

Proposed improvements at 173-175 Field End Road, Pinner, HA5 1QR

EXISTING BUILDING

Heat loss floors

Floors to flats 1 and 2 above retail space – assumed u value of $0.7\text{W/m}^2\text{K}$ as per Appendix S5.7 of the SAP manual (if this is to be insulated then a better u value could be allocated)

Exposed soffit in flat 5 over access stairwell insulated to $0.2\text{W/m}^2\text{K}$

Heat loss walls

Existing external walls to existing building – insulated to $0.3\text{W/m}^2\text{K}$ (this includes areas of party wall that become heat loss where they protrude above adjacent properties. Assumed 17.62m^2 to flat 4 and 29.22m^2 to flat 5)

Sheltered wall between Flat 2 and stairwell – insulated to $0.3\text{W/m}^2\text{K}$

Party walls solid or filled and sealed

Dwarf walls in roof room area of duplex apartments $0.28\text{W/m}^2\text{K}$

Dormer Cheeks $0.28\text{W/m}^2\text{K}$

Roofs

Cold roof insulated at ceiling level $0.16\text{W/m}^2\text{K}$

Vaulted ceilings (insulated slope) $0.18\text{W/m}^2\text{K}$

Dormer roof (flat roof) $0.18\text{W/m}^2\text{K}$

External openings

Windows Double glazed u-value $1.4\text{W/m}^2\text{K}$ Low E soft coat

Flat entrance Door $1.8\text{W/m}^2\text{K}$

Velux Double glazed u-value $1.4\text{W/m}^2\text{K}$ Low E soft coat

Ventilation

Natural ventilation with local extract

Air permeability – not tested assumed $15\text{m}^3/\text{hm}^2$

Heating

Gas central heating with radiators via Worcester Bosch Greenstar 32CDi Compact ErP

Controls- Timer, room thermostat and TRVs

Hot water (from combi boiler)

Lighting

All light low energy

NEW BUILD

Heat loss floor

Floor above retails space to have an effective u value of $0.11\text{W/m}^2\text{K}$ (see SAP 2012 manual, convention 3.5 – treat as external element but reduce U=value by a factor of 2. Therefore u value $0.22\text{W/m}^2\text{K}$ required)

External wall

Assumed the entire perimeter will be new heat loss wall. U value $0.22\text{W/m}^2\text{K}$

Flat roof

U value $0.14\text{W/m}^2\text{K}$

External openings

Windows Double glazed u-value $1.4\text{W/m}^2\text{K}$ Low E soft coat

Flat entrance Door $1.2\text{W/m}^2\text{K}$

Thermal bridging

Accredited construction details have been assumed

Ventilation

Natural ventilation with local extract

Air permeability $5\text{m}^3/\text{hm}^2$

Heating

Gas central heating with radiators via Worcester Bosch Greenstar 32CDi Compact ErP

Controls- Time and temperature zone control with delayed start thermostat

Hot water (from combi boiler)

Lighting

All light low energy

Overheating

There is an overheating risk if the windows cannot be fully opened all the time. Balcony would need to be secure to allow this.

User Details:

Assessor Name: James Mcglashan **Stroma Number:** STRO000976
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Flat 1

Address : Apartment 1, 173-175 Field End Road, PINNER, HA5 1QR

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	54.71 (1a)	x	2.8 (2a)	=	153.19 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54.71 (4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	153.19 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total		m ³ per hour
Number of chimneys	0	+	0	=	0	x 40 = 0 (6a)
Number of open flues	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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.88 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.75 (21)

Infiltration rate modified for monthly wind speed

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

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

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

0.95	0.94	0.92	0.82	0.8	0.71	0.71	0.69	0.75	0.8	0.84	0.88
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.96 0.94 0.92 0.84 0.82 0.75 0.75 0.74 0.78 0.82 0.85 0.89 (24d)

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

(25)m= 0.96 0.94 0.92 0.84 0.82 0.75 0.75 0.74 0.78 0.82 0.85 0.89 (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			2.25	x 1.8	= 4.05		(26)
Windows Type 1			1.65	x 1/[1/(1.6)+0.04]	= 2.48		(27)
Windows Type 2			1.11	x 1/[1/(1.6)+0.04]	= 1.67		(27)
Floor			54.71	x 0.7	= 38.297		(28)
Walls	35.06	10.53	24.53	x 0.3	= 7.36		(29)
Total area of elements, m²			89.77				(31)
Party wall			48.94	x 0	= 0		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 62.16 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 1094.2 (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 13.46 (36)

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

Total fabric heat loss (33) + (36) = 75.62 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	48.29	47.4	46.52	42.41	41.64	38.06	38.06	37.39	39.44	41.64	43.2	44.83

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

(39)m=	123.92	123.02	122.15	118.03	117.26	113.68	113.68	113.01	115.06	117.26	118.82	120.45
Average = Sum(39) _{1...12} /12=												118.03

Heat loss parameter (HLP), W/m²K

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

(40)m=	2.26	2.25	2.23	2.16	2.14	2.08	2.08	2.07	2.1	2.14	2.17	2.2		
Average = Sum(40) _{1...12} /12=													2.16	(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

1.83

(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

81.72

(43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
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Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	89.89	86.62	83.36	80.09	76.82	73.55	73.55	76.82	80.09	83.36	86.62	89.89		
Total = Sum(44) _{1...12} =													980.66	(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=	133.31	116.59	120.31	104.89	100.65	86.85	80.48	92.35	93.45	108.91	118.89	129.1		
Total = Sum(45) _{1...12} =													1285.8	(45)

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

(46)m=	20	17.49	18.05	15.73	15.1	13.03	12.07	13.85	14.02	16.34	17.83	19.37		(46)
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Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

0

(58)

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

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

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

(61)m=	25.25	22.79	25.21	24.36	25.15	24.31	25.1	25.13	24.33	25.18	24.41	25.24	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	158.56	139.39	145.52	129.25	125.8	111.16	105.58	117.48	117.79	134.09	143.29	154.34	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
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Output from water heater

(64)m=	158.56	139.39	145.52	129.25	125.8	111.16	105.58	117.48	117.79	134.09	143.29	154.34	
Output from water heater (annual) _{1...12}												1582.26	(64)

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

(65)m=	50.64	44.47	46.31	40.97	39.75	34.96	33.03	36.99	37.16	42.51	45.63	49.24	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	109.73	109.73	109.73	109.73	109.73	109.73	109.73	109.73	109.73	109.73	109.73	109.73	(66)

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

(67)m=	37.49	33.3	27.08	20.5	15.33	12.94	13.98	18.17	24.39	30.97	36.15	38.54	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	237.97	240.44	234.21	220.97	204.24	188.53	178.03	175.56	181.78	195.03	211.75	227.47	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	47.8	47.8	47.8	47.8	47.8	47.8	47.8	47.8	47.8	47.8	47.8	47.8	(69)
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Pumps and fans gains (Table 5a)

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

(71)m=	-73.15	-73.15	-73.15	-73.15	-73.15	-73.15	-73.15	-73.15	-73.15	-73.15	-73.15	-73.15	(71)
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Water heating gains (Table 5)

(72)m=	68.06	66.17	62.24	56.9	53.43	48.55	44.4	49.72	51.61	57.14	63.38	66.18	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	430.9	427.29	410.92	385.75	360.38	337.39	323.79	330.83	345.16	370.51	398.66	419.56	(73)
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6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	1.11	x	11.28	x	0.63	x	0.7	=	11.48	(75)
Northeast 0.9x	0.77	x	1.11	x	22.97	x	0.63	x	0.7	=	23.37	(75)
Northeast 0.9x	0.77	x	1.11	x	41.38	x	0.63	x	0.7	=	42.11	(75)
Northeast 0.9x	0.77	x	1.11	x	67.96	x	0.63	x	0.7	=	69.16	(75)
Northeast 0.9x	0.77	x	1.11	x	91.35	x	0.63	x	0.7	=	92.96	(75)

Northeast 0.9x	0.77	x	1.11	x	97.38	x	0.63	x	0.7	=	99.11	(75)
Northeast 0.9x	0.77	x	1.11	x	91.1	x	0.63	x	0.7	=	92.71	(75)
Northeast 0.9x	0.77	x	1.11	x	72.63	x	0.63	x	0.7	=	73.91	(75)
Northeast 0.9x	0.77	x	1.11	x	50.42	x	0.63	x	0.7	=	51.31	(75)
Northeast 0.9x	0.77	x	1.11	x	28.07	x	0.63	x	0.7	=	28.56	(75)
Northeast 0.9x	0.77	x	1.11	x	14.2	x	0.63	x	0.7	=	14.45	(75)
Northeast 0.9x	0.77	x	1.11	x	9.21	x	0.63	x	0.7	=	9.38	(75)
Southwest 0.9x	0.77	x	1.65	x	36.79		0.63	x	0.7	=	55.66	(79)
Southwest 0.9x	0.77	x	1.65	x	62.67		0.63	x	0.7	=	94.81	(79)
Southwest 0.9x	0.77	x	1.65	x	85.75		0.63	x	0.7	=	129.73	(79)
Southwest 0.9x	0.77	x	1.65	x	106.25		0.63	x	0.7	=	160.74	(79)
Southwest 0.9x	0.77	x	1.65	x	119.01		0.63	x	0.7	=	180.04	(79)
Southwest 0.9x	0.77	x	1.65	x	118.15		0.63	x	0.7	=	178.74	(79)
Southwest 0.9x	0.77	x	1.65	x	113.91		0.63	x	0.7	=	172.32	(79)
Southwest 0.9x	0.77	x	1.65	x	104.39		0.63	x	0.7	=	157.92	(79)
Southwest 0.9x	0.77	x	1.65	x	92.85		0.63	x	0.7	=	140.46	(79)
Southwest 0.9x	0.77	x	1.65	x	69.27		0.63	x	0.7	=	104.79	(79)
Southwest 0.9x	0.77	x	1.65	x	44.07		0.63	x	0.7	=	66.67	(79)
Southwest 0.9x	0.77	x	1.65	x	31.49		0.63	x	0.7	=	47.63	(79)

Solar gains in watts, calculated for each month

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

(83)m=	67.14	118.18	171.84	229.89	273	277.84	265.03	231.83	191.78	133.35	81.12	57.01	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	498.05	545.47	582.75	615.64	633.38	615.24	588.82	562.66	536.94	503.87	479.77	476.57	(84)
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7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.96	0.92	0.82	0.7	0.73	0.89	0.96	0.99	0.99	(86)

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

(87)m=	18.75	18.94	19.28	19.78	20.26	20.68	20.87	20.84	20.53	19.93	19.29	18.77	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.16	19.17	19.18	19.23	19.24	19.28	19.28	19.29	19.27	19.24	19.22	19.2	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.97	0.94	0.87	0.71	0.49	0.53	0.8	0.94	0.98	0.99	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.24	17.43	17.77	18.3	18.75	19.14	19.25	19.25	19.02	18.46	17.82	17.28	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.25

(91)

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

(92)m=	17.62	17.8	18.15	18.67	19.13	19.52	19.66	19.65	19.4	18.83	18.19	17.65	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.47	17.65	18	18.52	18.98	19.37	19.51	19.5	19.25	18.68	18.04	17.5	(93)
--------	-------	-------	----	-------	-------	-------	-------	------	-------	-------	-------	------	------

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	0.98	0.97	0.96	0.93	0.86	0.71	0.52	0.56	0.8	0.93	0.97	0.98	(94)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

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

(95)m=	488.62	531.23	559.27	571.05	543.9	438.97	306.03	317.47	428.6	469.26	466.19	468.74	(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, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	1631.39	1569.09	1404.47	1135.7	853.74	542.59	330.69	350.35	592.8	947.04	1299.46	1601.99	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	-------	--------	---------	---------	------

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

(98)m=	850.22	697.45	628.83	406.54	230.53	0	0	0	0	355.47	599.95	843.14	
Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$												4612.12	(98)

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

84.3	(99)
------	------

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

Space heating:

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

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

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

Efficiency of main space heating system 1 90.7 (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)

850.22	697.45	628.83	406.54	230.53	0	0	0	0	355.47	599.95	843.14
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

