0.63	x	0.7	=	260.85	(75)
Northeast 0.9x	0.77	x	12.56	x	91.35	x	0.63	x	0.7	=	350.63	(75)

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Northeast 0.9x	0.77	x	12.56	x	97.38	x	0.63	x	0.7	=	373.81	(75)
Northeast 0.9x	0.77	x	12.56	x	91.1	x	0.63	x	0.7	=	349.69	(75)
Northeast 0.9x	0.77	x	12.56	x	72.63	x	0.63	x	0.7	=	278.78	(75)
Northeast 0.9x	0.77	x	12.56	x	50.42	x	0.63	x	0.7	=	193.54	(75)
Northeast 0.9x	0.77	x	12.56	x	28.07	x	0.63	x	0.7	=	107.74	(75)
Northeast 0.9x	0.77	x	12.56	x	14.2	x	0.63	x	0.7	=	54.49	(75)
Northeast 0.9x	0.77	x	12.56	x	9.21	x	0.63	x	0.7	=	35.37	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	43.31	88.16	158.83	260.85	350.63	373.81	349.69	278.78	193.54	107.74	54.49	35.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	432.23	475.09	533.43	615.6	685.32	689.11	652.34	587.08	512	446.25	416.02	414.07	(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	0.94	0.8	0.58	0.43	0.5	0.79	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.05	20.17	20.4	20.71	20.92	20.99	21	21	20.95	20.66	20.31	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.13	20.13	20.14	20.15	20.16	20.16	20.16	20.15	20.15	20.14	20.13	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.75	0.51	0.35	0.41	0.72	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.85	19.03	19.36	19.8	20.07	20.15	20.16	20.16	20.11	19.75	19.24	18.84	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.41	19.56	19.84	20.22	20.47	20.54	20.55	20.55	20.5	20.17	19.74	19.4	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.41	19.56	19.84	20.22	20.47	20.54	20.55	20.55	20.5	20.17	19.74	19.4	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.92	0.77	0.54	0.39	0.45	0.75	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	430.49	471.49	522.25	567.24	525.23	375.06	251.83	263.24	383.87	427.04	412.52	412.76	(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=	1006.53	973.01	882.41	736.78	568.56	379.71	252.32	264.38	411.27	621.02	825.01	998.37	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	428.57	337.02	267.96	122.07	32.24	0	0	0	0	144.32	296.99	435.69	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2064.87	(98)
Space heating requirement in kWh/m²/year	29.49	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	428.57	337.02	267.96	122.07	32.24	0	0	0	0	144.32	296.99	435.69	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	458.36	360.45	286.58	130.56	34.48	0	0	0	0	154.36	317.64	465.98	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2208.41 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	189.41	167	175.49	157.47	154.42	138.14	132.82	145.53	145.21	163.28	172.46	184.91	

Efficiency of water heater 79.8 (216)

(217)m=	86.93	86.65	85.94	84.14	81.46	79.8	79.8	79.8	79.8	84.49	86.25	87.02	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	217.9	192.72	204.2	187.14	189.56	173.11	166.44	182.37	181.97	193.26	199.95	212.48	

Total = Sum(219a)$_{1...12}$ = 2301.1 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2208.41
Water heating fuel used		2301.1
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		317.47 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	477.02 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	497.04	(264)
Space and water heating	(261) + (262) + (263) + (264) =			974.06	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.77	(268)
Total CO2, kg/year	sum of (265)…(271) =			1177.75	(272)

TER = 16.82 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 3 5 TF

Address : R 3 5 TF, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	84.06 (1a)	x	2.55 (2a)	=	214.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	84.06 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	214.35	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.41	0.36	0.36	0.31	0.31	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			10.46	x1/[1/(1.4)+ 0.04]		=	13.87			(27)
Windows Type 2			8.46	x1/[1/(1.4)+ 0.04]		=	11.22			(27)
Walls Type1	49.11	18.92	30.19	x	0.18	=	5.43			(29)
Walls Type2	13.44	2.1	11.34	x	0.18	=	2.04			(29)
Roof	84.06	0	84.06	x	0.13	=	10.93			(30)
Total area of elements, m²			146.61							(31)
Party wall			35.6	x	0	=	0			(32)
Party floor			84.06							(32a)
Internal wall **			154.33							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.59 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9481.74 (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 19.38 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 64.97 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	41.69	41.44	41.2	40.07	39.86	38.88	38.88	38.69	39.25	39.86	40.29	40.73	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	106.65	106.41	106.17	105.04	104.83	103.84	103.84	103.66	104.22	104.83	105.25	105.7	

Average = Sum(39)$_{1...12}$ /12= 105.04 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.27	1.27	1.26	1.25	1.25	1.24	1.24	1.23	1.24	1.25	1.25	1.26	

Average = Sum(40)$_{1...12}$ /12= 1.25 (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 2.54 (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 94.42 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	103.86	100.08	96.3	92.53	88.75	84.97	84.97	88.75	92.53	96.3	100.08	103.86	

Total = Sum(44)$_{1...12}$ = 1132.99 (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=	154.02	134.7	139	121.19	116.28	100.34	92.98	106.7	107.97	125.83	137.35	149.16	

Total = Sum(45)$_{1...12}$ = 1485.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.1	20.21	20.85	18.18	17.44	15.05	13.95	16	16.2	18.87	20.6	22.37	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.61	176.79	185.6	166.28	162.88	145.43	139.58	153.29	153.06	172.43	182.45	195.75	(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=	200.61	176.79	185.6	166.28	162.88	145.43	139.58	153.29	153.06	172.43	182.45	195.75	

Output from water heater (annual)$_{1...12}$ | 2034.14 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.49	78.46	83.49	76.37	75.94	69.44	68.19	72.75	71.97	79.11	81.74	86.87	(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=	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.3	18.03	14.66	11.1	8.3	7	7.57	9.84	13.21	16.77	19.57	20.86	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	227.72	230.08	224.12	211.45	195.45	180.41	170.36	168	173.95	186.63	202.63	217.67	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	(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=	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	(71)

Water heating gains (Table 5)

(72)m=	118.93	116.75	112.22	106.07	102.07	96.44	91.66	97.79	99.96	106.34	113.53	116.76	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	430.98	428.89	415.04	392.65	369.84	347.88	333.62	339.65	351.15	373.76	399.76	419.32	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	10.46	x	11.28	x	0.63	x	0.7	=	36.07	(75)
Northeast 0.9x	0.77	x	10.46	x	22.97	x	0.63	x	0.7	=	73.42	(75)

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Northeast	0.9x	0.77	x	10.46	x	41.38	x	0.63	x	0.7	=	132.28	(75)
Northeast	0.9x	0.77	x	10.46	x	67.96	x	0.63	x	0.7	=	217.24	(75)
Northeast	0.9x	0.77	x	10.46	x	91.35	x	0.63	x	0.7	=	292.01	(75)
Northeast	0.9x	0.77	x	10.46	x	97.38	x	0.63	x	0.7	=	311.31	(75)
Northeast	0.9x	0.77	x	10.46	x	91.1	x	0.63	x	0.7	=	291.22	(75)
Northeast	0.9x	0.77	x	10.46	x	72.63	x	0.63	x	0.7	=	232.17	(75)
Northeast	0.9x	0.77	x	10.46	x	50.42	x	0.63	x	0.7	=	161.18	(75)
Northeast	0.9x	0.77	x	10.46	x	28.07	x	0.63	x	0.7	=	89.72	(75)
Northeast	0.9x	0.77	x	10.46	x	14.2	x	0.63	x	0.7	=	45.38	(75)
Northeast	0.9x	0.77	x	10.46	x	9.21	x	0.63	x	0.7	=	29.46	(75)
Southeast	0.9x	0.77	x	8.46	x	36.79	x	0.63	x	0.7	=	95.13	(77)
Southeast	0.9x	0.77	x	8.46	x	62.67	x	0.63	x	0.7	=	162.04	(77)
Southeast	0.9x	0.77	x	8.46	x	85.75	x	0.63	x	0.7	=	221.71	(77)
Southeast	0.9x	0.77	x	8.46	x	106.25	x	0.63	x	0.7	=	274.71	(77)
Southeast	0.9x	0.77	x	8.46	x	119.01	x	0.63	x	0.7	=	307.7	(77)
Southeast	0.9x	0.77	x	8.46	x	118.15	x	0.63	x	0.7	=	305.48	(77)
Southeast	0.9x	0.77	x	8.46	x	113.91	x	0.63	x	0.7	=	294.51	(77)
Southeast	0.9x	0.77	x	8.46	x	104.39	x	0.63	x	0.7	=	269.9	(77)
Southeast	0.9x	0.77	x	8.46	x	92.85	x	0.63	x	0.7	=	240.07	(77)
Southeast	0.9x	0.77	x	8.46	x	69.27	x	0.63	x	0.7	=	179.09	(77)
Southeast	0.9x	0.77	x	8.46	x	44.07	x	0.63	x	0.7	=	113.94	(77)
Southeast	0.9x	0.77	x	8.46	x	31.49	x	0.63	x	0.7	=	81.41	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	131.2	235.46	353.99	491.95	599.71	616.79	585.73	502.07	401.25	268.81	159.33	110.87	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	562.18	664.35	769.03	884.59	969.55	964.67	919.35	841.72	752.4	642.58	559.09	530.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.65	0.49	0.55	0.81	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.67	19.85	20.14	20.51	20.81	20.96	20.99	20.98	20.88	20.48	20	19.63	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.87	19.87	19.87	19.88	19.88	19.89	19.89	19.89	19.89	19.88	19.88	19.87	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.77	0.55	0.37	0.43	0.72	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.1	18.37	18.79	19.33	19.71	19.86	19.89	19.89	19.79	19.3	18.61	18.06	(90)