937.4	768.96	693.31	448.23	254.16	0	0	0	0	391.92	661.47	929.59
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Total ($kWh/year$) = $Sum(211)_{1..5,10..12} =$ 5085.03 (211)

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

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

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

Water heating

Output from water heater (calculated above)

158.56	139.39	145.52	129.25	125.8	111.16	105.58	117.48	117.79	134.09	143.29	154.34
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Efficiency of water heater 87.2 (216)

(217)m= (217)

90.13	90.1	90.02	89.83	89.43	87.2	87.2	87.2	87.2	89.71	90	90.14
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Fuel for water heating, $kWh/month$

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

(219)m=	175.92	154.71	161.65	143.89	140.66	127.48	121.08	134.73	135.08	149.47	159.21	171.23	
Total = $Sum(219a)_{1..12} =$												1775.09	(219)

Annual totals

Space heating fuel used, main system 1

$kWh/year$

$kWh/year$

5085.03

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Water heating fuel used		1775.09	
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		264.86	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48	x 0.01 = 176.96 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 = 61.77 (247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 = 9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19	x 0.01 = 34.94 (250)
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		403.56 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.7 (257)
SAP rating (Section 12)		76.29 (258)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 1098.37 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 383.42 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1481.79 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 137.46 (268)
Total CO2, kg/year	sum of (265)...(271) =		1658.18 (272)
CO2 emissions per m²	(272) ÷ (4) =		30.31 (273)
EI rating (section 14)			78 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	=	6203.73 (261)
Space heating (secondary)	(215) x	3.07	=	0 (263)
Energy for water heating	(219) x	1.22	=	2165.61 (264)
Space and water heating	(261) + (262) + (263) + (264) =			8369.35 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25 (267)
Electricity for lighting	(232) x	0	=	813.13 (268)
'Total Primary Energy		sum of (265)...(271) =		9412.73 (272)
Primary energy kWh/m ² /year		(272) ÷ (4) =		172.05 (273)

User Details:

Assessor Name: James Mcglashan **Stroma Number:** STRO000976
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Flat 2

Address : Apartment 2, 173-175 Field End Road, PINNER, HA5 1QR

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	44.56	(1a) x	2.8	(2a) =	124.77 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	44.56	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			124.77 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.16 (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			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.91 (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) =		0.77 (21)

Infiltration rate modified for monthly wind speed

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

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

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

0.99	0.97	0.95	0.85	0.83	0.74	0.74	0.72	0.77	0.83	0.87	0.91
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.99 0.97 0.95 0.86 0.85 0.77 0.77 0.76 0.8 0.85 0.88 0.91 (24d)

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

(25)m= 0.99 0.97 0.95 0.86 0.85 0.77 0.77 0.76 0.8 0.85 0.88 0.91 (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			2.25	x 1.8	= 4.05		(26)
Windows Type 1			1.65	x 1/[1/(1.6)+0.04]	= 2.48		(27)
Windows Type 2			1.11	x 1/[1/(1.6)+0.04]	= 1.67		(27)
Floor			44.56	x 0.7	= 31.192		(28)
Walls Type1	29.6	8.28	21.32	x 0.3	= 6.39		(29)
Walls Type2	19.38	2.25	17.13	x 0.3	= 5.14		(29)
Total area of elements, m²			93.53				(31)
Party wall			33.12	x 0	= 0		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 59.23 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 891.2 (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 14.03 (36)

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

Total fabric heat loss (33) + (36) = 73.26 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	40.62	39.84	39.08	35.5	34.83	31.71	31.71	31.13	32.91	34.83	36.19	37.6

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

(39)m= 113.88 113.1 112.34 108.76 108.09 104.97 104.97 104.39 106.17 108.09 109.44 110.86
Average = Sum(39)_{1...12} /12= 108.75 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	2.56	2.54	2.52	2.44	2.43	2.36	2.36	2.34	2.38	2.43	2.46	2.49		
Average = Sum(40) _{1...12} /12=													2.44	(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

1.53

(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

70.59

(43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
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Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	77.65	74.82	72	69.18	66.35	63.53	63.53	66.35	69.18	72	74.82	77.65		
Total = Sum(44) _{1...12} =													847.05	(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=	115.15	100.71	103.92	90.6	86.93	75.02	69.52	79.77	80.72	94.07	102.69	111.51		
Total = Sum(45) _{1...12} =													1110.62	(45)

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

(46)m=	17.27	15.11	15.59	13.59	13.04	11.25	10.43	11.97	12.11	14.11	15.4	16.73		(46)
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Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0

(54)

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

0

(55)

Water storage loss calculated for each month

((56)m = (55) x (41)m

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

(61)m=	25.19	22.74	25.15	24.31	25.1	24.27	25.06	25.09	24.29	25.13	24.35	25.18	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	140.33	123.45	129.07	114.91	112.04	99.29	94.58	104.86	105.01	119.2	127.04	136.69	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

Output from water heater

(64)m=	140.33	123.45	129.07	114.91	112.04	99.29	94.58	104.86	105.01	119.2	127.04	136.69	
Output from water heater (annual) _{1...12}												1406.47	(64)

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

(65)m=	44.58	39.17	40.84	36.2	35.18	31.01	29.38	32.8	32.91	37.56	40.23	43.37	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	91.93	91.93	91.93	91.93	91.93	91.93	91.93	91.93	91.93	91.93	91.93	91.93	(66)

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

(67)m=	30.16	26.79	21.79	16.49	12.33	10.41	11.25	14.62	19.62	24.92	29.08	31	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	198.73	200.79	195.59	184.53	170.57	157.44	148.67	146.61	151.81	162.87	176.83	189.96	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	45.72	45.72	45.72	45.72	45.72	45.72	45.72	45.72	45.72	45.72	45.72	45.72	(69)
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Pumps and fans gains (Table 5a)

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

(71)m=	-61.28	-61.28	-61.28	-61.28	-61.28	-61.28	-61.28	-61.28	-61.28	-61.28	-61.28	-61.28	(71)
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Water heating gains (Table 5)

(72)m=	59.92	58.29	54.89	50.28	47.29	43.07	39.49	44.08	45.71	50.49	55.88	58.3	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(73)m=	368.18	365.24	351.64	330.67	309.55	290.29	278.77	284.68	296.51	317.64	341.16	358.62	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	1.11	x	11.28	x	0.63	x	0.7	=	11.48	(75)
Northeast 0.9x	0.77	x	1.11	x	22.97	x	0.63	x	0.7	=	23.37	(75)
Northeast 0.9x	0.77	x	1.11	x	41.38	x	0.63	x	0.7	=	42.11	(75)
Northeast 0.9x	0.77	x	1.11	x	67.96	x	0.63	x	0.7	=	69.16	(75)
Northeast 0.9x	0.77	x	1.11	x	91.35	x	0.63	x	0.7	=	92.96	(75)

Northeast 0.9x	0.77	x	1.11	x	97.38	x	0.63	x	0.7	=	99.11	(75)
Northeast 0.9x	0.77	x	1.11	x	91.1	x	0.63	x	0.7	=	92.71	(75)
Northeast 0.9x	0.77	x	1.11	x	72.63	x	0.63	x	0.7	=	73.91	(75)
Northeast 0.9x	0.77	x	1.11	x	50.42	x	0.63	x	0.7	=	51.31	(75)
Northeast 0.9x	0.77	x	1.11	x	28.07	x	0.63	x	0.7	=	28.56	(75)
Northeast 0.9x	0.77	x	1.11	x	14.2	x	0.63	x	0.7	=	14.45	(75)
Northeast 0.9x	0.77	x	1.11	x	9.21	x	0.63	x	0.7	=	9.38	(75)
Southwest 0.9x	0.77	x	1.65	x	36.79		0.63	x	0.7	=	55.66	(79)
Southwest 0.9x	0.77	x	1.65	x	62.67		0.63	x	0.7	=	94.81	(79)
Southwest 0.9x	0.77	x	1.65	x	85.75		0.63	x	0.7	=	129.73	(79)
Southwest 0.9x	0.77	x	1.65	x	106.25		0.63	x	0.7	=	160.74	(79)
Southwest 0.9x	0.77	x	1.65	x	119.01		0.63	x	0.7	=	180.04	(79)
Southwest 0.9x	0.77	x	1.65	x	118.15		0.63	x	0.7	=	178.74	(79)
Southwest 0.9x	0.77	x	1.65	x	113.91		0.63	x	0.7	=	172.32	(79)
Southwest 0.9x	0.77	x	1.65	x	104.39		0.63	x	0.7	=	157.92	(79)
Southwest 0.9x	0.77	x	1.65	x	92.85		0.63	x	0.7	=	140.46	(79)
Southwest 0.9x	0.77	x	1.65	x	69.27		0.63	x	0.7	=	104.79	(79)
Southwest 0.9x	0.77	x	1.65	x	44.07		0.63	x	0.7	=	66.67	(79)
Southwest 0.9x	0.77	x	1.65	x	31.49		0.63	x	0.7	=	47.63	(79)

Solar gains in watts, calculated for each month

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

(83)m=	67.14	118.18	171.84	229.89	273	277.84	265.03	231.83	191.78	133.35	81.12	57.01	(83)
--------	-------	--------	--------	--------	-----	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	435.32	483.42	523.48	560.57	582.55	568.13	543.81	516.51	488.29	450.99	422.28	415.64	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)
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Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.95	0.9	0.81	0.68	0.72	0.87	0.96	0.98	0.99	(86)

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

(87)m=	18.53	18.74	19.11	19.66	20.18	20.63	20.84	20.81	20.47	19.82	19.12	18.54	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	18.99	19	19.01	19.06	19.06	19.11	19.11	19.11	19.09	19.06	19.05	19.03	(88)
--------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.98	0.98	0.96	0.93	0.85	0.68	0.45	0.5	0.78	0.93	0.97	0.99	(89)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

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

(90)m=	16.9	17.11	17.49	18.06	18.55	18.95	19.08	19.07	18.83	18.22	17.52	16.94	(90)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46 (91)

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

(92)m=	17.65	17.85	18.23	18.79	19.3	19.72	19.89	19.87	19.58	18.95	18.25	17.67	(92)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=

17.5	17.7	18.08	18.64	19.15	19.57	19.74	19.72	19.43	18.8	18.1	17.52
------	------	-------	-------	-------	-------	-------	-------	-------	------	------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=

0.98	0.97	0.95	0.92	0.85	0.72	0.54	0.59	0.8	0.93	0.97	0.98
------	------	------	------	------	------	------	------	-----	------	------	------

 (94)

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

(95)m=

425.75	468.67	499.09	515.01	494.92	406.35	295.32	302.9	390.01	417.56	408.7	407.63
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	--------

 (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, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=

1502.86	1448.24	1301.04	1059.56	804.71	521.88	329.33	346.65	566.23	886.3	1204.04	1476.8
---------	---------	---------	---------	--------	--------	--------	--------	--------	-------	---------	--------

 (97)

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

(98)m=

801.37	658.27	596.66	392.08	230.49	0	0	0	0	348.74	572.64	795.46
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

4395.7

 (98)

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

98.65

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

1

 (204)

Efficiency of main space heating system 1

90.7

 (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)

801.37	658.27	596.66	392.08	230.49	0	0	0	0	348.74	572.64	795.46
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

883.54	725.76	657.83	432.28	254.12	0	0	0	0	384.5	631.36	877.02
--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------

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

4846.42

 (211)

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

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

(215)m=

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

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

0

 (215)

Water heating

Output from water heater (calculated above)

140.33	123.45	129.07	114.91	112.04	99.29	94.58	104.86	105.01	119.2	127.04	136.69
--------	--------	--------	--------	--------	-------	-------	--------	--------	-------	--------	--------

Efficiency of water heater

87.2

 (216)

(217)m=

90.16	90.13	90.06	89.88	89.52	87.2	87.2	87.2	87.2	89.78	90.04	90.17
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 (217)

Fuel for water heating, $kWh/month$

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

(219)m=

155.65	136.97	143.32	127.85	125.15	113.86	108.46	120.25	120.43	132.77	141.09	151.59
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

1577.38

 (219)

Annual totals

$kWh/year$

$kWh/year$

Space heating fuel used, main system 1

4846.42

SAP WorkSheet: New dwelling created by change of us

Water heating fuel used		1577.38	
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		213.07	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48	x 0.01 = 168.66 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 = 54.89 (247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 = 9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19	x 0.01 = 28.1 (250)
Additional standing charges (Table 12)			120 (251)

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

Total energy cost (245)...(247) + (250)...(254) = 381.54 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42 (256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.79 (257)
SAP rating (Section 12)		75.04 (258)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 1046.83 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 340.71 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1387.54 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 110.58 (268)
Total CO2, kg/year	sum of (265)...(271) =		1537.05 (272)
CO2 emissions per m²	(272) ÷ (4) =		34.49 (273)
El rating (section 14)			77 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	=	5912.63 (261)
Space heating (secondary)	(215) x	3.07	=	0 (263)
Energy for water heating	(219) x	1.22	=	1924.4 (264)
Space and water heating	(261) + (262) + (263) + (264) =			7837.04 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25 (267)
Electricity for lighting	(232) x	0	=	654.13 (268)
'Total Primary Energy		sum of (265)...(271) =		8721.42 (272)
Primary energy kWh/m ² /year		(272) ÷ (4) =		195.72 (273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.12
Printed on 15 December 2020 at 16:30:56

Project Information:

Assessed By: James Mcglashan (STRO000976)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 62.83m²

Site Reference : Q100341

Plot Reference: Flat 3

Address : Apartment 3, 173-175 Field End Road, Pinner, HA5 1QR

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 21.16 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 20.93 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 61.1 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 57.0 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.22 (max. 0.30)	0.22 (max. 0.70)	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 5.00 (design value)
Maximum 10.0

OK

4 Heating efficiency

Main Heating system: Database: (rev 469, product index 017513):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Worcester
Model: Greenstar
Model qualifier: 32CDi Compact ErP (Combi)
Efficiency 89.8 % SEDBUK2009
Minimum 88.0 %

OK

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

No cylinder

Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

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

Based on:

Overshading: Average or unknown

Windows facing: North East 7.2m²

Windows facing: North East 8.64m²

Ventilation rate: 4.00

10 Key features

Thermal bridging 0.016 W/m²K

Floors U-value 0.11 W/m²K

Thermal Bridge Report

Property Details: Flat 3

Address: Apartment 3, 173-175 Field End Road, Pinner, HA5 1QR
Located in: England
Region: Thames valley

Thermal bridges:

Thermal bridges: User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0157

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.3	7.6	E2	[A]
Sill	0.04	0	E3	[A]
Jamb	0.05	18.6	E4	[A]
Exposed floor (normal)	0.32	0	E20	[D]
Flat roof	0.04	0	E14	[UD]
Corner (normal)	0.09	0	E16	[A]

Predicted Energy Assessment



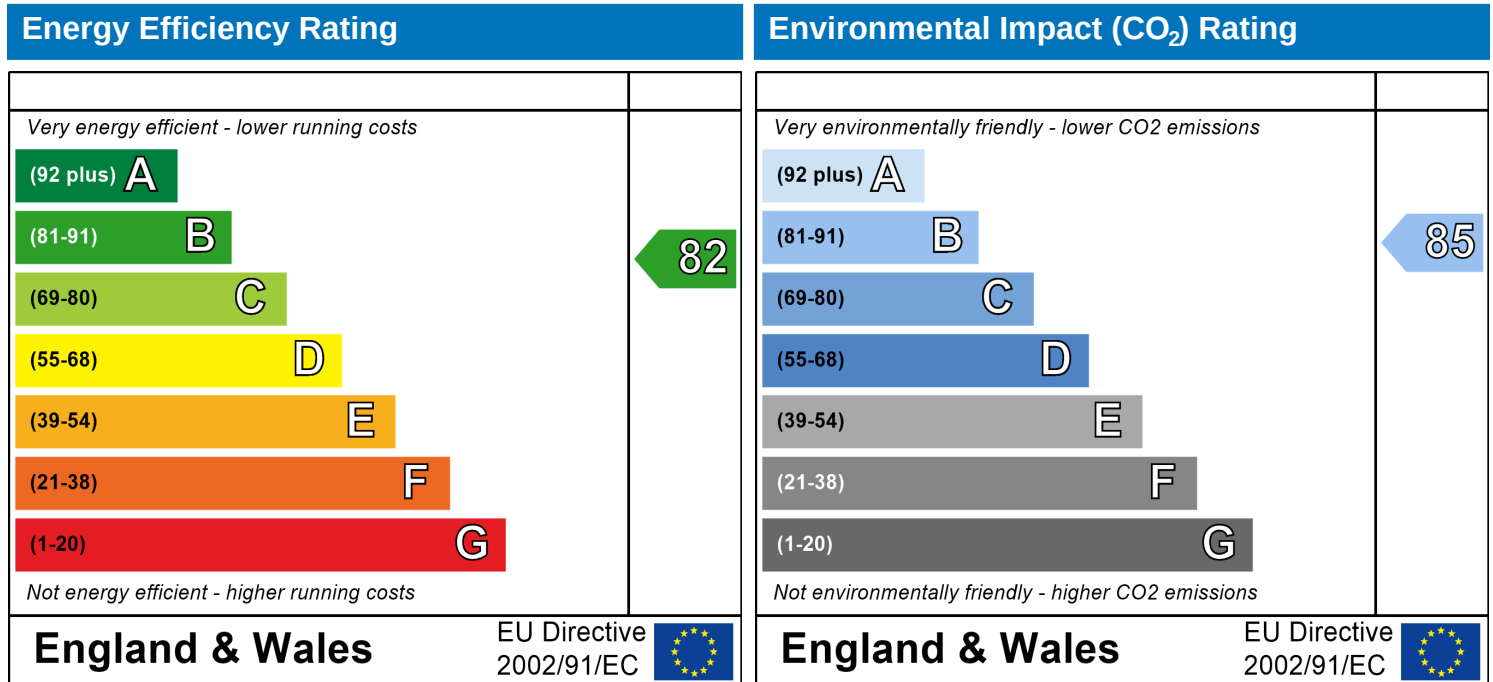
Apartment 3
173-175 Field End Road
Pinner
HA5 1QR

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Top floor Flat
15 December 2020
James Mcglashan
62.83 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Property Details: Flat 3

Address: Apartment 3, 173-175 Field End Road, Pinner, HA5 1QR
 Located in: England
 Region: Thames valley
 UPRN:
 Date of assessment: 15 December 2020
 Date of certificate: 15 December 2020
 Assessment type: New dwelling design stage
 Transaction type: None of the above
 Tenure type: Unknown
 Related party disclosure: No related party
 Thermal Mass Parameter: Indicative Value Medium
 Water use <= 125 litres/person/day: True
 PCDF Version: 469

Property description:

Dwelling type: Flat
 Detachment:
 Year Completed: 2020
 Floor Location: Floor area: Storey height:
 Floor 0 62.83 m² 2.45 m
 Living area: 23.76 m² (fraction 0.378)
 Front of dwelling faces: South West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Door	Manufacturer	Solid			PVC-U
Living	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
Bed 1 & 2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Door	mm	0.7	0	1.2	2.1	1
Living	16mm or more	0.8	0.63	1.4	7.2	1
Bed 1 & 2	16mm or more	0.8	0.63	1.4	4.32	2

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Door		External wall	South West	1	2.1
Living		External wall	North East	3	2.4
Bed 1 & 2		External wall	North East	1.8	2.4

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
External wall	78.99	17.94	61.05	0.22	0	False	N/A
Flat roof	62.83	0	62.83	0.14	0		N/A
Floor over retail	62.83			0.11			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0157

[Approved]	Length	Psi-value	
	7.6	0.3	E2 Other lintels (including other steel lintels)

SAP Input

[Approved]	0	0.04	E3	Sill
[Approved]	18.6	0.05	E4	Jamb
	0	0.32	E20	Exposed floor (normal)
	0	0.04	E14	Flat roof
[Approved]	0	0.09	E16	Corner (normal)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	2
Number of passive stacks:	0
Number of sides sheltered:	1
Pressure test:	5

Main heating system:

Main heating system:	Boiler systems with radiators or underfloor heating
	Gas boilers and oil boilers
	Fuel: mains gas
	Info Source: Boiler Database
	Database: (rev 469, product index 017513) Efficiency: Winter 87.2 % Summer: 90.7
	Brand name: Worcester
	Model: Greenstar
	Model qualifier: 32CDi Compact ErP
	(Combi boiler)
	Systems with radiators
	Central heating pump : 2013 or later
	Design flow temperature: Unknown
	Room-sealed
	Boiler interlock: Yes
	Delayed start

Main heating Control:

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

Secondary heating system:

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

Water heating:

Water heating:	From main heating system
	Water code: 901
	Fuel :mains gas
	No hot water cylinder
	Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

User Details:

Assessor Name: James Mcglashan **Stroma Number:** STRO000976
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Flat 3

Address : Apartment 3, 173-175 Field End Road, Pinner, HA5 1QR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	62.83 (1a) x	2.45 (2a) =	153.93 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.83 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	153.93 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				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 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		0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used		
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (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
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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.6 0.6 0.59 0.57 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 0.57 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	= 2.52		(26)
Windows Type 1			7.2	x 1/[1/(1.4)+0.04]	= 9.55		(27)
Windows Type 2			4.32	x 1/[1/(1.4)+0.04]	= 5.73		(27)
Floor			62.83	x 0.11	= 6.9113		(28)
Walls	78.99	17.94	61.05	x 0.22	= 13.43		(29)
Roof	62.83	0	62.83	x 0.14	= 8.8		(30)
Total area of elements, m²			204.65				(31)

* 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) = 52.66 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 3.21 (36)

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

Total fabric heat loss (33) + (36) = 55.87 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	30.5	30.3	30.11	29.19	29.02	28.23	28.23	28.08	28.54	29.02	29.37	29.73

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

(39)m=	86.37	86.17	85.97	85.06	84.89	84.1	84.1	83.95	84.4	84.89	85.24	85.6
Average = Sum(39) _{1...12} /12=												85.06

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.37	1.37	1.37	1.35	1.35	1.34	1.34	1.34	1.34	1.35	1.36	1.36		
Average = Sum(40) _{1...12} /12=													1.35	(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

2.06

(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

83.13

(43)

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

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

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

(44)m=	91.45	88.12	84.8	81.47	78.15	74.82	74.82	78.15	81.47	84.8	88.12	91.45		
Total = Sum(44) _{1...12} =													997.62	(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=	135.62	118.61	122.39	106.71	102.39	88.35	81.87	93.95	95.07	110.8	120.94	131.34		
Total = Sum(45) _{1...12} =													1308.03	(45)

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

(46)m=	20.34	17.79	18.36	16.01	15.36	13.25	12.28	14.09	14.26	16.62	18.14	19.7		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	--	------

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

SAP WorkSheet: New dwelling design stage

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

(61)m=	25.26	22.8	25.22	24.37	25.16	24.32	25.1	25.14	24.34	25.19	24.41	25.25	(61)
--------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(62)m=	160.87	141.41	147.61	131.08	127.54	112.67	106.98	119.09	119.41	135.98	145.36	156.58	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

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

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

Output from water heater

(64)m=	160.87	141.41	147.61	131.08	127.54	112.67	106.98	119.09	119.41	135.98	145.36	156.58	
Output from water heater (annual) _{1...12}												1604.58	(64)

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

(65)m=	51.41	45.14	47	41.57	40.33	35.46	33.5	37.52	37.7	43.14	46.32	49.98	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.62	123.62	123.62	123.62	123.62	123.62	123.62	123.62	123.62	123.62	123.62	123.62	(66)

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

(67)m=	40.12	35.64	28.98	21.94	16.4	13.85	14.96	19.45	26.1	33.14	38.68	41.24	(67)
--------	-------	-------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	------

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

(68)m=	268.69	271.48	264.45	249.5	230.61	212.87	201.01	198.23	205.25	220.21	239.09	256.84	(68)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	(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=	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	69.09	67.17	63.17	57.74	54.21	49.24	45.02	50.43	52.36	57.98	64.33	67.18	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	471.54	467.92	450.24	422.81	394.86	369.59	354.63	361.74	377.34	404.96	435.73	458.88	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	7.2	x	11.28	x	0.63	x	0.8	=	28.37	(75)
Northeast 0.9x	0.77	x	4.32	x	11.28	x	0.63	x	0.8	=	34.05	(75)
Northeast 0.9x	0.77	x	7.2	x	22.97	x	0.63	x	0.8	=	57.76	(75)
Northeast 0.9x	0.77	x	4.32	x	22.97	x	0.63	x	0.8	=	69.31	(75)
Northeast 0.9x	0.77	x	7.2	x	41.38	x	0.63	x	0.8	=	104.06	(75)