fLA = Living area ÷ (4) = 0.31 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.59	18.83	19.21	19.69	20.05	20.2	20.23	20.23	20.13	19.66	19.04	18.55	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.59	18.83	19.21	19.69	20.05	20.2	20.23	20.23	20.13	19.66	19.04	18.55	(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	0.97	0.91	0.78	0.58	0.41	0.46	0.74	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	558.72	655.52	744	804.74	756.4	559.65	373.71	390.78	559.83	605.7	552.11	527.67	(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=	1523.73	1481.95	1349.45	1133.85	875.04	581.79	376.95	396.73	628.39	950.16	1256.75	1516.79	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	717.97	555.36	450.46	236.95	88.27	0	0	0	0	256.28	507.34	735.9	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3548.52 (98)

Space heating requirement in kWh/m²/year 42.21 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	717.97	555.36	450.46	236.95	88.27	0	0	0	0	256.28	507.34	735.9	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	767.88	593.97	481.77	253.43	94.41	0	0	0	0	274.09	542.61	787.06	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3795.21 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	200.61	176.79	185.6	166.28	162.88	145.43	139.58	153.29	153.06	172.43	182.45	195.75	

Efficiency of water heater 79.8 (216)

(217)m=	87.93	87.66	87.09	85.76	83.26	79.8	79.8	79.8	79.8	85.87	87.4	88.02	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	228.16	201.67	213.1	193.89	195.62	182.25	174.91	192.1	191.81	200.8	208.75	222.39	

Total = Sum(219a)$_{1...12}$ = 2405.46 (219)

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Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3795.21	
Water heating fuel used			2405.46	
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			358.47	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	819.77	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	519.58	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1339.34	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	186.05	(268)
Total CO2, kg/year	sum of (265)…(271) =				1564.32	(272)

TER = 18.61 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 3 3 GF

Address : R 3 3, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.26 (1a)	x	2.55 (2a)	=	199.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.26 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	199.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.43	0.42	0.37	0.37	0.32	0.32	0.31	0.34	0.37	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.38	x	1/[1/(1.4)+ 0.04]	=	16.41			(27)
Floor			78.26	x	0.13	=	10.1738			(28)
Walls Type1	31.08	12.38	18.7	x	0.18	=	3.37			(29)
Walls Type2	25.91	2.1	23.81	x	0.18	=	4.29			(29)
Total area of elements, m²			135.25							(31)
Party wall			34.22	x	0	=	0			(32)
Party ceiling			78.26							(32b)
Internal wall **			143.69							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10989.01 (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 8.51 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 44.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.13	38.89	38.65	37.54	37.33	36.37	36.37	36.19	36.74	37.33	37.75	38.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	83.97	83.73	83.5	82.39	82.18	81.22	81.22	81.04	81.59	82.18	82.6	83.04	

Average = Sum(39)$_{1...12}$ /12= 82.39 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.07	1.07	1.05	1.05	1.04	1.04	1.04	1.04	1.05	1.06	1.06

Average = Sum(40)$_{1...12}$ /12= 1.05 (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 2.43 (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 91.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.08	97.4	93.73	90.05	86.38	82.7	82.7	86.38	90.05	93.73	97.4	101.08

Total = Sum(44)$_{1...12}$ = 1102.67 (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=	149.9	131.1	135.28	117.94	113.17	97.66	90.49	103.84	105.08	122.46	133.68	145.17

Total = Sum(45)$_{1...12}$ = 1445.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.48	19.66	20.29	17.69	16.98	14.65	13.57	15.58	15.76	18.37	20.05	21.77

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	196.49	173.19	181.88	163.04	159.76	142.75	137.09	150.44	150.17	169.06	178.77	191.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	196.49	173.19	181.88	163.04	159.76	142.75	137.09	150.44	150.17	169.06	178.77	191.76	

Output from water heater (annual)$_{1...12}$ 1994.39 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	87.12	77.26	82.26	75.29	74.9	68.54	67.36	71.8	71.01	78	80.52	85.54	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.11	17.86	14.53	11	8.22	6.94	7.5	9.75	13.09	16.61	19.39	20.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.77	218	212.36	200.35	185.19	170.94	161.42	159.18	164.82	176.83	191.99	206.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	(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=	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	(71)

Water heating gains (Table 5)

(72)m=	117.09	114.97	110.56	104.57	100.68	95.2	90.54	96.51	98.63	104.83	111.84	114.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	415.41	413.27	399.89	378.35	356.52	335.52	321.9	327.87	338.97	360.71	385.66	404.33	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	12.38	x	36.79	x	0.63	x	0.7	=	139.21	(77)
Southeast 0.9x	0.77	x	12.38	x	62.67	x	0.63	x	0.7	=	237.12	(77)
Southeast 0.9x	0.77	x	12.38	x	85.75	x	0.63	x	0.7	=	324.44	(77)
Southeast 0.9x	0.77	x	12.38	x	106.25	x	0.63	x	0.7	=	402	(77)
Southeast 0.9x	0.77	x	12.38	x	119.01	x	0.63	x	0.7	=	450.28	(77)

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Southeast 0.9x	0.77	x	12.38	x	118.15	x	0.63	x	0.7	=	447.02	(77)
Southeast 0.9x	0.77	x	12.38	x	113.91	x	0.63	x	0.7	=	430.97	(77)
Southeast 0.9x	0.77	x	12.38	x	104.39	x	0.63	x	0.7	=	394.96	(77)
Southeast 0.9x	0.77	x	12.38	x	92.85	x	0.63	x	0.7	=	351.3	(77)
Southeast 0.9x	0.77	x	12.38	x	69.27	x	0.63	x	0.7	=	262.07	(77)
Southeast 0.9x	0.77	x	12.38	x	44.07	x	0.63	x	0.7	=	166.74	(77)
Southeast 0.9x	0.77	x	12.38	x	31.49	x	0.63	x	0.7	=	119.13	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	139.21	237.12	324.44	402	450.28	447.02	430.97	394.96	351.3	262.07	166.74	119.13	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	554.62	650.4	724.33	780.36	806.8	782.53	752.87	722.83	690.28	622.79	552.4	523.47	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.93	0.82	0.64	0.47	0.51	0.75	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.14	20.38	20.67	20.87	20.98	21	20.99	20.94	20.67	20.27	19.93	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.04	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.9	0.77	0.55	0.37	0.41	0.67	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.65	18.91	19.26	19.66	19.92	20.04	20.05	20.05	20.01	19.68	19.1	18.61	(90)

fLA = Living area ÷ (4) = 0.29 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.03	19.27	19.59	19.95	20.2	20.31	20.33	20.33	20.28	19.97	19.44	19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.03	19.27	19.59	19.95	20.2	20.31	20.33	20.33	20.28	19.97	19.44	19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.9	0.78	0.58	0.4	0.44	0.69	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	550.29	638.88	694.97	703.02	627.24	452.47	301.33	316.12	475.75	571.92	542.87	520.36	(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, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1237.29	1203.11	1092.65	910.54	698.58	463.7	302.58	318.12	504.07	769.9	1019.24	1228.9	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	511.13	379.16	295.87	149.42	53.08	0	0	0	0	147.3	342.99	527.15	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2406.1	(98)
Space heating requirement in kWh/m²/year	30.74	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	511.13	379.16	295.87	149.42	53.08	0	0	0	0	147.3	342.99	527.15	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	546.66	405.52	316.44	159.8	56.77	0	0	0	0	157.54	366.83	563.8	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2573.37 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	196.49	173.19	181.88	163.04	159.76	142.75	137.09	150.44	150.17	169.06	178.77	191.76

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.25	86.85	86.1	84.58	82.22	79.8	79.8	79.8	79.8	84.45	86.52	87.37

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	225.2	199.41	211.23	192.75	194.3	178.88	171.79	188.52	188.19	200.19	206.61	219.47

Total = Sum(219a)$_{1...12}$ = 2376.55 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2573.37
Water heating fuel used		2376.55
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		355.21 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	555.85 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	513.33	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1069.18	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	184.35	(268)
Total CO2, kg/year	sum of (265)…(271) =			1292.46	(272)