SAP WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	4.32	x	41.38	x	0.63	x	0.8	=	124.87	(75)
Northeast 0.9x	0.77	x	7.2	x	67.96	x	0.63	x	0.8	=	170.89	(75)
Northeast 0.9x	0.77	x	4.32	x	67.96	x	0.63	x	0.8	=	205.07	(75)
Northeast 0.9x	0.77	x	7.2	x	91.35	x	0.63	x	0.8	=	229.71	(75)
Northeast 0.9x	0.77	x	4.32	x	91.35	x	0.63	x	0.8	=	275.66	(75)
Northeast 0.9x	0.77	x	7.2	x	97.38	x	0.63	x	0.8	=	244.9	(75)
Northeast 0.9x	0.77	x	4.32	x	97.38	x	0.63	x	0.8	=	293.88	(75)
Northeast 0.9x	0.77	x	7.2	x	91.1	x	0.63	x	0.8	=	229.1	(75)
Northeast 0.9x	0.77	x	4.32	x	91.1	x	0.63	x	0.8	=	274.92	(75)
Northeast 0.9x	0.77	x	7.2	x	72.63	x	0.63	x	0.8	=	182.64	(75)
Northeast 0.9x	0.77	x	4.32	x	72.63	x	0.63	x	0.8	=	219.17	(75)
Northeast 0.9x	0.77	x	7.2	x	50.42	x	0.63	x	0.8	=	126.8	(75)
Northeast 0.9x	0.77	x	4.32	x	50.42	x	0.63	x	0.8	=	152.15	(75)
Northeast 0.9x	0.77	x	7.2	x	28.07	x	0.63	x	0.8	=	70.58	(75)
Northeast 0.9x	0.77	x	4.32	x	28.07	x	0.63	x	0.8	=	84.7	(75)
Northeast 0.9x	0.77	x	7.2	x	14.2	x	0.63	x	0.8	=	35.7	(75)
Northeast 0.9x	0.77	x	4.32	x	14.2	x	0.63	x	0.8	=	42.84	(75)
Northeast 0.9x	0.77	x	7.2	x	9.21	x	0.63	x	0.8	=	23.17	(75)
Northeast 0.9x	0.77	x	4.32	x	9.21	x	0.63	x	0.8	=	27.81	(75)

Solar gains in watts, calculated for each month

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

(83)m=	62.42	127.06	228.93	375.96	505.37	538.78	504.01	401.81	278.95	155.28	78.54	50.98	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	533.96	594.98	679.17	798.77	900.23	908.37	858.65	763.54	656.29	560.24	514.28	509.86	(84)
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7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.9	0.76	0.57	0.43	0.49	0.76	0.95	0.99	0.99	(86)

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

(87)m=	19.69	19.85	20.15	20.56	20.85	20.97	20.99	20.99	20.88	20.49	20.02	19.66	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.78	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.79	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	-------	------

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

(89)m=	0.99	0.98	0.96	0.87	0.69	0.47	0.31	0.37	0.67	0.92	0.98	0.99	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.08	18.31	18.75	19.31	19.67	19.79	19.81	19.81	19.72	19.24	18.58	18.04	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.38 (91)

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

(92)m=	18.69	18.89	19.28	19.78	20.11	20.24	20.26	20.25	20.16	19.71	19.12	18.65	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

SAP WorkSheet: New dwelling design stage

(93)m=

18.54	18.74	19.13	19.63	19.96	20.09	20.11	20.1	20.01	19.56	18.97	18.5
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 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=

0.99	0.98	0.95	0.87	0.7	0.5	0.34	0.4	0.69	0.92	0.97	0.99
------	------	------	------	-----	-----	------	-----	------	------	------	------

 (94)

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

(95)m=

525.97	580.43	643.82	691.3	632.21	450.04	293.23	307.56	453.36	513.23	501.19	503.5
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

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

(97)m=

1229.8	1193	1085.83	912.8	701.38	461.4	294.88	310.92	498.98	761.06	1012.09	1224.48
--------	------	---------	-------	--------	-------	--------	--------	--------	--------	---------	---------

 (97)

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

(98)m=

523.65	411.65	328.86	159.48	51.47	0	0	0	0	184.38	367.85	536.41
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

2563.74

 (98)

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

40.8

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

1

 (204)

Efficiency of main space heating system 1

90.7

 (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)

523.65	411.65	328.86	159.48	51.47	0	0	0	0	184.38	367.85	536.41
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

577.34	453.86	362.58	175.83	56.74	0	0	0	0	203.29	405.57	591.41
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

2826.62

 (211)

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

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

(215)m=

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

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

0

 (215)

Water heating

Output from water heater (calculated above)

160.87	141.41	147.61	131.08	127.54	112.67	106.98	119.09	119.41	135.98	145.36	156.58
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

87.2

 (216)

(217)m=

89.85	89.78	89.59	89.09	88.18	87.2	87.2	87.2	87.2	89.18	89.68	89.88
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, $kWh/month$

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

(219)m=

179.04	157.51	164.77	147.13	144.64	129.21	122.68	136.57	136.94	152.48	162.08	174.2
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

1807.26

 (219)

Annual totals

$kWh/year$

$kWh/year$

Space heating fuel used, main system 1

2826.62

SAP WorkSheet: New dwelling design stage

Water heating fuel used			1807.26	
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			283.43	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	3.48	x 0.01 = 98.37 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 = 62.89 (247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 = 9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a			
Energy for lighting	(232)	13.19	x 0.01 = 37.39 (250)
Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		328.54 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.28	(257)
SAP rating (Section 12)		82.15	(258)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 610.55 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 390.37 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1000.92 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 147.1 (268)
Total CO2, kg/year	sum of (265)...(271) =		1186.94 (272)
CO2 emissions per m²	(272) ÷ (4) =		18.89 (273)
EI rating (section 14)			85 (274)

13a. Primary Energy

SAP WorkSheet: New dwelling design stage

	Energy kWh/year	Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	=	3448.48 (261)
Space heating (secondary)	(215) x	3.07	=	0 (263)
Energy for water heating	(219) x	1.22	=	2204.85 (264)
Space and water heating	(261) + (262) + (263) + (264) =			5653.33 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25 (267)
Electricity for lighting	(232) x	0	=	870.14 (268)
'Total Primary Energy	sum of (265)...(271) =			6753.72 (272)
Primary energy kWh/m²/year	(272) ÷ (4) =			107.49 (273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: James Mcglashan **Stroma Number:** STRO000976
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Flat 3

Address : Apartment 3, 173-175 Field End Road, Pinner, HA5 1QR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	62.83 (1a) x	2.45 (2a) =	153.93 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.83 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	153.93 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (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
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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.6 0.6 0.59 0.57 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 0.57 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 Type 1			6.19	x1/[1/(1.4)+0.04]	= 8.21		(27)
Windows Type 2			3.71	x1/[1/(1.4)+0.04]	= 4.92		(27)
Floor			62.83	x 0.13	= 8.1679		(28)
Walls	78.99	15.71	63.28	x 0.18	= 11.39		(29)
Roof	62.83	0	62.83	x 0.13	= 8.17		(30)
Total area of elements, m²			204.65				(31)

* 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) = 47.87 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 1.31 (36)

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

Total fabric heat loss (33) + (36) = 49.18 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	30.5	30.3	30.11	29.19	29.02	28.23	28.23	28.08	28.54	29.02	29.37	29.73

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

(39)m=	79.68	79.48	79.29	78.37	78.2	77.41	77.41	77.26	77.72	78.2	78.55	78.91
Average = Sum(39) _{1...12} /12=												78.37

TFEE WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.27	1.27	1.26	1.25	1.24	1.23	1.23	1.23	1.24	1.24	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

2.06

(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

83.13

(43)

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

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

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

(44)m=	91.45	88.12	84.8	81.47	78.15	74.82	74.82	78.15	81.47	84.8	88.12	91.45		
Total = Sum(44) _{1...12} =													997.62	(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=	135.62	118.61	122.39	106.71	102.39	88.35	81.87	93.95	95.07	110.8	120.94	131.34		
Total = Sum(45) _{1...12} =													1308.03	(45)

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

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

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

TFEE WorkSheet: New dwelling design stage

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

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

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

(62)m=	115.27	100.82	104.04	90.7	87.03	75.1	69.59	79.86	80.81	94.18	102.8	111.64	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

Output from water heater

(64)m=	115.27	100.82	104.04	90.7	87.03	75.1	69.59	79.86	80.81	94.18	102.8	111.64	
Output from water heater (annual) _{1...12}												1111.83	(64)

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

(65)m=	28.82	25.2	26.01	22.68	21.76	18.77	17.4	19.96	20.2	23.54	25.7	27.91	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	(66)

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

(67)m=	16.06	14.27	11.6	8.78	6.57	5.54	5.99	7.79	10.45	13.27	15.49	16.51	(67)
--------	-------	-------	------	------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	180.02	181.89	177.18	167.16	154.51	142.62	134.68	132.81	137.52	147.54	160.19	172.08	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	(69)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	(71)
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Water heating gains (Table 5)

(72)m=	38.73	37.51	34.96	31.49	29.24	26.08	23.38	26.83	28.06	31.65	35.69	37.51	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	288.73	287.57	277.65	261.35	244.23	228.15	217.96	221.34	229.93	246.36	265.28	280.01	(73)
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6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	6.19	x	11.28	x	0.63	x	0.7	=	21.34	(75)
Northeast 0.9x	0.77	x	3.71	x	11.28	x	0.63	x	0.7	=	25.59	(75)
Northeast 0.9x	0.77	x	6.19	x	22.97	x	0.63	x	0.7	=	43.45	(75)
Northeast 0.9x	0.77	x	3.71	x	22.97	x	0.63	x	0.7	=	52.08	(75)
Northeast 0.9x	0.77	x	6.19	x	41.38	x	0.63	x	0.7	=	78.28	(75)

TREE WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	3.71	x	41.38	x	0.63	x	0.7	=	93.83	(75)
Northeast 0.9x	0.77	x	6.19	x	67.96	x	0.63	x	0.7	=	128.56	(75)
Northeast 0.9x	0.77	x	3.71	x	67.96	x	0.63	x	0.7	=	154.1	(75)
Northeast 0.9x	0.77	x	6.19	x	91.35	x	0.63	x	0.7	=	172.8	(75)
Northeast 0.9x	0.77	x	3.71	x	91.35	x	0.63	x	0.7	=	207.14	(75)
Northeast 0.9x	0.77	x	6.19	x	97.38	x	0.63	x	0.7	=	184.23	(75)
Northeast 0.9x	0.77	x	3.71	x	97.38	x	0.63	x	0.7	=	220.83	(75)
Northeast 0.9x	0.77	x	6.19	x	91.1	x	0.63	x	0.7	=	172.34	(75)
Northeast 0.9x	0.77	x	3.71	x	91.1	x	0.63	x	0.7	=	206.59	(75)
Northeast 0.9x	0.77	x	6.19	x	72.63	x	0.63	x	0.7	=	137.39	(75)
Northeast 0.9x	0.77	x	3.71	x	72.63	x	0.63	x	0.7	=	164.69	(75)
Northeast 0.9x	0.77	x	6.19	x	50.42	x	0.63	x	0.7	=	95.38	(75)
Northeast 0.9x	0.77	x	3.71	x	50.42	x	0.63	x	0.7	=	114.34	(75)
Northeast 0.9x	0.77	x	6.19	x	28.07	x	0.63	x	0.7	=	53.1	(75)
Northeast 0.9x	0.77	x	3.71	x	28.07	x	0.63	x	0.7	=	63.65	(75)
Northeast 0.9x	0.77	x	6.19	x	14.2	x	0.63	x	0.7	=	26.86	(75)
Northeast 0.9x	0.77	x	3.71	x	14.2	x	0.63	x	0.7	=	32.19	(75)
Northeast 0.9x	0.77	x	6.19	x	9.21	x	0.63	x	0.7	=	17.43	(75)
Northeast 0.9x	0.77	x	3.71	x	9.21	x	0.63	x	0.7	=	20.89	(75)