TER = 16.51 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 3 3 TF

Address : R 3 3, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.26 (1a)	x	2.55 (2a)	=	199.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.26 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	199.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.43	0.42	0.37	0.37	0.32	0.32	0.31	0.34	0.37	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.38	x	1/[1/(1.4)+ 0.04]	=	16.41			(27)
Walls Type1	31.08	12.38	18.7	x	0.18	=	3.37			(29)
Walls Type2	25.91	2.1	23.81	x	0.18	=	4.29			(29)
Roof	78.26	0	78.26	x	0.13	=	10.17			(30)
Total area of elements, m²			135.25							(31)
Party wall			34.22	x	0	=	0			(32)
Party floor			78.26							(32a)
Internal wall **			143.69							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.34 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 8954.25 (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 17.78 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 54.12 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.13	38.89	38.65	37.54	37.33	36.37	36.37	36.19	36.74	37.33	37.75	38.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	93.24	93	92.76	91.66	91.45	90.48	90.48	90.31	90.86	91.45	91.87	92.31	

Average = Sum(39)$_{1...12}$ /12= 91.66 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.19	1.17	1.17	1.16	1.16	1.15	1.16	1.17	1.17	1.18

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 2.43 (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 91.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.08	97.4	93.73	90.05	86.38	82.7	82.7	86.38	90.05	93.73	97.4	101.08

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1102.67 (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=	149.9	131.1	135.28	117.94	113.17	97.66	90.49	103.84	105.08	122.46	133.68	145.17

Total = Sum(45)$_{1...12}$ = 1445.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.48	19.66	20.29	17.69	16.98	14.65	13.57	15.58	15.76	18.37	20.05	21.77

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	196.49	173.19	181.88	163.04	159.76	142.75	137.09	150.44	150.17	169.06	178.77	191.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	196.49	173.19	181.88	163.04	159.76	142.75	137.09	150.44	150.17	169.06	178.77	191.76	

Output from water heater (annual)$_{1...12}$ 1994.39 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	87.12	77.26	82.26	75.29	74.9	68.54	67.36	71.8	71.01	78	80.52	85.54	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.11	17.86	14.53	11	8.22	6.94	7.5	9.75	13.09	16.61	19.39	20.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.77	218	212.36	200.35	185.19	170.94	161.42	159.18	164.82	176.83	191.99	206.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	(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=	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	(71)

Water heating gains (Table 5)

(72)m=	117.09	114.97	110.56	104.57	100.68	95.2	90.54	96.51	98.63	104.83	111.84	114.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	415.41	413.27	399.89	378.35	356.52	335.52	321.9	327.87	338.97	360.71	385.66	404.33	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	12.38	x	36.79	x	0.63	x	0.7	=	139.21	(77)
Southeast 0.9x	0.77	x	12.38	x	62.67	x	0.63	x	0.7	=	237.12	(77)
Southeast 0.9x	0.77	x	12.38	x	85.75	x	0.63	x	0.7	=	324.44	(77)
Southeast 0.9x	0.77	x	12.38	x	106.25	x	0.63	x	0.7	=	402	(77)
Southeast 0.9x	0.77	x	12.38	x	119.01	x	0.63	x	0.7	=	450.28	(77)

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Southeast 0.9x	0.77	x	12.38	x	118.15	x	0.63	x	0.7	=	447.02	(77)
Southeast 0.9x	0.77	x	12.38	x	113.91	x	0.63	x	0.7	=	430.97	(77)
Southeast 0.9x	0.77	x	12.38	x	104.39	x	0.63	x	0.7	=	394.96	(77)
Southeast 0.9x	0.77	x	12.38	x	92.85	x	0.63	x	0.7	=	351.3	(77)
Southeast 0.9x	0.77	x	12.38	x	69.27	x	0.63	x	0.7	=	262.07	(77)
Southeast 0.9x	0.77	x	12.38	x	44.07	x	0.63	x	0.7	=	166.74	(77)
Southeast 0.9x	0.77	x	12.38	x	31.49	x	0.63	x	0.7	=	119.13	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	139.21	237.12	324.44	402	450.28	447.02	430.97	394.96	351.3	262.07	166.74	119.13	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	554.62	650.4	724.33	780.36	806.8	782.53	752.87	722.83	690.28	622.79	552.4	523.47	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.85	0.69	0.52	0.56	0.79	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.8	19.98	20.24	20.55	20.81	20.95	20.99	20.99	20.9	20.57	20.13	19.77	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.94	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.92	0.8	0.6	0.4	0.44	0.71	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.35	18.61	18.98	19.43	19.76	19.92	19.95	19.95	19.88	19.47	18.83	18.31	(90)

fLA = Living area ÷ (4) = 0.29 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.77	19.01	19.35	19.75	20.06	20.22	20.25	20.25	20.18	19.79	19.21	18.73	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.77	19.01	19.35	19.75	20.06	20.22	20.25	20.25	20.18	19.79	19.21	18.73	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.92	0.81	0.62	0.44	0.47	0.73	0.93	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	550.35	639.67	698.27	714.26	652.94	486.47	327.58	343.23	502.87	578.97	543.52	520.36	(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, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1349.26	1312.21	1191.84	994.9	764.86	508.8	330.62	347.91	552.02	840.28	1112.37	1341.58	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	594.39	451.95	367.22	202.06	83.27	0	0	0	0	194.41	409.57	610.99	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2913.86	(98)
Space heating requirement in kWh/m²/year	37.23	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	594.39	451.95	367.22	202.06	83.27	0	0	0	0	194.41	409.57	610.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	635.71	483.36	392.75	216.11	89.05	0	0	0	0	207.92	438.04	653.47	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3116.43 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)	196.49	173.19	181.88	163.04	159.76	142.75	137.09	150.44	150.17	169.06	178.77	191.76	
Efficiency of water heater													79.8 (216)
(217)m=	87.58	87.26	86.65	85.39	83.17	79.8	79.8	79.8	79.8	85.19	86.96	87.69	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	224.35	198.47	209.9	190.94	192.1	178.88	171.79	188.52	188.19	198.46	205.58	218.68	

Total = Sum(219a)$_{1...12}$ = 2365.85 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3116.43
Water heating fuel used		2365.85
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		355.21 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	673.15 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	511.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1184.17	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	184.35	(268)
Total CO2, kg/year	sum of (265)…(271) =			1407.45	(272)

TER = 17.98 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 3 3

Address : R 3 3, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	78.26	(1a) x	2.55	(2a) =	199.56	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.26	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		199.56	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.43	0.42	0.37	0.37	0.32	0.32	0.31	0.34	0.37	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows			12.38	x	1/[1/(1.4)+ 0.04]	=	16.41			(27)
Walls Type1	31.08	12.38	18.7	x	0.18	=	3.37			(29)
Walls Type2	25.91	2.1	23.81	x	0.18	=	4.29			(29)
Total area of elements, m²			56.99							(31)
Party wall			34.22	x	0	=	0			(32)
Party floor			78.26							(32a)
Party ceiling			78.26							(32b)
Internal wall **			143.69							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.16 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10597.71 (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 5.22 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 31.38 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.13	38.89	38.65	37.54	37.33	36.37	36.37	36.19	36.74	37.33	37.75	38.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	70.51	70.27	70.03	68.92	68.71	67.75	67.75	67.57	68.12	68.71	69.13	69.57	

Average = Sum(39)$_{1...12}$ /12= 68.92 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.89	0.88	0.88	0.87	0.87	0.86	0.87	0.88	0.88	0.89

Average = Sum(40)$_{1...12}$ /12= 0.88 (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 2.43 (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 91.89 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.08	97.4	93.73	90.05	86.38	82.7	82.7	86.38	90.05	93.73	97.4	101.08

Total = Sum(44)$_{1...12}$ = 1102.67 (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=	149.9	131.1	135.28	117.94	113.17	97.66	90.49	103.84	105.08	122.46	133.68	145.17

Total = Sum(45)$_{1...12}$ = 1445.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.48	19.66	20.29	17.69	16.98	14.65	13.57	15.58	15.76	18.37	20.05	21.77

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(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	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=	196.49	173.19	181.88	163.04	159.76	142.75	137.09	150.44	150.17	169.06	178.77	191.76	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	196.49	173.19	181.88	163.04	159.76	142.75	137.09	150.44	150.17	169.06	178.77	191.76	

Output from water heater (annual)$_{1...12}$ 1994.39 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	87.12	77.26	82.26	75.29	74.9	68.54	67.36	71.8	71.01	78	80.52	85.54	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	121.45	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.11	17.86	14.53	11	8.22	6.94	7.5	9.75	13.09	16.61	19.39	20.67	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	215.77	218	212.36	200.35	185.19	170.94	161.42	159.18	164.82	176.83	191.99	206.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	35.15	(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=	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	-97.16	(71)

Water heating gains (Table 5)

(72)m=	117.09	114.97	110.56	104.57	100.68	95.2	90.54	96.51	98.63	104.83	111.84	114.98	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	415.41	413.27	399.89	378.35	356.52	335.52	321.9	327.87	338.97	360.71	385.66	404.33	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	12.38	x	36.79	x	0.63	x	0.7	=	139.21	(77)
Southeast 0.9x	0.77	x	12.38	x	62.67	x	0.63	x	0.7	=	237.12	(77)
Southeast 0.9x	0.77	x	12.38	x	85.75	x	0.63	x	0.7	=	324.44	(77)
Southeast 0.9x	0.77	x	12.38	x	106.25	x	0.63	x	0.7	=	402	(77)
Southeast 0.9x	0.77	x	12.38	x	119.01	x	0.63	x	0.7	=	450.28	(77)

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Southeast 0.9x	0.77	x	12.38	x	118.15	x	0.63	x	0.7	=	447.02	(77)
Southeast 0.9x	0.77	x	12.38	x	113.91	x	0.63	x	0.7	=	430.97	(77)
Southeast 0.9x	0.77	x	12.38	x	104.39	x	0.63	x	0.7	=	394.96	(77)
Southeast 0.9x	0.77	x	12.38	x	92.85	x	0.63	x	0.7	=	351.3	(77)
Southeast 0.9x	0.77	x	12.38	x	69.27	x	0.63	x	0.7	=	262.07	(77)
Southeast 0.9x	0.77	x	12.38	x	44.07	x	0.63	x	0.7	=	166.74	(77)
Southeast 0.9x	0.77	x	12.38	x	31.49	x	0.63	x	0.7	=	119.13	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	139.21	237.12	324.44	402	450.28	447.02	430.97	394.96	351.3	262.07	166.74	119.13	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	554.62	650.4	724.33	780.36	806.8	782.53	752.87	722.83	690.28	622.79	552.4	523.47	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.89	0.75	0.55	0.4	0.43	0.66	0.91	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.21	20.38	20.6	20.82	20.95	20.99	21	21	20.98	20.82	20.48	20.18	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.18	20.19	20.2	20.2	20.2	20.19	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.86	0.69	0.48	0.32	0.35	0.59	0.89	0.98	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.12	19.37	19.68	19.99	20.14	20.19	20.2	20.2	20.18	19.99	19.51	19.09	(90)

fLA = Living area ÷ (4) = 0.29 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.44	19.66	19.94	20.23	20.38	20.43	20.43	20.43	20.41	20.23	19.79	19.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.66	19.94	20.23	20.38	20.43	20.43	20.43	20.41	20.23	19.79	19.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.86	0.71	0.5	0.34	0.38	0.61	0.89	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	549.78	636.2	685.27	673.07	570.06	392.15	259.28	272.04	421.65	552.52	540.59	520.09	(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=	1067.37	1037.38	941.44	780.94	596.33	394.71	259.48	272.38	430.07	661.64	877.47	1057.91	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	385.09	269.6	190.59	77.66	19.55	0	0	0	0	81.19	242.56	400.14	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	1666.37	(98)
Space heating requirement in kWh/m²/year	21.29	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	385.09	269.6	190.59	77.66	19.55	0	0	0	0	81.19	242.56	400.14	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	411.86	288.34	203.84	83.06	20.91	0	0	0	0	86.83	259.42	427.96	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1782.21 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	196.49	173.19	181.88	163.04	159.76	142.75	137.09	150.44	150.17	169.06	178.77	191.76	

Efficiency of water heater 79.8 (216)

(217)m=	86.58	85.99	84.94	82.96	80.84	79.8	79.8	79.8	79.8	82.98	85.63	86.73	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	226.95	201.4	214.13	196.51	197.63	178.88	171.79	188.52	188.19	203.73	208.77	221.1	

Total = Sum(219a)$_{1...12}$ = 2397.59 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1782.21
Water heating fuel used		2397.59
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		355.21 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	384.96 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	517.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =			902.84	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	184.35	(268)
Total CO2, kg/year	sum of (265)…(271) =			1126.12	(272)

TER = 14.39 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 3 4 GF

Address : R 3 4, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	98.47 (1a)	x	2.55 (2a)	=	251.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	98.47 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	251.1	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.38	0.35	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			10.51	x	1/[1/(1.4)+ 0.04]	=	13.93			(27)
Windows Type 2			12.01	x	1/[1/(1.4)+ 0.04]	=	15.92			(27)
Floor			98.47	x	0.13	=	12.8011			(28)
Walls Type1	51.1	22.52	28.58	x	0.18	=	5.14			(29)
Walls Type2	3.83	2.1	1.73	x	0.18	=	0.31			(29)
Walls Type3	14.23	0	14.23	x	0.18	=	2.56			(29)
Total area of elements, m²			167.63							(31)
Party wall			41.03	x	0	=	0			(32)
Party ceiling			98.47							(32b)
Internal wall **			180.79							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 52.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15442.02 (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 10.53 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 63.3 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	48.07	47.82	47.56	46.38	46.15	45.12	45.12	44.93	45.52	46.15	46.6	47.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	111.38	111.12	110.87	109.68	109.46	108.42	108.42	108.23	108.82	109.46	109.91	110.38	

Average = Sum(39)$_{1...12}$ /12= 109.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.13	1.11	1.11	1.1	1.1	1.1	1.11	1.11	1.12	1.12	

Average = Sum(40)$_{1...12}$ /12= 1.11 (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 2.72 (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 98.92 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	108.81	104.85	100.89	96.94	92.98	89.02	89.02	92.98	96.94	100.89	104.85	108.81	

Total = Sum(44)$_{1...12}$ = 1187 (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=	161.36	141.13	145.63	126.96	121.82	105.12	97.41	111.78	113.12	131.83	143.9	156.27	

Total = Sum(45)$_{1...12}$ = 1556.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.2	21.17	21.84	19.04	18.27	15.77	14.61	16.77	16.97	19.77	21.59	23.44	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	207.95	183.21	192.22	172.05	168.42	150.22	144.01	158.38	158.21	178.42	188.99	202.86	(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=	207.95	183.21	192.22	172.05	168.42	150.22	144.01	158.38	158.21	178.42	188.99	202.86	

Output from water heater (annual)$_{1...12}$ — 2104.96 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.93	80.59	85.7	78.29	77.78	71.03	69.67	74.44	73.69	81.11	83.92	89.23	(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=	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.63	20.1	16.35	12.37	9.25	7.81	8.44	10.97	14.72	18.69	21.82	23.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	253.83	256.46	249.83	235.7	217.86	201.09	189.9	187.26	193.9	208.03	225.87	242.63	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	(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=	-109	-109	-109	-109	-109	-109	-109	-109	-109	-109	-109	-109	(71)

Water heating gains (Table 5)

(72)m=	122.21	119.93	115.19	108.73	104.55	98.65	93.64	100.06	102.34	109.02	116.56	119.94	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	465.55	463.37	448.23	423.68	398.53	374.43	358.84	365.16	377.83	402.61	431.11	452.7	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast 0.9x	0.77	x	10.51	x	11.28	x	0.63	x	0.7	=	36.24	(75)
Northeast 0.9x	0.77	x	10.51	x	22.97	x	0.63	x	0.7	=	73.77	(75)
Northeast 0.9x	0.77	x	10.51	x	41.38	x	0.63	x	0.7	=	132.91	(75)
Northeast 0.9x	0.77	x	10.51	x	67.96	x	0.63	x	0.7	=	218.27	(75)
Northeast 0.9x	0.77	x	10.51	x	91.35	x	0.63	x	0.7	=	293.4	(75)
Northeast 0.9x	0.77	x	10.51	x	97.38	x	0.63	x	0.7	=	312.8	(75)
Northeast 0.9x	0.77	x	10.51	x	91.1	x	0.63	x	0.7	=	292.62	(75)
Northeast 0.9x	0.77	x	10.51	x	72.63	x	0.63	x	0.7	=	233.28	(75)
Northeast 0.9x	0.77	x	10.51	x	50.42	x	0.63	x	0.7	=	161.95	(75)
Northeast 0.9x	0.77	x	10.51	x	28.07	x	0.63	x	0.7	=	90.15	(75)
Northeast 0.9x	0.77	x	10.51	x	14.2	x	0.63	x	0.7	=	45.6	(75)
Northeast 0.9x	0.77	x	10.51	x	9.21	x	0.63	x	0.7	=	29.6	(75)
Northwest 0.9x	0.77	x	12.01	x	11.28	x	0.63	x	0.7	=	41.41	(81)
Northwest 0.9x	0.77	x	12.01	x	22.97	x	0.63	x	0.7	=	84.3	(81)
Northwest 0.9x	0.77	x	12.01	x	41.38	x	0.63	x	0.7	=	151.88	(81)
Northwest 0.9x	0.77	x	12.01	x	67.96	x	0.63	x	0.7	=	249.43	(81)
Northwest 0.9x	0.77	x	12.01	x	91.35	x	0.63	x	0.7	=	335.28	(81)
Northwest 0.9x	0.77	x	12.01	x	97.38	x	0.63	x	0.7	=	357.44	(81)
Northwest 0.9x	0.77	x	12.01	x	91.1	x	0.63	x	0.7	=	334.38	(81)
Northwest 0.9x	0.77	x	12.01	x	72.63	x	0.63	x	0.7	=	266.57	(81)
Northwest 0.9x	0.77	x	12.01	x	50.42	x	0.63	x	0.7	=	185.06	(81)
Northwest 0.9x	0.77	x	12.01	x	28.07	x	0.63	x	0.7	=	103.02	(81)
Northwest 0.9x	0.77	x	12.01	x	14.2	x	0.63	x	0.7	=	52.11	(81)
Northwest 0.9x	0.77	x	12.01	x	9.21	x	0.63	x	0.7	=	33.82	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	77.65	158.07	284.79	467.7	628.68	670.24	627	499.85	347.02	193.17	97.71	63.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	543.2	621.43	733.02	891.38	1027.21	1044.67	985.84	865.01	724.85	595.78	528.82	516.12	(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	0.95	0.83	0.64	0.48	0.56	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.74	19.88	20.16	20.54	20.85	20.97	20.99	20.99	20.87	20.47	20.04	19.72	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	19.99	20	20	20	20	19.99	19.99	19.98	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.94	0.78	0.55	0.37	0.45	0.78	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.29	18.5	18.9	19.45	19.84	19.98	20	20	19.89	19.36	18.74	18.26	(90)