Solar gains in watts, calculated for each month

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

(83)m=	46.93	95.53	172.11	282.65	379.94	405.06	378.93	302.08	209.72	116.74	59.05	38.33	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	335.66	383.1	449.76	544	624.17	633.21	596.89	523.42	439.65	363.1	324.33	318.34	(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	0.71	0.55	0.64	0.9	0.99	1	1	(86)

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

(87)m=	19.54	19.69	19.97	20.38	20.74	20.93	20.98	20.97	20.79	20.33	19.87	19.52	(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	19.9	19.89	19.88	19.88	19.88	(88)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.95	0.84	0.62	0.42	0.51	0.84	0.98	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	18.54	18.69	18.97	19.38	19.71	19.87	19.89	19.89	19.77	19.34	18.88	18.53	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.38 (91)

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

(92)m=	18.92	19.06	19.35	19.76	20.1	20.27	20.3	20.3	20.16	19.72	19.26	18.9	(92)
--------	-------	-------	-------	-------	------	-------	------	------	-------	-------	-------	------	------

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

TFEE WorkSheet: New dwelling design stage

(93)m=

18.92	19.06	19.35	19.76	20.1	20.27	20.3	20.3	20.16	19.72	19.26	18.9
-------	-------	-------	-------	------	-------	------	------	-------	-------	-------	------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=

1	1	0.99	0.95	0.85	0.65	0.47	0.56	0.85	0.98	1	1
---	---	------	------	------	------	------	------	------	------	---	---

 (94)

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

(95)m=

334.93	381.43	444.18	518.16	527.77	412.09	282.13	291.54	374.9	355.56	322.99	317.8
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------

 (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, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=

1164.92	1125.74	1018.66	851.04	656.88	438.89	286.75	301.11	470.6	712.87	954.83	1160.28
---------	---------	---------	--------	--------	--------	--------	--------	-------	--------	--------	---------

 (97)

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

(98)m=

617.52	500.18	427.41	239.67	96.06	0	0	0	0	265.83	454.92	626.81
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

3228.39

 (98)

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

51.38

 (99)

8c. Space cooling requirement

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

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

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

(100)m=

0	0	0	0	0	727.65	572.83	587.2	0	0	0	0
---	---	---	---	---	--------	--------	-------	---	---	---	---

 (100)

Utilisation factor for loss h_m

(101)m=

0	0	0	0	0	0.87	0.92	0.89	0	0	0	0
---	---	---	---	---	------	------	------	---	---	---	---

 (101)

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

(102)m=

0	0	0	0	0	633.37	529.45	519.73	0	0	0	0
---	---	---	---	---	--------	--------	--------	---	---	---	---

 (102)

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

(103)m=

0	0	0	0	0	816.88	772.9	688.24	0	0	0	0
---	---	---	---	---	--------	-------	--------	---	---	---	---

 (103)

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

(104)m=

0	0	0	0	0	132.13	181.13	125.38	0	0	0	0
---	---	---	---	---	--------	--------	--------	---	---	---	---

Total = $Sum(104) =$

438.64

 (104)

Cooled fraction

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

1

 (105)

Intermittency factor (Table 10b)

(106)m=

0	0	0	0	0	0.25	0.25	0.25	0	0	0	0
---	---	---	---	---	------	------	------	---	---	---	---

Total = $Sum(104) =$

0

 (106)

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

(107)m=

0	0	0	0	0	33.03	45.28	31.34	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = $Sum(107) =$

109.66

 (107)

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

$(107) \div (4) =$

1.75

 (108)

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

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

53.13

 (109)

Target Fabric Energy Efficiency (TFEE)

61.1

 (109)

User Details:

Assessor Name: James Mcglashan **Stroma Number:** STRO000976
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Flat 3

Address : Apartment 3, 173-175 Field End Road, Pinner, HA5 1QR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	62.83 (1a) x	2.45 (2a) =	153.93 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.83 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	153.93 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DFEE WorkSheet: New dwelling design stage

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

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.6 0.6 0.59 0.57 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 0.57 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	= 2.52		(26)
Windows Type 1			7.2	x 1/[1/(1.4)+0.04]	= 9.55		(27)
Windows Type 2			4.32	x 1/[1/(1.4)+0.04]	= 5.73		(27)
Floor			62.83	x 0.11	= 6.9113		(28)
Walls	78.99	17.94	61.05	x 0.22	= 13.43		(29)
Roof	62.83	0	62.83	x 0.14	= 8.8		(30)
Total area of elements, m²			204.65				(31)

* 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) = 52.66 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 3.21 (36)

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

Total fabric heat loss (33) + (36) = 55.87 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	30.5	30.3	30.11	29.19	29.02	28.23	28.23	28.08	28.54	29.02	29.37	29.73

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

(39)m=	86.37	86.17	85.97	85.06	84.89	84.1	84.1	83.95	84.4	84.89	85.24	85.6
Average = Sum(39) _{1...12} /12=												85.06

DFEE WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.37	1.37	1.37	1.35	1.35	1.34	1.34	1.34	1.34	1.35	1.36	1.36	
Average = Sum(40) _{1...12} /12=													1.35

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	

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

$$\text{if TFA} \leq 13.9, N = 1$$

2.06

(42)

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

83.13

(43)

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

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

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

(44)m=	91.45	88.12	84.8	81.47	78.15	74.82	74.82	78.15	81.47	84.8	88.12	91.45	
Total = Sum(44) _{1...12} =													997.62

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=	135.62	118.61	122.39	106.71	102.39	88.35	81.87	93.95	95.07	110.8	120.94	131.34	
Total = Sum(45) _{1...12} =													1308.03

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

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

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

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

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

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

(62)m=	115.27	100.82	104.04	90.7	87.03	75.1	69.59	79.86	80.81	94.18	102.8	111.64	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	115.27	100.82	104.04	90.7	87.03	75.1	69.59	79.86	80.81	94.18	102.8	111.64	
Output from water heater (annual) _{1...12}												1111.83	(64)

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

(65)m=	28.82	25.2	26.01	22.68	21.76	18.77	17.4	19.96	20.2	23.54	25.7	27.91	(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=	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	(66)

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

(67)m=	16.05	14.25	11.59	8.78	6.56	5.54	5.98	7.78	10.44	13.26	15.47	16.5	(67)
--------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	------	------

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

(68)m=	180.02	181.89	177.18	167.16	154.51	142.62	134.68	132.81	137.52	147.54	160.19	172.08	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	(69)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

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

(71)m=	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	38.73	37.51	34.96	31.49	29.24	26.08	23.38	26.83	28.06	31.65	35.69	37.51	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	288.71	287.56	277.64	261.34	244.22	228.14	217.95	221.33	229.93	246.35	265.27	279.99	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g _p Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	7.2	x	11.28	x	0.63	x	0.8	=	28.37	(75)
Northeast 0.9x	0.77	x	4.32	x	11.28	x	0.63	x	0.8	=	34.05	(75)
Northeast 0.9x	0.77	x	7.2	x	22.97	x	0.63	x	0.8	=	57.76	(75)
Northeast 0.9x	0.77	x	4.32	x	22.97	x	0.63	x	0.8	=	69.31	(75)
Northeast 0.9x	0.77	x	7.2	x	41.38	x	0.63	x	0.8	=	104.06	(75)

DFEE WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	4.32	x	41.38	x	0.63	x	0.8	=	124.87	(75)
Northeast 0.9x	0.77	x	7.2	x	67.96	x	0.63	x	0.8	=	170.89	(75)
Northeast 0.9x	0.77	x	4.32	x	67.96	x	0.63	x	0.8	=	205.07	(75)
Northeast 0.9x	0.77	x	7.2	x	91.35	x	0.63	x	0.8	=	229.71	(75)
Northeast 0.9x	0.77	x	4.32	x	91.35	x	0.63	x	0.8	=	275.66	(75)
Northeast 0.9x	0.77	x	7.2	x	97.38	x	0.63	x	0.8	=	244.9	(75)
Northeast 0.9x	0.77	x	4.32	x	97.38	x	0.63	x	0.8	=	293.88	(75)
Northeast 0.9x	0.77	x	7.2	x	91.1	x	0.63	x	0.8	=	229.1	(75)
Northeast 0.9x	0.77	x	4.32	x	91.1	x	0.63	x	0.8	=	274.92	(75)
Northeast 0.9x	0.77	x	7.2	x	72.63	x	0.63	x	0.8	=	182.64	(75)
Northeast 0.9x	0.77	x	4.32	x	72.63	x	0.63	x	0.8	=	219.17	(75)
Northeast 0.9x	0.77	x	7.2	x	50.42	x	0.63	x	0.8	=	126.8	(75)
Northeast 0.9x	0.77	x	4.32	x	50.42	x	0.63	x	0.8	=	152.15	(75)
Northeast 0.9x	0.77	x	7.2	x	28.07	x	0.63	x	0.8	=	70.58	(75)
Northeast 0.9x	0.77	x	4.32	x	28.07	x	0.63	x	0.8	=	84.7	(75)
Northeast 0.9x	0.77	x	7.2	x	14.2	x	0.63	x	0.8	=	35.7	(75)
Northeast 0.9x	0.77	x	4.32	x	14.2	x	0.63	x	0.8	=	42.84	(75)
Northeast 0.9x	0.77	x	7.2	x	9.21	x	0.63	x	0.8	=	23.17	(75)
Northeast 0.9x	0.77	x	4.32	x	9.21	x	0.63	x	0.8	=	27.81	(75)

Solar gains in watts, calculated for each month

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

(83)m=	62.42	127.06	228.93	375.96	505.37	538.78	504.01	401.81	278.95	155.28	78.54	50.98	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	351.14	414.62	506.57	637.3	749.59	766.92	721.97	623.14	508.88	401.63	343.81	330.97	(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	0.84	0.65	0.5	0.59	0.87	0.98	1	1	(86)

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

(87)m=	19.43	19.6	19.93	20.39	20.77	20.94	20.99	20.97	20.8	20.3	19.79	19.41	(87)
--------	-------	------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	------

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

(88)m=	19.78	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.79	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	-------	------

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

(89)m=	1	1	0.98	0.93	0.78	0.55	0.37	0.45	0.79	0.97	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(90)m=	18.37	18.54	18.86	19.32	19.65	19.79	19.81	19.81	19.69	19.24	18.73	18.35	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.38 (91)

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

(92)m=	18.77	18.94	19.26	19.72	20.07	20.22	20.25	20.25	20.11	19.64	19.13	18.75	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

DFEE WorkSheet: New dwelling design stage

(93)m=	18.77	18.94	19.26	19.72	20.07	20.22	20.25	20.25	20.11	19.64	19.13	18.75	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	1	0.99	0.98	0.93	0.79	0.59	0.42	0.5	0.82	0.97	0.99	1	(94)
--------	---	------	------	------	------	------	------	-----	------	------	------	---	------

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

(95)m=	350.15	412.1	497.22	592.62	594.72	450.4	303.3	314.46	414.82	390.39	341.96	330.26	(95)
--------	--------	-------	--------	--------	--------	-------	-------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1249.65	1209.64	1097.47	920.67	710.77	473.03	307.25	322.96	507.35	767.31	1025.43	1245.25	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	669.23	535.95	446.59	236.19	86.34	0	0	0	0	280.42	492.1	680.76	
Total per year ($kWh/year$) = $Sum(98)_{1..5,9..12} =$												3427.58	(98)

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

54.55	(99)
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8c. Space cooling requirement

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Heat loss rate L_m (calculated using $25^\circ C$ internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	790.53	622.33	638.03	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss h_m

(101)m=	0	0	0	0	0	0.89	0.94	0.9	0	0	0	0	(101)
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Useful loss, $h_m L_m$ (Watts) = $(100)m \times (101)m$

(102)m=	0	0	0	0	0	703.97	582.24	572.81	0	0	0	0	(102)
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Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	973.16	919.1	804.78	0	0	0	0	(103)
---------	---	---	---	---	---	--------	-------	--------	---	---	---	---	-------