fLA = Living area ÷ (4) = 0.31 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.74	18.93	19.29	19.79	20.16	20.29	20.31	20.31	20.2	19.71	19.15	18.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.74	18.93	19.29	19.79	20.16	20.29	20.31	20.31	20.2	19.71	19.15	18.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.79	0.57	0.41	0.48	0.8	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	541.77	618	720.66	831.58	812.88	600.17	400.05	417.68	579.45	578.27	525.99	515.07	(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=	1608.64	1559.01	1418.18	1194.94	925.81	617.13	402.3	422.93	663.79	997.02	1323.89	1602.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	793.75	632.36	518.96	261.62	84.02	0	0	0	0	311.55	574.49	808.95	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3985.69 (98)

Space heating requirement in kWh/m²/year 40.48 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	793.75	632.36	518.96	261.62	84.02	0	0	0	0	311.55	574.49	808.95	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	848.93	676.32	555.03	279.81	89.86	0	0	0	0	333.21	614.42	865.18	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4262.77 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	207.95	183.21	192.22	172.05	168.42	150.22	144.01	158.38	158.21	178.42	188.99	202.86

Efficiency of water heater 79.8 (216)

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(217)m=	88.05	87.85	87.33	85.93	83.07	79.8	79.8	79.8	79.8	86.29	87.59	88.13

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	236.18	208.54	220.1	200.23	202.75	188.24	180.46	198.47	198.26	206.78	215.76	230.18

Total = Sum(219a)$_{1...12}$ = 2485.96 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4262.77
Water heating fuel used		2485.96
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		399.64 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	920.76 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	536.97 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1457.72 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	207.41 (268)
Total CO2, kg/year	sum of (265)…(271) =			1704.06 (272)

TER = 17.31 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 3 4

Address : R 3 4, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	98.47 (1a)	x	2.55 (2a)	=	251.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	98.47 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	251.1	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.38	0.35	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			10.51	x	1/[1/(1.4)+ 0.04]	=	13.93			(27)
Windows Type 2			12.01	x	1/[1/(1.4)+ 0.04]	=	15.92			(27)
Walls Type1	51.1	22.52	28.58	x	0.18	=	5.14			(29)
Walls Type2	3.83	2.1	1.73	x	0.18	=	0.31			(29)
Walls Type3	14.23	0	14.23	x	0.18	=	2.56			(29)
Total area of elements, m²			69.16							(31)
Party wall			41.03	x	0	=	0			(32)
Party floor			98.47							(32a)
Party ceiling			98.47							(32b)
Internal wall **			180.79							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.97 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14949.67 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.59 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 46.56 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	48.07	47.82	47.56	46.38	46.15	45.12	45.12	44.93	45.52	46.15	46.6	47.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.64	94.38	94.13	92.94	92.72	91.68	91.68	91.49	92.08	92.72	93.17	93.64	

Average = Sum(39)$_{1...12}$ /12= 92.94 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.96	0.96	0.96	0.94	0.94	0.93	0.93	0.93	0.94	0.94	0.95	0.95	

Average = Sum(40)$_{1...12}$ /12= 0.94 (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 2.72 (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 98.92 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	108.81	104.85	100.89	96.94	92.98	89.02	89.02	92.98	96.94	100.89	104.85	108.81	

Total = Sum(44)$_{1...12}$ = 1187 (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=	161.36	141.13	145.63	126.96	121.82	105.12	97.41	111.78	113.12	131.83	143.9	156.27	

Total = Sum(45)$_{1...12}$ = 1556.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.2	21.17	21.84	19.04	18.27	15.77	14.61	16.77	16.97	19.77	21.59	23.44	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	207.95	183.21	192.22	172.05	168.42	150.22	144.01	158.38	158.21	178.42	188.99	202.86	(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=	207.95	183.21	192.22	172.05	168.42	150.22	144.01	158.38	158.21	178.42	188.99	202.86	

Output from water heater (annual)$_{1...12}$ — 2104.96 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.93	80.59	85.7	78.29	77.78	71.03	69.67	74.44	73.69	81.11	83.92	89.23	(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=	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.63	20.1	16.35	12.37	9.25	7.81	8.44	10.97	14.72	18.69	21.82	23.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	253.83	256.46	249.83	235.7	217.86	201.09	189.9	187.26	193.9	208.03	225.87	242.63	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	(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=	-109	-109	-109	-109	-109	-109	-109	-109	-109	-109	-109	-109	(71)

Water heating gains (Table 5)

(72)m=	122.21	119.93	115.19	108.73	104.55	98.65	93.64	100.06	102.34	109.02	116.56	119.94	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	465.55	463.37	448.23	423.68	398.53	374.43	358.84	365.16	377.83	402.61	431.11	452.7	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast 0.9x	0.77	x	10.51	x	11.28	x	0.63	x	0.7	=	36.24	(75)
Northeast 0.9x	0.77	x	10.51	x	22.97	x	0.63	x	0.7	=	73.77	(75)
Northeast 0.9x	0.77	x	10.51	x	41.38	x	0.63	x	0.7	=	132.91	(75)
Northeast 0.9x	0.77	x	10.51	x	67.96	x	0.63	x	0.7	=	218.27	(75)
Northeast 0.9x	0.77	x	10.51	x	91.35	x	0.63	x	0.7	=	293.4	(75)
Northeast 0.9x	0.77	x	10.51	x	97.38	x	0.63	x	0.7	=	312.8	(75)
Northeast 0.9x	0.77	x	10.51	x	91.1	x	0.63	x	0.7	=	292.62	(75)
Northeast 0.9x	0.77	x	10.51	x	72.63	x	0.63	x	0.7	=	233.28	(75)
Northeast 0.9x	0.77	x	10.51	x	50.42	x	0.63	x	0.7	=	161.95	(75)
Northeast 0.9x	0.77	x	10.51	x	28.07	x	0.63	x	0.7	=	90.15	(75)
Northeast 0.9x	0.77	x	10.51	x	14.2	x	0.63	x	0.7	=	45.6	(75)
Northeast 0.9x	0.77	x	10.51	x	9.21	x	0.63	x	0.7	=	29.6	(75)
Northwest 0.9x	0.77	x	12.01	x	11.28	x	0.63	x	0.7	=	41.41	(81)
Northwest 0.9x	0.77	x	12.01	x	22.97	x	0.63	x	0.7	=	84.3	(81)
Northwest 0.9x	0.77	x	12.01	x	41.38	x	0.63	x	0.7	=	151.88	(81)
Northwest 0.9x	0.77	x	12.01	x	67.96	x	0.63	x	0.7	=	249.43	(81)
Northwest 0.9x	0.77	x	12.01	x	91.35	x	0.63	x	0.7	=	335.28	(81)
Northwest 0.9x	0.77	x	12.01	x	97.38	x	0.63	x	0.7	=	357.44	(81)
Northwest 0.9x	0.77	x	12.01	x	91.1	x	0.63	x	0.7	=	334.38	(81)
Northwest 0.9x	0.77	x	12.01	x	72.63	x	0.63	x	0.7	=	266.57	(81)
Northwest 0.9x	0.77	x	12.01	x	50.42	x	0.63	x	0.7	=	185.06	(81)
Northwest 0.9x	0.77	x	12.01	x	28.07	x	0.63	x	0.7	=	103.02	(81)
Northwest 0.9x	0.77	x	12.01	x	14.2	x	0.63	x	0.7	=	52.11	(81)
Northwest 0.9x	0.77	x	12.01	x	9.21	x	0.63	x	0.7	=	33.82	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	77.65	158.07	284.79	467.7	628.68	670.24	627	499.85	347.02	193.17	97.71	63.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	543.2	621.43	733.02	891.38	1027.21	1044.67	985.84	865.01	724.85	595.78	528.82	516.12	(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	0.93	0.77	0.55	0.41	0.48	0.79	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.11	20.37	20.71	20.93	20.99	21	21	20.94	20.62	20.24	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.12	20.12	20.12	20.13	20.13	20.14	20.14	20.14	20.14	20.13	20.13	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.98	0.91	0.72	0.48	0.33	0.39	0.72	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.73	18.93	19.31	19.8	20.07	20.14	20.14	20.14	20.09	19.68	19.13	18.71	(90)

fLA = Living area ÷ (4) = 0.31 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.12	19.3	19.64	20.08	20.34	20.4	20.41	20.41	20.36	19.98	19.48	19.1	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.12	19.3	19.64	20.08	20.34	20.4	20.41	20.41	20.36	19.98	19.48	19.1	(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=	1	0.99	0.98	0.91	0.73	0.5	0.35	0.42	0.74	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	541.87	617.9	718.57	813.01	751.68	527.47	348.84	365.62	538.39	574.18	525.92	515.17	(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=	1402.88	1359.39	1236.78	1039.4	800.98	532.16	349.3	366.87	576.23	869.54	1153.3	1395.19	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	640.6	498.28	385.55	163	36.68	0	0	0	0	219.75	451.71	654.74	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3050.31 (98)