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

(104)m=	0	0	0	0	0	193.82	250.62	172.59	0	0	0	0	
Total = $Sum(104) =$												617.03	(104)

Cooled fraction

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

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

Intermittency factor (Table 10b)

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

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

(107)m=	0	0	0	0	0	48.45	62.66	43.15	0	0	0	0	
Total = $Sum(107) =$												154.26	(107)

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

$(107) \div (4) =$

2.46	(108)
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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency	$(99) + (108) =$	57.01	(109)
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User Details:

Assessor Name: James Mcglashan **Stroma Number:** STRO000976
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Flat 3

Address : Apartment 3, 173-175 Field End Road, Pinner, HA5 1QR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	62.83 (1a) x	2.45 (2a) =	153.93 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.83 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	153.93 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (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
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Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.6 0.6 0.59 0.57 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 0.57 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	= 2.52		(26)
Windows Type 1			7.2	x 1/[1/(1.4)+0.04]	= 9.55		(27)
Windows Type 2			4.32	x 1/[1/(1.4)+0.04]	= 5.73		(27)
Floor			62.83	x 0.11	= 6.9113		(28)
Walls	78.99	17.94	61.05	x 0.22	= 13.43		(29)
Roof	62.83	0	62.83	x 0.14	= 8.8		(30)
Total area of elements, m²			204.65				(31)

* 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) = 52.66 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 3.21 (36)

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

Total fabric heat loss (33) + (36) = 55.87 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	30.5	30.3	30.11	29.19	29.02	28.23	28.23	28.08	28.54	29.02	29.37	29.73

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

(39)m=	86.37	86.17	85.97	85.06	84.89	84.1	84.1	83.95	84.4	84.89	85.24	85.6
Average = Sum(39) _{1...12} /12=												85.06

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.37	1.37	1.37	1.35	1.35	1.34	1.34	1.34	1.34	1.35	1.36	1.36		
Average = Sum(40) _{1...12} /12=													1.35	(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

2.06

(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

83.13

(43)

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

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

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

(44)m=	91.45	88.12	84.8	81.47	78.15	74.82	74.82	78.15	81.47	84.8	88.12	91.45		
Total = Sum(44) _{1...12} =													997.62	(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=	135.62	118.61	122.39	106.71	102.39	88.35	81.87	93.95	95.07	110.8	120.94	131.34		
Total = Sum(45) _{1...12} =													1308.03	(45)

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

(46)m=	20.34	17.79	18.36	16.01	15.36	13.25	12.28	14.09	14.26	16.62	18.14	19.7		(46)
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Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

DER WorkSheet: New dwelling design stage

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

(61)m=	25.26	22.8	25.22	24.37	25.16	24.32	25.1	25.14	24.34	25.19	24.41	25.25	(61)
--------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(62)m=	160.87	141.41	147.61	131.08	127.54	112.67	106.98	119.09	119.41	135.98	145.36	156.58	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
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Output from water heater

(64)m=	160.87	141.41	147.61	131.08	127.54	112.67	106.98	119.09	119.41	135.98	145.36	156.58	
Output from water heater (annual) _{1...12}												1604.58	(64)

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

(65)m=	51.41	45.14	47	41.57	40.33	35.46	33.5	37.52	37.7	43.14	46.32	49.98	(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=	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	(66)

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

(67)m=	16.05	14.25	11.59	8.78	6.56	5.54	5.98	7.78	10.44	13.26	15.47	16.5	(67)
--------	-------	-------	-------	------	------	------	------	------	-------	-------	-------	------	------

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

(68)m=	180.02	181.89	177.18	167.16	154.51	142.62	134.68	132.81	137.52	147.54	160.19	172.08	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	(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=	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	69.09	67.17	63.17	57.74	54.21	49.24	45.02	50.43	52.36	57.98	64.33	67.18	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	322.07	320.22	308.86	290.58	272.19	254.31	242.59	247.93	257.22	275.68	296.9	312.66	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	7.2	x	11.28	x	0.63	x	0.8	=	28.37	(75)
Northeast 0.9x	0.77	x	4.32	x	11.28	x	0.63	x	0.8	=	34.05	(75)
Northeast 0.9x	0.77	x	7.2	x	22.97	x	0.63	x	0.8	=	57.76	(75)
Northeast 0.9x	0.77	x	4.32	x	22.97	x	0.63	x	0.8	=	69.31	(75)
Northeast 0.9x	0.77	x	7.2	x	41.38	x	0.63	x	0.8	=	104.06	(75)

DER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	4.32	x	41.38	x	0.63	x	0.8	=	124.87	(75)
Northeast 0.9x	0.77	x	7.2	x	67.96	x	0.63	x	0.8	=	170.89	(75)
Northeast 0.9x	0.77	x	4.32	x	67.96	x	0.63	x	0.8	=	205.07	(75)
Northeast 0.9x	0.77	x	7.2	x	91.35	x	0.63	x	0.8	=	229.71	(75)
Northeast 0.9x	0.77	x	4.32	x	91.35	x	0.63	x	0.8	=	275.66	(75)
Northeast 0.9x	0.77	x	7.2	x	97.38	x	0.63	x	0.8	=	244.9	(75)
Northeast 0.9x	0.77	x	4.32	x	97.38	x	0.63	x	0.8	=	293.88	(75)
Northeast 0.9x	0.77	x	7.2	x	91.1	x	0.63	x	0.8	=	229.1	(75)
Northeast 0.9x	0.77	x	4.32	x	91.1	x	0.63	x	0.8	=	274.92	(75)
Northeast 0.9x	0.77	x	7.2	x	72.63	x	0.63	x	0.8	=	182.64	(75)
Northeast 0.9x	0.77	x	4.32	x	72.63	x	0.63	x	0.8	=	219.17	(75)
Northeast 0.9x	0.77	x	7.2	x	50.42	x	0.63	x	0.8	=	126.8	(75)
Northeast 0.9x	0.77	x	4.32	x	50.42	x	0.63	x	0.8	=	152.15	(75)
Northeast 0.9x	0.77	x	7.2	x	28.07	x	0.63	x	0.8	=	70.58	(75)
Northeast 0.9x	0.77	x	4.32	x	28.07	x	0.63	x	0.8	=	84.7	(75)
Northeast 0.9x	0.77	x	7.2	x	14.2	x	0.63	x	0.8	=	35.7	(75)
Northeast 0.9x	0.77	x	4.32	x	14.2	x	0.63	x	0.8	=	42.84	(75)
Northeast 0.9x	0.77	x	7.2	x	9.21	x	0.63	x	0.8	=	23.17	(75)
Northeast 0.9x	0.77	x	4.32	x	9.21	x	0.63	x	0.8	=	27.81	(75)

Solar gains in watts, calculated for each month

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

(83)m=	62.42	127.06	228.93	375.96	505.37	538.78	504.01	401.81	278.95	155.28	78.54	50.98	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	384.5	447.28	537.78	666.55	777.56	793.09	746.61	649.74	536.17	430.96	375.44	363.64	(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	0.82	0.63	0.48	0.57	0.85	0.98	1	1	(86)

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

(87)m=	19.48	19.65	19.97	20.42	20.78	20.95	20.99	20.98	20.82	20.33	19.83	19.45	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.78	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.79	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	-------	------

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

(89)m=	1	0.99	0.98	0.92	0.76	0.53	0.36	0.43	0.77	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=	17.78	18.02	18.49	19.14	19.6	19.78	19.81	19.8	19.66	19.03	18.3	17.74	(90)
--------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =

0.38 (91)

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

(92)m=	18.42	18.64	19.05	19.62	20.05	20.22	20.25	20.25	20.1	19.52	18.88	18.39	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

DER WorkSheet: New dwelling design stage

(93)m=

18.27	18.49	18.9	19.47	19.9	20.07	20.1	20.1	19.95	19.37	18.73	18.24
-------	-------	------	-------	------	-------	------	------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=

1	0.99	0.97	0.91	0.77	0.56	0.39	0.47	0.78	0.96	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (94)

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

(95)m=

382.72	443.16	524.17	609.38	597.05	442.23	291.8	304.29	418.81	413.97	372.21	362.32
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 (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
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 (96)

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

(97)m=

1206.6	1170.67	1066.17	899.46	695.93	460.22	294.64	310.39	493.61	744.85	991.28	1201.81
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------

 (97)

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

(98)m=

612.97	488.89	403.25	208.86	73.57	0	0	0	0	246.17	445.73	624.58
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

3104.02

 (98)

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

49.4

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

Fraction of space heat from main system(s)

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

1

 (202)

Fraction of total heating from main system 1

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

1

 (204)

Efficiency of main space heating system 1

90.7

 (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)

612.97	488.89	403.25	208.86	73.57	0	0	0	0	246.17	445.73	624.58
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

675.82	539.02	444.6	230.27	81.11	0	0	0	0	271.41	491.44	688.62
--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------

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

3422.29

 (211)

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

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

(215)m=

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

0

 (215)

Water heating

Output from water heater (calculated above)

160.87	141.41	147.61	131.08	127.54	112.67	106.98	119.09	119.41	135.98	145.36	156.58
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

87.2

 (216)

(217)m=

89.95	89.89	89.73	89.32	88.45	87.2	87.2	87.2	87.2	89.42	89.81	89.98
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 (217)

Fuel for water heating, $kWh/month$

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

(219)m=

178.85	157.31	164.5	146.75	144.2	129.21	122.68	136.57	136.94	152.07	161.84	174.03
--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------

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

1804.94

 (219)

Annual totals

$kWh/year$

$kWh/year$

Space heating fuel used, main system 1

3422.29

DER WorkSheet: New dwelling design stage

Water heating fuel used			1804.94	
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			283.43	(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	=	739.21 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	389.87 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1129.08 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	147.1 (268)
Total CO2, kg/year		sum of (265)...(271) =		1315.11 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		20.93 (273)
El rating (section 14)				84 (274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: James Mcglashan **Stroma Number:** STRO000976
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Flat 3

Address : Apartment 3, 173-175 Field End Road, Pinner, HA5 1QR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	62.83 (1a)	2.45 (2a)	153.93 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.83 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	153.93 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (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
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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.6 0.6 0.59 0.57 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 0.57 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 Type 1			6.19	x 1/[1/(1.4)+0.04]	= 8.21		(27)
Windows Type 2			3.71	x 1/[1/(1.4)+0.04]	= 4.92		(27)
Floor			62.83	x 0.13	= 8.1679		(28)
Walls	78.99	15.71	63.28	x 0.18	= 11.39		(29)
Roof	62.83	0	62.83	x 0.13	= 8.17		(30)
Total area of elements, m²			204.65				(31)

* 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) = 47.87 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 1.31 (36)

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

Total fabric heat loss (33) + (36) = 49.18 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	30.5	30.3	30.11	29.19	29.02	28.23	28.23	28.08	28.54	29.02	29.37	29.73

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

(39)m=	79.68	79.48	79.29	78.37	78.2	77.41	77.41	77.26	77.72	78.2	78.55	78.91		
Average = Sum(39) _{1...12} /12=													78.37	(39)

TER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.27	1.27	1.26	1.25	1.24	1.23	1.23	1.23	1.24	1.24	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

2.06

(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

83.13

(43)

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

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

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

(44)m=	91.45	88.12	84.8	81.47	78.15	74.82	74.82	78.15	81.47	84.8	88.12	91.45		
Total = Sum(44) _{1...12} =													997.62	(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=	135.62	118.61	122.39	106.71	102.39	88.35	81.87	93.95	95.07	110.8	120.94	131.34		
Total = Sum(45) _{1...12} =													1308.03	(45)

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

(46)m=	20.34	17.79	18.36	16.01	15.36	13.25	12.28	14.09	14.26	16.62	18.14	19.7		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	--	------

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

TER WorkSheet: New dwelling design stage

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

(61)m=	46.6	40.56	43.21	40.18	39.82	36.9	38.13	39.82	40.18	43.21	43.46	46.6	(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=	182.22	159.17	165.61	146.88	142.21	125.25	120	133.77	135.25	154.01	164.4	177.94	(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=	182.22	159.17	165.61	146.88	142.21	125.25	120	133.77	135.25	154.01	164.4	177.94	
Output from water heater (annual) _{1...12}												1806.71	(64)