Space heating requirement in kWh/m²/year 30.98 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	640.6	498.28	385.55	163	36.68	0	0	0	0	219.75	451.71	654.74	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	685.13	532.92	412.35	174.33	39.23	0	0	0	0	235.03	483.12	700.25	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3262.37 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	207.95	183.21	192.22	172.05	168.42	150.22	144.01	158.38	158.21	178.42	188.99	202.86

Efficiency of water heater 79.8 (216)

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(217)m=	87.62	87.35	86.64	84.67	81.52	79.8	79.8	79.8	79.8	85.37	87.06	87.72

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	237.33	209.74	221.88	203.21	206.59	188.24	180.46	198.47	198.26	209	217.09	231.27

Total = Sum(219a)$_{1...12}$ = 2501.54 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3262.37	
Water heating fuel used		2501.54	
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		399.64	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	704.67	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	540.33	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1245	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	207.41	(268)
Total CO2, kg/year	sum of (265)…(271) =				1491.34	(272)

TER = 15.15 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 3 4 TF

Address : R 3 4, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	98.47	(1a) x	2.55	(2a) =	251.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	98.47	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		251.1	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.31 (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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.38	0.35	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			10.51	x1/[1/(1.4)+ 0.04]		=	13.93			(27)
Windows Type 2			12.01	x1/[1/(1.4)+ 0.04]		=	15.92			(27)
Walls Type1	51.1	22.52	28.58	x	0.18	=	5.14			(29)
Walls Type2	3.83	2.1	1.73	x	0.18	=	0.31			(29)
Walls Type3	14.23	0	14.23	x	0.18	=	2.56			(29)
Roof	98.47	0	98.47	x	0.13	=	12.8			(30)
Total area of elements, m²			167.63							(31)
Party wall			41.03	x	0	=	0			(32)
Party floor			98.47							(32a)
Internal wall **			180.79							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 52.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12881.8 (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 21.81 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 74.58 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	48.07	47.82	47.56	46.38	46.15	45.12	45.12	44.93	45.52	46.15	46.6	47.07	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	122.66	122.4	122.15	120.96	120.74	119.7	119.7	119.51	120.1	120.74	121.19	121.66	

Average = Sum(39)$_{1...12}$ /12= 120.96 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.25	1.24	1.24	1.23	1.23	1.22	1.22	1.21	1.22	1.23	1.23	1.24	

Average = Sum(40)$_{1...12}$ /12= 1.23 (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 2.72 (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 98.92 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	108.81	104.85	100.89	96.94	92.98	89.02	89.02	92.98	96.94	100.89	104.85	108.81	

Total = Sum(44)$_{1...12}$ = 1187 (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=	161.36	141.13	145.63	126.96	121.82	105.12	97.41	111.78	113.12	131.83	143.9	156.27	

Total = Sum(45)$_{1...12}$ = 1556.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.2	21.17	21.84	19.04	18.27	15.77	14.61	16.77	16.97	19.77	21.59	23.44	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	207.95	183.21	192.22	172.05	168.42	150.22	144.01	158.38	158.21	178.42	188.99	202.86	(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=	207.95	183.21	192.22	172.05	168.42	150.22	144.01	158.38	158.21	178.42	188.99	202.86	

Output from water heater (annual)$_{1...12}$ — 2104.96 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.93	80.59	85.7	78.29	77.78	71.03	69.67	74.44	73.69	81.11	83.92	89.23	(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=	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	136.25	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.63	20.1	16.35	12.37	9.25	7.81	8.44	10.97	14.72	18.69	21.82	23.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	253.83	256.46	249.83	235.7	217.86	201.09	189.9	187.26	193.9	208.03	225.87	242.63	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	36.62	(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=	-109	-109	-109	-109	-109	-109	-109	-109	-109	-109	-109	-109	(71)

Water heating gains (Table 5)

(72)m=	122.21	119.93	115.19	108.73	104.55	98.65	93.64	100.06	102.34	109.02	116.56	119.94	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	465.55	463.37	448.23	423.68	398.53	374.43	358.84	365.16	377.83	402.61	431.11	452.7	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.77	x	10.51	x	11.28	x	0.63	x	0.7	=	36.24	(75)
Northeast	0.9x	0.77	x	10.51	x	22.97	x	0.63	x	0.7	=	73.77	(75)
Northeast	0.9x	0.77	x	10.51	x	41.38	x	0.63	x	0.7	=	132.91	(75)
Northeast	0.9x	0.77	x	10.51	x	67.96	x	0.63	x	0.7	=	218.27	(75)
Northeast	0.9x	0.77	x	10.51	x	91.35	x	0.63	x	0.7	=	293.4	(75)
Northeast	0.9x	0.77	x	10.51	x	97.38	x	0.63	x	0.7	=	312.8	(75)
Northeast	0.9x	0.77	x	10.51	x	91.1	x	0.63	x	0.7	=	292.62	(75)
Northeast	0.9x	0.77	x	10.51	x	72.63	x	0.63	x	0.7	=	233.28	(75)
Northeast	0.9x	0.77	x	10.51	x	50.42	x	0.63	x	0.7	=	161.95	(75)
Northeast	0.9x	0.77	x	10.51	x	28.07	x	0.63	x	0.7	=	90.15	(75)
Northeast	0.9x	0.77	x	10.51	x	14.2	x	0.63	x	0.7	=	45.6	(75)
Northeast	0.9x	0.77	x	10.51	x	9.21	x	0.63	x	0.7	=	29.6	(75)
Northwest	0.9x	0.77	x	12.01	x	11.28	x	0.63	x	0.7	=	41.41	(81)
Northwest	0.9x	0.77	x	12.01	x	22.97	x	0.63	x	0.7	=	84.3	(81)
Northwest	0.9x	0.77	x	12.01	x	41.38	x	0.63	x	0.7	=	151.88	(81)
Northwest	0.9x	0.77	x	12.01	x	67.96	x	0.63	x	0.7	=	249.43	(81)
Northwest	0.9x	0.77	x	12.01	x	91.35	x	0.63	x	0.7	=	335.28	(81)
Northwest	0.9x	0.77	x	12.01	x	97.38	x	0.63	x	0.7	=	357.44	(81)
Northwest	0.9x	0.77	x	12.01	x	91.1	x	0.63	x	0.7	=	334.38	(81)
Northwest	0.9x	0.77	x	12.01	x	72.63	x	0.63	x	0.7	=	266.57	(81)
Northwest	0.9x	0.77	x	12.01	x	50.42	x	0.63	x	0.7	=	185.06	(81)
Northwest	0.9x	0.77	x	12.01	x	28.07	x	0.63	x	0.7	=	103.02	(81)
Northwest	0.9x	0.77	x	12.01	x	14.2	x	0.63	x	0.7	=	52.11	(81)
Northwest	0.9x	0.77	x	12.01	x	9.21	x	0.63	x	0.7	=	33.82	(81)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	77.65	158.07	284.79	467.7	628.68	670.24	627	499.85	347.02	193.17	97.71	63.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	543.2	621.43	733.02	891.38	1027.21	1044.67	985.84	865.01	724.85	595.78	528.82	516.12	(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	0.96	0.86	0.68	0.52	0.61	0.88	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.73	20.02	20.43	20.78	20.95	20.99	20.98	20.82	20.37	19.91	19.56	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.88	19.89	19.89	19.9	19.9	19.91	19.91	19.91	19.9	19.9	19.9	19.89	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.95	0.81	0.59	0.4	0.48	0.81	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18	18.22	18.64	19.23	19.68	19.87	19.9	19.9	19.75	19.15	18.49	17.97	(90)

fLA = Living area ÷ (4) = 0.31 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.5	18.69	19.07	19.6	20.03	20.21	20.24	20.24	20.09	19.54	18.93	18.47	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.5	18.69	19.07	19.6	20.03	20.21	20.24	20.24	20.09	19.54	18.93	18.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.82	0.61	0.44	0.52	0.82	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	541.67	617.93	721.26	838.4	840.07	640.59	431.29	448.22	597.39	579.61	525.93	514.97	(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=	1741.81	1688.13	1535.32	1294.7	1005.27	671.65	436.16	458.64	719.12	1078.85	1434.03	1736.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	892.91	719.18	605.65	328.53	122.91	0	0	0	0	371.44	653.84	908.78	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4603.24 (98)

Space heating requirement in kWh/m²/year 46.75 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	892.91	719.18	605.65	328.53	122.91	0	0	0	0	371.44	653.84	908.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	954.98	769.18	647.76	351.37	131.45	0	0	0	0	397.26	699.29	971.96	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4923.25 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	207.95	183.21	192.22	172.05	168.42	150.22	144.01	158.38	158.21	178.42	188.99	202.86

Efficiency of water heater 79.8 (216)

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(217)m=	88.26	88.1	87.67	86.51	83.99	79.8	79.8	79.8	79.8	86.73	87.86	88.34	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	235.6	207.95	219.26	198.88	200.52	188.24	180.46	198.47	198.26	205.73	215.11	229.64	

Total = Sum(219a)$_{1...12}$ = 2478.14 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		4923.25	
Water heating fuel used		2478.14	
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		399.64	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1063.42	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	535.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1598.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	207.41	(268)
Total CO2, kg/year	sum of (265)…(271) =			1845.04	(272)

TER = 18.74 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 3 5 GF

Address : R 3 5, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	84.06 (1a)	x	2.55 (2a)	=	214.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	84.06 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	214.35	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.41	0.36	0.36	0.31	0.31	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			10.46	x1/[1/(1.4)+ 0.04]		=	13.87			(27)
Windows Type 2			8.46	x1/[1/(1.4)+ 0.04]		=	11.22			(27)
Floor			84.06	x	0.13	=	10.9278			(28)
Walls Type1	49.11	18.92	30.19	x	0.18	=	5.43			(29)
Walls Type2	13.44	2.1	11.34	x	0.18	=	2.04			(29)
Total area of elements, m²			146.61							(31)
Party wall			35.6	x	0	=	0			(32)
Party ceiling			84.06							(32b)
Internal wall **			154.33							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.59 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11667.3 (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 9.22 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 54.81 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	41.69	41.44	41.2	40.07	39.86	38.88	38.88	38.69	39.25	39.86	40.29	40.73	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.49	96.25	96.01	94.88	94.67	93.68	93.68	93.5	94.06	94.67	95.09	95.54	

Average = Sum(39)$_{1...12}$ /12= 94.88 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.14	1.14	1.13	1.13	1.11	1.11	1.11	1.12	1.13	1.13	1.14	

Average = Sum(40)$_{1...12}$ /12= 1.13 (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 2.54 (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 94.42 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	103.86	100.08	96.3	92.53	88.75	84.97	84.97	88.75	92.53	96.3	100.08	103.86	

Total = Sum(44)$_{1...12}$ = 1132.99 (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=	154.02	134.7	139	121.19	116.28	100.34	92.98	106.7	107.97	125.83	137.35	149.16	

Total = Sum(45)$_{1...12}$ = 1485.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.1	20.21	20.85	18.18	17.44	15.05	13.95	16	16.2	18.87	20.6	22.37	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.61	176.79	185.6	166.28	162.88	145.43	139.58	153.29	153.06	172.43	182.45	195.75	(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=	200.61	176.79	185.6	166.28	162.88	145.43	139.58	153.29	153.06	172.43	182.45	195.75	

Output from water heater (annual)$_{1...12}$ | 2034.14 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.49	78.46	83.49	76.37	75.94	69.44	68.19	72.75	71.97	79.11	81.74	86.87	(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=	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.3	18.03	14.66	11.1	8.3	7	7.57	9.84	13.21	16.77	19.57	20.86	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	227.72	230.08	224.12	211.45	195.45	180.41	170.36	168	173.95	186.63	202.63	217.67	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	(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=	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	(71)

Water heating gains (Table 5)

(72)m=	118.93	116.75	112.22	106.07	102.07	96.44	91.66	97.79	99.96	106.34	113.53	116.76	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	430.98	428.89	415.04	392.65	369.84	347.88	333.62	339.65	351.15	373.76	399.76	419.32	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	10.46	x	11.28	x	0.63	x	0.7	=	36.07	(75)
Northeast 0.9x	0.77	x	10.46	x	22.97	x	0.63	x	0.7	=	73.42	(75)

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Northeast	0.9x	0.77	x	10.46	x	41.38	x	0.63	x	0.7	=	132.28	(75)
Northeast	0.9x	0.77	x	10.46	x	67.96	x	0.63	x	0.7	=	217.24	(75)
Northeast	0.9x	0.77	x	10.46	x	91.35	x	0.63	x	0.7	=	292.01	(75)
Northeast	0.9x	0.77	x	10.46	x	97.38	x	0.63	x	0.7	=	311.31	(75)
Northeast	0.9x	0.77	x	10.46	x	91.1	x	0.63	x	0.7	=	291.22	(75)
Northeast	0.9x	0.77	x	10.46	x	72.63	x	0.63	x	0.7	=	232.17	(75)
Northeast	0.9x	0.77	x	10.46	x	50.42	x	0.63	x	0.7	=	161.18	(75)
Northeast	0.9x	0.77	x	10.46	x	28.07	x	0.63	x	0.7	=	89.72	(75)
Northeast	0.9x	0.77	x	10.46	x	14.2	x	0.63	x	0.7	=	45.38	(75)
Northeast	0.9x	0.77	x	10.46	x	9.21	x	0.63	x	0.7	=	29.46	(75)
Southeast	0.9x	0.77	x	8.46	x	36.79	x	0.63	x	0.7	=	95.13	(77)
Southeast	0.9x	0.77	x	8.46	x	62.67	x	0.63	x	0.7	=	162.04	(77)
Southeast	0.9x	0.77	x	8.46	x	85.75	x	0.63	x	0.7	=	221.71	(77)
Southeast	0.9x	0.77	x	8.46	x	106.25	x	0.63	x	0.7	=	274.71	(77)
Southeast	0.9x	0.77	x	8.46	x	119.01	x	0.63	x	0.7	=	307.7	(77)
Southeast	0.9x	0.77	x	8.46	x	118.15	x	0.63	x	0.7	=	305.48	(77)
Southeast	0.9x	0.77	x	8.46	x	113.91	x	0.63	x	0.7	=	294.51	(77)
Southeast	0.9x	0.77	x	8.46	x	104.39	x	0.63	x	0.7	=	269.9	(77)
Southeast	0.9x	0.77	x	8.46	x	92.85	x	0.63	x	0.7	=	240.07	(77)
Southeast	0.9x	0.77	x	8.46	x	69.27	x	0.63	x	0.7	=	179.09	(77)
Southeast	0.9x	0.77	x	8.46	x	44.07	x	0.63	x	0.7	=	113.94	(77)
Southeast	0.9x	0.77	x	8.46	x	31.49	x	0.63	x	0.7	=	81.41	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	131.2	235.46	353.99	491.95	599.71	616.79	585.73	502.07	401.25	268.81	159.33	110.87	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	562.18	664.35	769.03	884.59	969.55	964.67	919.35	841.72	752.4	642.58	559.09	530.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.79	0.6	0.44	0.5	0.77	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	20	20.28	20.63	20.88	20.98	21	20.99	20.92	20.59	20.14	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.96	19.97	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.98	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.74	0.51	0.34	0.4	0.69	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.67	19.07	19.56	19.87	19.97	19.99	19.99	19.93	19.51	18.87	18.37	(90)

fLA = Living area ÷ (4) = 0.31 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.84	19.08	19.45	19.89	20.18	20.29	20.3	20.3	20.23	19.84	19.27	18.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.84	19.08	19.45	19.89	20.18	20.29	20.3	20.3	20.23	19.84	19.27	18.81	(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	0.96	0.9	0.75	0.54	0.38	0.43	0.71	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	558.79	655.2	741.61	793.05	725.78	521.13	345.2	361.8	534.24	601.07	551.88	527.76	(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=	1403.43	1364.84	1242.85	1042.63	802.59	532.59	346.62	364.57	577.05	875.11	1156.92	1395.73	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	628.41	476.87	372.92	179.7	57.14	0	0	0	0	203.89	435.62	645.77	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3000.33 (98)

Space heating requirement in kWh/m²/year 35.69 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	628.41	476.87	372.92	179.7	57.14	0	0	0	0	203.89	435.62	645.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	672.1	510.03	398.85	192.19	61.12	0	0	0	0	218.06	465.91	690.66	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3208.91 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	200.61	176.79	185.6	166.28	162.88	145.43	139.58	153.29	153.06	172.43	182.45	195.75	