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

(65)m=	56.74	49.58	51.5	45.52	44	38.6	36.75	41.19	41.66	47.64	51.08	55.32	(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=	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	103.02	(66)

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

(67)m=	16.06	14.27	11.6	8.78	6.57	5.54	5.99	7.79	10.45	13.27	15.49	16.51	(67)
--------	-------	-------	------	------	------	------	------	------	-------	-------	-------	-------	------

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

(68)m=	180.02	181.89	177.18	167.16	154.51	142.62	134.68	132.81	137.52	147.54	160.19	172.08	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	(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=	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	76.27	73.78	69.22	63.23	59.14	53.61	49.4	55.37	57.86	64.04	70.94	74.35	(72)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(73)m=	329.26	326.84	314.91	296.08	277.12	258.69	246.98	252.87	262.73	281.75	303.53	319.85	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	6.19	x	11.28	x	0.63	x	0.7	=	21.34	(75)
Northeast 0.9x	0.77	x	3.71	x	11.28	x	0.63	x	0.7	=	25.59	(75)
Northeast 0.9x	0.77	x	6.19	x	22.97	x	0.63	x	0.7	=	43.45	(75)
Northeast 0.9x	0.77	x	3.71	x	22.97	x	0.63	x	0.7	=	52.08	(75)
Northeast 0.9x	0.77	x	6.19	x	41.38	x	0.63	x	0.7	=	78.28	(75)

TER WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	3.71	x	41.38	x	0.63	x	0.7	=	93.83	(75)
Northeast 0.9x	0.77	x	6.19	x	67.96	x	0.63	x	0.7	=	128.56	(75)
Northeast 0.9x	0.77	x	3.71	x	67.96	x	0.63	x	0.7	=	154.1	(75)
Northeast 0.9x	0.77	x	6.19	x	91.35	x	0.63	x	0.7	=	172.8	(75)
Northeast 0.9x	0.77	x	3.71	x	91.35	x	0.63	x	0.7	=	207.14	(75)
Northeast 0.9x	0.77	x	6.19	x	97.38	x	0.63	x	0.7	=	184.23	(75)
Northeast 0.9x	0.77	x	3.71	x	97.38	x	0.63	x	0.7	=	220.83	(75)
Northeast 0.9x	0.77	x	6.19	x	91.1	x	0.63	x	0.7	=	172.34	(75)
Northeast 0.9x	0.77	x	3.71	x	91.1	x	0.63	x	0.7	=	206.59	(75)
Northeast 0.9x	0.77	x	6.19	x	72.63	x	0.63	x	0.7	=	137.39	(75)
Northeast 0.9x	0.77	x	3.71	x	72.63	x	0.63	x	0.7	=	164.69	(75)
Northeast 0.9x	0.77	x	6.19	x	50.42	x	0.63	x	0.7	=	95.38	(75)
Northeast 0.9x	0.77	x	3.71	x	50.42	x	0.63	x	0.7	=	114.34	(75)
Northeast 0.9x	0.77	x	6.19	x	28.07	x	0.63	x	0.7	=	53.1	(75)
Northeast 0.9x	0.77	x	3.71	x	28.07	x	0.63	x	0.7	=	63.65	(75)
Northeast 0.9x	0.77	x	6.19	x	14.2	x	0.63	x	0.7	=	26.86	(75)
Northeast 0.9x	0.77	x	3.71	x	14.2	x	0.63	x	0.7	=	32.19	(75)
Northeast 0.9x	0.77	x	6.19	x	9.21	x	0.63	x	0.7	=	17.43	(75)
Northeast 0.9x	0.77	x	3.71	x	9.21	x	0.63	x	0.7	=	20.89	(75)

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

(83)m=	46.93	95.53	172.11	282.65	379.94	405.06	378.93	302.08	209.72	116.74	59.05	38.33	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	376.19	422.37	487.02	578.74	657.07	663.75	625.9	554.96	472.45	398.49	362.58	358.18	(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=	1	1	0.99	0.96	0.86	0.69	0.53	0.61	0.87	0.98	1	1	(86)

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

(87)m=	19.6	19.74	20.02	20.42	20.77	20.94	20.99	20.98	20.82	20.38	19.93	19.58	(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	19.9	19.89	19.88	19.88	19.88	(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	0.59	0.4	0.48	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=	18.01	18.22	18.63	19.21	19.66	19.86	19.89	19.89	19.74	19.16	18.5	17.99	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

$$fLA = \text{Living area} \div (4) = 0.38 \quad (91)$$

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

(92)m=	18.61	18.79	19.15	19.67	20.08	20.27	20.3	20.3	20.15	19.62	19.04	18.59	(92)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

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

TER WorkSheet: New dwelling design stage

(93)m=

18.61	18.79	19.15	19.67	20.08	20.27	20.3	20.3	20.15	19.62	19.04	18.59
-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------

 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=

1	0.99	0.98	0.94	0.82	0.63	0.45	0.53	0.82	0.97	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

 (94)

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

(95)m=

374.74	419.4	478.3	543.93	541.38	415.93	282.95	293.48	389.18	386.32	360.02	357.08
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

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

(97)m=

1140.46	1104.35	1003.28	843.77	655.12	438.8	286.78	301.2	470.04	705.3	937.72	1135.44
---------	---------	---------	--------	--------	-------	--------	-------	--------	-------	--------	---------

 (97)

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

(98)m=

569.69	460.29	390.58	215.88	84.62	0	0	0	0	237.33	415.94	579.11
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

2953.45

 (98)

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

47.01

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

 (201)

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

1

 (202)

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

1

 (204)

Efficiency of main space heating system 1

93.4

 (206)

Efficiency of secondary/supplementary heating system, %

0

 (208)

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

Space heating requirement (calculated above)

569.69	460.29	390.58	215.88	84.62	0	0	0	0	237.33	415.94	579.11
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

609.95	492.81	418.18	231.14	90.6	0	0	0	0	254.1	445.34	620.03
--------	--------	--------	--------	------	---	---	---	---	-------	--------	--------

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

3162.15

 (211)

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

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

(215)m=

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

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

0

 (215)

Water heating

Output from water heater (calculated above)

182.22	159.17	165.61	146.88	142.21	125.25	120	133.77	135.25	154.01	164.4	177.94
--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	-------	--------

Efficiency of water heater

80.3

 (216)

(217)m=

87.73	87.57	87.14	86.02	83.79	80.3	80.3	80.3	80.3	86.14	87.29	87.8
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	------

 (217)

Fuel for water heating, $kWh/month$

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

(219)m=

207.71	181.76	190.05	170.76	169.72	155.98	149.44	166.59	168.43	178.8	188.34	202.65
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

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

2130.23

 (219)

Annual totals

Space heating fuel used, main system 1

3162.15

 $kWh/year$ $kWh/year$

TER WorkSheet: New dwelling design stage

Water heating fuel used			2130.23	
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			283.7	(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	=	683.02	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	460.13	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1143.15	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	147.24	(268)
Total CO2, kg/year		sum of (265)...(271) =			1329.32	(272)

TER = 21.16 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 15 December 2020

Property Details: Flat 3

Dwelling type:	Flat
Located in:	England
Region:	Thames valley
Cross ventilation possible:	No
Number of storeys:	1
Front of dwelling faces:	South West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	203.19	(P1)
Transmission heat loss coefficient:	55.9	
Summer heat loss coefficient:	259.06	(P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North East (Living)	0	1
North East (Bed 1 & 2)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North East (Living)	1	0.9	1	0.9	(P8)
North East (Bed 1 & 2)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains
North East (Living)	0.9 x	7.2	98.85	0.63	0.8	0.9	290.54
North East (Bed 1 & 2)	0.9 x	8.64	98.85	0.63	0.8	0.9	348.65
Total							639.18 (P3/P4)

Internal gains:

	June	July	August	
Internal gains	366.59	351.63	358.74	
Total summer gains	1056.62	990.82	881.67	(P5)
Summer gain/loss ratio	4.08	3.82	3.4	(P6)
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	20.33	21.97	21.45	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

User Details:

Assessor Name: James Mcglashan **Stroma Number:** STRO000976
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Flat 3

Address : Apartment 3, 173-175 Field End Road, Pinner, HA5 1QR

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	62.83 (1a) x	2.45 (2a) =	153.93 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.83 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	153.93 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				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)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.38 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (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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SAP WorkSheet: New dwelling design stage

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

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.6 0.6 0.59 0.57 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 0.57 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	= 2.52		(26)
Windows Type 1			7.2	x 1/[1/(1.4)+0.04]	= 9.55		(27)
Windows Type 2			4.32	x 1/[1/(1.4)+0.04]	= 5.73		(27)
Floor			62.83	x 0.11	= 6.9113		(28)
Walls	78.99	17.94	61.05	x 0.22	= 13.43		(29)
Roof	62.83	0	62.83	x 0.14	= 8.8		(30)
Total area of elements, m²			204.65				(31)

* 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) = 52.66 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 3.21 (36)

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

Total fabric heat loss (33) + (36) = 55.87 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	30.5	30.3	30.11	29.19	29.02	28.23	28.23	28.08	28.54	29.02	29.37	29.73

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

(39)m=	86.37	86.17	85.97	85.06	84.89	84.1	84.1	83.95	84.4	84.89	85.24	85.6
Average = Sum(39) _{1...12} /12=												85.06 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

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

(40)m=	1.37	1.37	1.37	1.35	1.35	1.34	1.34	1.34	1.34	1.35	1.36	1.36		
Average = Sum(40) _{1...12} /12=													1.35	(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

2.06

(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

83.13

(43)

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

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

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

(44)m=	91.45	88.12	84.8	81.47	78.15	74.82	74.82	78.15	81.47	84.8	88.12	91.45		
Total = Sum(44) _{1...12} =													997.62	(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=	135.62	118.61	122.39	106.71	102.39	88.35	81.87	93.95	95.07	110.8	120.94	131.34		
Total = Sum(45) _{1...12} =													1308.03	(45)

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

(46)m=	20.34	17.79	18.36	16.01	15.36	13.25	12.28	14.09	14.26	16.62	18.14	19.7		(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	--	------

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

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

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

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

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

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

Primary circuit loss (annual) from Table 3

0

(58)

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

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

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

SAP WorkSheet: New dwelling design stage

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

(61)m=	25.26	22.8	25.22	24.37	25.16	24.32	25.1	25.14	24.34	25.19	24.41	25.25	(61)
--------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

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

(62)m=	160.87	141.41	147.61	131.08	127.54	112.67	106.98	119.09	119.41	135.98	145.36	156.58	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

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

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

Output from water heater

(64)m=	160.87	141.41	147.61	131.08	127.54	112.67	106.98	119.09	119.41	135.98	145.36	156.58	
Output from water heater (annual) _{1...12}												1604.58	(64)

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

(65)m=	51.41	45.14	47	41.57	40.33	35.46	33.5	37.52	37.7	43.14	46.32	49.98	(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=	123.62	123.62	123.62	123.62	123.62	123.62	123.62	123.62	123.62	123.62	123.62	123.62	(66)

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

(67)m=	40.12	35.64	28.98	21.94	16.4	13.85	14.96	19.45	26.1	33.14	38.68	41.24	(67)
--------	-------	-------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	------

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

(68)m=	268.69	271.48	264.45	249.5	230.61	212.87	201.01	198.23	205.25	220.21	239.09	256.84	(68)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	49.42	(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=	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	-82.42	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	69.09	67.17	63.17	57.74	54.21	49.24	45.02	50.43	52.36	57.98	64.33	67.18	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	471.54	467.92	450.24	422.81	394.86	369.59	354.63	361.74	377.34	404.96	435.73	458.88	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	7.2	x	11.28	x	0.63	x	0.8	=	28.37	(75)
Northeast 0.9x	0.77	x	4.32	x	11.28	x	0.63	x	0.8	=	34.05	(75)
Northeast 0.9x	0.77	x	7.2	x	22.97	x	0.63	x	0.8	=	57.76	(75)
Northeast 0.9x	0.77	x	4.32	x	22.97	x	0.63	x	0.8	=	69.31	(75)
Northeast 0.9x	0.77	x	7.2	x	41.38	x	0.63	x	0.8	=	104.06	(75)