Efficiency of water heater 79.8 (216)

(217)m=	87.66	87.33	86.64	85.02	82.33	79.8	79.8	79.8	79.8	85.26	87.05	87.76	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	228.86	202.43	214.22	195.57	197.84	182.25	174.91	192.1	191.81	202.23	209.58	223.05	

Total = Sum(219a)$_{1...12}$ = 2414.84 (219)

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Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3208.91	
Water heating fuel used			2414.84	
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			358.47	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	693.12	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	521.61	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1214.73	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	186.05	(268)
Total CO2, kg/year	sum of (265)…(271) =				1439.7	(272)

TER = 17.13 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: R 3 5

Address : R 3 5, 217 High Street, Yiewsley, Hillingdon, TBA

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	84.06 (1a)	x	2.55 (2a)	=	214.35	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	84.06 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	214.35	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.39	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.33	(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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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.41	0.36	0.36	0.31	0.31	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1	=	2.1			(26)
Windows Type 1			10.46	x1/[1/(1.4)+ 0.04]		=	13.87			(27)
Windows Type 2			8.46	x1/[1/(1.4)+ 0.04]		=	11.22			(27)
Walls Type1	49.11	18.92	30.19	x	0.18	=	5.43			(29)
Walls Type2	13.44	2.1	11.34	x	0.18	=	2.04			(29)
Total area of elements, m²			62.55							(31)
Party wall			35.6	x	0	=	0			(32)
Party floor			84.06							(32a)
Party ceiling			84.06							(32b)
Internal wall **			154.33							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.66 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11247 (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 5.69 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 40.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	41.69	41.44	41.2	40.07	39.86	38.88	38.88	38.69	39.25	39.86	40.29	40.73	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	82.03	81.78	81.54	80.42	80.2	79.22	79.22	79.04	79.6	80.2	80.63	81.08	

Average = Sum(39)$_{1...12}$ /12= 80.41 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.97	0.97	0.96	0.95	0.94	0.94	0.94	0.95	0.95	0.96	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.96 (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 2.54 (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 94.42 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	103.86	100.08	96.3	92.53	88.75	84.97	84.97	88.75	92.53	96.3	100.08	103.86	

Total = Sum(44)$_{1...12}$ = 1132.99 (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=	154.02	134.7	139	121.19	116.28	100.34	92.98	106.7	107.97	125.83	137.35	149.16	

Total = Sum(45)$_{1...12}$ = 1485.53 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.1	20.21	20.85	18.18	17.44	15.05	13.95	16	16.2	18.87	20.6	22.37	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.61	176.79	185.6	166.28	162.88	145.43	139.58	153.29	153.06	172.43	182.45	195.75	(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=	200.61	176.79	185.6	166.28	162.88	145.43	139.58	153.29	153.06	172.43	182.45	195.75	

Output from water heater (annual)$_{1...12}$ | 2034.14 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.49	78.46	83.49	76.37	75.94	69.44	68.19	72.75	71.97	79.11	81.74	86.87	(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=	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	126.77	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.3	18.03	14.66	11.1	8.3	7	7.57	9.84	13.21	16.77	19.57	20.86	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	227.72	230.08	224.12	211.45	195.45	180.41	170.36	168	173.95	186.63	202.63	217.67	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	35.68	(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=	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	-101.42	(71)

Water heating gains (Table 5)

(72)m=	118.93	116.75	112.22	106.07	102.07	96.44	91.66	97.79	99.96	106.34	113.53	116.76	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	430.98	428.89	415.04	392.65	369.84	347.88	333.62	339.65	351.15	373.76	399.76	419.32	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	10.46	x	11.28	x	0.63	x	0.7	=	36.07	(75)
Northeast 0.9x	0.77	x	10.46	x	22.97	x	0.63	x	0.7	=	73.42	(75)

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Northeast	0.9x	0.77	x	10.46	x	41.38	x	0.63	x	0.7	=	132.28	(75)
Northeast	0.9x	0.77	x	10.46	x	67.96	x	0.63	x	0.7	=	217.24	(75)
Northeast	0.9x	0.77	x	10.46	x	91.35	x	0.63	x	0.7	=	292.01	(75)
Northeast	0.9x	0.77	x	10.46	x	97.38	x	0.63	x	0.7	=	311.31	(75)
Northeast	0.9x	0.77	x	10.46	x	91.1	x	0.63	x	0.7	=	291.22	(75)
Northeast	0.9x	0.77	x	10.46	x	72.63	x	0.63	x	0.7	=	232.17	(75)
Northeast	0.9x	0.77	x	10.46	x	50.42	x	0.63	x	0.7	=	161.18	(75)
Northeast	0.9x	0.77	x	10.46	x	28.07	x	0.63	x	0.7	=	89.72	(75)
Northeast	0.9x	0.77	x	10.46	x	14.2	x	0.63	x	0.7	=	45.38	(75)
Northeast	0.9x	0.77	x	10.46	x	9.21	x	0.63	x	0.7	=	29.46	(75)
Southeast	0.9x	0.77	x	8.46	x	36.79	x	0.63	x	0.7	=	95.13	(77)
Southeast	0.9x	0.77	x	8.46	x	62.67	x	0.63	x	0.7	=	162.04	(77)
Southeast	0.9x	0.77	x	8.46	x	85.75	x	0.63	x	0.7	=	221.71	(77)
Southeast	0.9x	0.77	x	8.46	x	106.25	x	0.63	x	0.7	=	274.71	(77)
Southeast	0.9x	0.77	x	8.46	x	119.01	x	0.63	x	0.7	=	307.7	(77)
Southeast	0.9x	0.77	x	8.46	x	118.15	x	0.63	x	0.7	=	305.48	(77)
Southeast	0.9x	0.77	x	8.46	x	113.91	x	0.63	x	0.7	=	294.51	(77)
Southeast	0.9x	0.77	x	8.46	x	104.39	x	0.63	x	0.7	=	269.9	(77)
Southeast	0.9x	0.77	x	8.46	x	92.85	x	0.63	x	0.7	=	240.07	(77)
Southeast	0.9x	0.77	x	8.46	x	69.27	x	0.63	x	0.7	=	179.09	(77)
Southeast	0.9x	0.77	x	8.46	x	44.07	x	0.63	x	0.7	=	113.94	(77)
Southeast	0.9x	0.77	x	8.46	x	31.49	x	0.63	x	0.7	=	81.41	(77)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	131.2	235.46	353.99	491.95	599.71	616.79	585.73	502.07	401.25	268.81	159.33	110.87	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	562.18	664.35	769.03	884.59	969.55	964.67	919.35	841.72	752.4	642.58	559.09	530.19	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.89	0.72	0.52	0.38	0.43	0.7	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.07	20.24	20.5	20.79	20.95	20.99	21	21	20.97	20.73	20.34	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.11	20.11	20.12	20.12	20.13	20.13	20.13	20.13	20.12	20.12	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.86	0.67	0.45	0.3	0.35	0.62	0.92	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.86	19.11	19.48	19.88	20.08	20.13	20.13	20.13	20.11	19.83	19.27	18.82	(90)

fLA = Living area ÷ (4) = 0.31 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.23	19.46	19.79	20.16	20.35	20.4	20.4	20.4	20.37	20.11	19.61	19.2	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.23	19.46	19.79	20.16	20.35	20.4	20.4	20.4	20.37	20.11	19.61	19.2	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.86	0.68	0.47	0.33	0.37	0.64	0.92	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	558.69	653.96	734.9	763.98	662.57	456.16	300.77	315.62	483.39	588.8	550.93	527.76	(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=	1224.9	1190.89	1084.06	905.68	693.46	459.16	301.05	316.22	499.36	762.48	1008.36	1216.07	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	495.66	360.82	259.78	102.02	22.98	0	0	0	0	129.22	329.35	512.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2211.94 (98)

Space heating requirement in kWh/m²/year 26.31 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	495.66	360.82	259.78	102.02	22.98	0	0	0	0	129.22	329.35	512.11	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	530.12	385.91	277.84	109.12	24.58	0	0	0	0	138.2	352.25	547.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2365.71 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	200.61	176.79	185.6	166.28	162.88	145.43	139.58	153.29	153.06	172.43	182.45	195.75	

Efficiency of water heater 79.8 (216)

(217)m=	87.13	86.68	85.71	83.56	80.98	79.8	79.8	79.8	79.8	84.06	86.37	87.26	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	230.23	203.96	216.54	199	201.12	182.25	174.91	192.1	191.81	205.13	211.23	224.32	

Total = Sum(219a)$_{1...12}$ = 2432.6 (219)

TER WorkSheet: New dwelling design stage

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2365.71	
Water heating fuel used		2432.6	
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		358.47	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216 =	510.99	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	525.44	(264)
Space and water heating	(261) + (262) + (263) + (264) =		1036.44	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93	(267)
Electricity for lighting	(232) x	0.519 =	186.05	(268)
Total CO2, kg/year	sum of (265)…(271) =		1261.41	(272)

TER = 15.01 (273)