SAP WorkSheet: New dwelling design stage

Northeast 0.9x	0.77	x	4.32	x	41.38	x	0.63	x	0.8	=	124.87	(75)
Northeast 0.9x	0.77	x	7.2	x	67.96	x	0.63	x	0.8	=	170.89	(75)
Northeast 0.9x	0.77	x	4.32	x	67.96	x	0.63	x	0.8	=	205.07	(75)
Northeast 0.9x	0.77	x	7.2	x	91.35	x	0.63	x	0.8	=	229.71	(75)
Northeast 0.9x	0.77	x	4.32	x	91.35	x	0.63	x	0.8	=	275.66	(75)
Northeast 0.9x	0.77	x	7.2	x	97.38	x	0.63	x	0.8	=	244.9	(75)
Northeast 0.9x	0.77	x	4.32	x	97.38	x	0.63	x	0.8	=	293.88	(75)
Northeast 0.9x	0.77	x	7.2	x	91.1	x	0.63	x	0.8	=	229.1	(75)
Northeast 0.9x	0.77	x	4.32	x	91.1	x	0.63	x	0.8	=	274.92	(75)
Northeast 0.9x	0.77	x	7.2	x	72.63	x	0.63	x	0.8	=	182.64	(75)
Northeast 0.9x	0.77	x	4.32	x	72.63	x	0.63	x	0.8	=	219.17	(75)
Northeast 0.9x	0.77	x	7.2	x	50.42	x	0.63	x	0.8	=	126.8	(75)
Northeast 0.9x	0.77	x	4.32	x	50.42	x	0.63	x	0.8	=	152.15	(75)
Northeast 0.9x	0.77	x	7.2	x	28.07	x	0.63	x	0.8	=	70.58	(75)
Northeast 0.9x	0.77	x	4.32	x	28.07	x	0.63	x	0.8	=	84.7	(75)
Northeast 0.9x	0.77	x	7.2	x	14.2	x	0.63	x	0.8	=	35.7	(75)
Northeast 0.9x	0.77	x	4.32	x	14.2	x	0.63	x	0.8	=	42.84	(75)
Northeast 0.9x	0.77	x	7.2	x	9.21	x	0.63	x	0.8	=	23.17	(75)
Northeast 0.9x	0.77	x	4.32	x	9.21	x	0.63	x	0.8	=	27.81	(75)

Solar gains in watts, calculated for each month

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

(83)m=	62.42	127.06	228.93	375.96	505.37	538.78	504.01	401.81	278.95	155.28	78.54	50.98	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	533.96	594.98	679.17	798.77	900.23	908.37	858.65	763.54	656.29	560.24	514.28	509.86	(84)
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7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.9	0.76	0.57	0.43	0.49	0.76	0.95	0.99	0.99	(86)

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

(87)m=	19.69	19.85	20.15	20.56	20.85	20.97	20.99	20.99	20.88	20.49	20.02	19.66	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.78	19.79	19.79	19.8	19.8	19.81	19.81	19.81	19.81	19.8	19.8	19.79	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	-------	------

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

(89)m=	0.99	0.98	0.96	0.87	0.69	0.47	0.31	0.37	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=	18.08	18.31	18.75	19.31	19.67	19.79	19.81	19.81	19.72	19.24	18.58	18.04	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.38 (91)

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

(92)m=	18.69	18.89	19.28	19.78	20.11	20.24	20.26	20.25	20.16	19.71	19.12	18.65	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

SAP WorkSheet: New dwelling design stage

(93)m=

18.54	18.74	19.13	19.63	19.96	20.09	20.11	20.1	20.01	19.56	18.97	18.5
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 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=

0.99	0.98	0.95	0.87	0.7	0.5	0.34	0.4	0.69	0.92	0.97	0.99
------	------	------	------	-----	-----	------	-----	------	------	------	------

 (94)

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

(95)m=

525.97	580.43	643.82	691.3	632.21	450.04	293.23	307.56	453.36	513.23	501.19	503.5
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------

 (95)

Monthly average external temperature from Table 8

(96)m=

4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

 (96)

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

(97)m=

1229.8	1193	1085.83	912.8	701.38	461.4	294.88	310.92	498.98	761.06	1012.09	1224.48
--------	------	---------	-------	--------	-------	--------	--------	--------	--------	---------	---------

 (97)

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

(98)m=

523.65	411.65	328.86	159.48	51.47	0	0	0	0	184.38	367.85	536.41
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

2563.74

 (98)

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

40.8

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

1

 (204)

Efficiency of main space heating system 1

90.7

 (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)

523.65	411.65	328.86	159.48	51.47	0	0	0	0	184.38	367.85	536.41
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

577.34	453.86	362.58	175.83	56.74	0	0	0	0	203.29	405.57	591.41
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

2826.62

 (211)

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

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

(215)m=

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

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

0

 (215)

Water heating

Output from water heater (calculated above)

160.87	141.41	147.61	131.08	127.54	112.67	106.98	119.09	119.41	135.98	145.36	156.58
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

87.2

 (216)

(217)m=

89.85	89.78	89.59	89.09	88.18	87.2	87.2	87.2	87.2	89.18	89.68	89.88
-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------

 (217)

Fuel for water heating, $kWh/month$

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

(219)m=

179.04	157.51	164.77	147.13	144.64	129.21	122.68	136.57	136.94	152.48	162.08	174.2
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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

1807.26

 (219)

Annual totals

$kWh/year$

$kWh/year$

Space heating fuel used, main system 1

2826.62

SAP WorkSheet: New dwelling design stage

Water heating fuel used			1807.26	
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			283.43	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	98.37 (240)
Space heating - main system 2	(213) x	0	x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	62.89 (247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89 (249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a				
Energy for lighting	(232)	13.19	x 0.01 =	37.39 (250)
Additional standing charges (Table 12)				120 (251)
Appendix Q items: repeat lines (253) and (254) as needed				
Total energy cost	(245)...(247) + (250)...(254) =			328.54 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.28	(257)
SAP rating (Section 12)		82.15	(258)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	610.55 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	390.37 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1000.92 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
Electricity for lighting	(232) x	0.519	=	147.1 (268)
Total CO2, kg/year	sum of (265)...(271) =			1186.94 (272)
CO2 emissions per m²	(272) ÷ (4) =			18.89 (273)
EI rating (section 14)				85 (274)

13a. Primary Energy

SAP WorkSheet: New dwelling design stage

	Energy kWh/year	Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	=	3448.48 (261)
Space heating (secondary)	(215) x	3.07	=	0 (263)
Energy for water heating	(219) x	1.22	=	2204.85 (264)
Space and water heating	(261) + (262) + (263) + (264) =			5653.33 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25 (267)
Electricity for lighting	(232) x	0	=	870.14 (268)
'Total Primary Energy	sum of (265)...(271) =			6753.72 (272)
Primary energy kWh/m ² /year	(272) ÷ (4) =			107.49 (273)

User Details:

Assessor Name: James Mcglashan **Stroma Number:** STRO000976
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Flat 4

Address : Apartment 4, 173-175 Field End Road, PINNER, HA5 1QR

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	54.93 (1a)	x	2.63 (2a)	=	144.47 (3a)
First floor	40.61 (1b)	x	2.9 (2b)	=	117.77 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	95.54 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	262.23 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (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			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.86 (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) =		0.73 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

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

	0.94	0.92	0.9	0.81	0.79	0.7	0.7	0.68	0.73	0.79	0.83	0.86
--	------	------	-----	------	------	-----	-----	------	------	------	------	------

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 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 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 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= 0.94 0.92 0.91 0.83 0.81 0.74 0.74 0.73 0.77 0.81 0.84 0.87 (24d)

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

(25)m= 0.94 0.92 0.91 0.83 0.81 0.74 0.74 0.73 0.77 0.81 0.84 0.87 (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			2.25	x 1.8	= 4.05		(26)
Windows Type 1			1.5	x 1/[1/(1.6) + 0.04]	= 2.26		(27)
Windows Type 2			1.57	x 1/[1/(1.6) + 0.04]	= 2.36		(27)
Windows Type 3			2.51	x 1/[1/(1.6) + 0.04]	= 3.77		(27)
Rooflights			0.8008	x 1/[1/(1.7) + 0.04]	= 1.36136		(27b)
Walls Type1	33.72	8.32	25.4	x 0.3	= 7.62		(29)
Walls Type2	17.63	0	17.63	x 0.3	= 5.29		(29)
Walls Type3	19.91	0	19.91	x 0.28	= 5.57		(29)
Walls Type4	5.55	2.51	3.04	x 0.28	= 0.85		(29)
Roof Type1	51.71	1.6	50.11	x 0.18	= 9.02		(30)
Roof Type2	14.32	0	14.32	x 0.16	= 2.29		(30)
Total area of elements, m²			142.84				(31)
Party wall			65.33	x 0	= 0		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 50.15 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

21.43 (36)

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

Total fabric heat loss

(33) + (36) =

71.57 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	81.24	79.77	78.32	71.53	70.26	64.35	64.35	63.25	66.63	70.26	72.83	75.52

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	152.81	151.34	149.89	143.11	141.84	135.92	135.92	134.83	138.2	141.84	144.41	147.09
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

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

143.1 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.6	1.58	1.57	1.5	1.48	1.42	1.42	1.41	1.45	1.48	1.51	1.54
--------	-----	------	------	-----	------	------	------	------	------	------	------	------

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

1.5 (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

2.69

(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

98.19

(43)

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

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

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

(44)m=	108.01	104.08	100.15	96.22	92.3	88.37	88.37	92.3	96.22	100.15	104.08	108.01
--------	--------	--------	--------	-------	------	-------	-------	------	-------	--------	--------	--------

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

1178.25 (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=	160.17	140.09	144.56	126.03	120.93	104.35	96.7	110.96	112.29	130.86	142.84	155.12
--------	--------	--------	--------	--------	--------	--------	------	--------	--------	--------	--------	--------

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

1544.88 (45)

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

(46)m=	24.03	21.01	21.68	18.9	18.14	15.65	14.5	16.64	16.84	19.63	21.43	23.27
--------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$

0
0

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

0

 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=

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

 (56)

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

(57)m=

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

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

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

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

(59)m=

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

 (59)

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

(61)m=

25.33	22.87	25.29	24.44	25.22	24.37	25.16	25.2	24.4	25.25	24.48	25.32
-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------

 (61)

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

(62)m=

185.5	162.95	169.85	150.46	146.15	128.72	121.85	136.16	136.69	156.11	167.32	180.43
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

185.5	162.95	169.85	150.46	146.15	128.72	121.85	136.16	136.69	156.11	167.32	180.43
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) _{1...12}	1842.2
---	--------

 (64)

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

(65)m=

59.59	52.3	54.39	48.01	46.51	40.79	38.44	43.19	43.43	49.82	53.62	57.91
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
161.65	161.65	161.65	161.65	161.65	161.65	161.65	161.65	161.65	161.65	161.65	161.65

 (66)

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

(67)m=

62.76	55.75	45.34	34.32	25.66	21.66	23.4	30.42	40.83	51.85	60.51	64.51
-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

371.51	375.36	365.65	344.97	318.86	294.32	277.93	274.08	283.79	304.47	330.58	355.11
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

53.86	53.86	53.86	53.86	53.86	53.86	53.86	53.86	53.86	53.86	53.86	53.86
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-107.77	-107.77	-107.77	-107.77	-107.77	-107.77	-107.77	-107.77	-107.77	-107.77	-107.77	-107.77
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

80.09	77.82	73.1	66.68	62.52	56.65	51.67	58.06	60.33	66.97	74.47	77.83
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

625.11	619.67	594.83	556.72	517.78	483.38	463.75	473.3	495.69	534.03	576.3	608.2
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 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	1.57	x	11.28	x	0.63	x	0.7	=	5.41	(75)
Northeast 0.9x	0.77	x	2.51	x	11.28	x	0.63	x	0.7	=	8.66	(75)
Northeast 0.9x	0.77	x	1.57	x	22.97	x	0.63	x	0.7	=	11.02	(75)
Northeast 0.9x	0.77	x	2.51	x	22.97	x	0.63	x	0.7	=	17.62	(75)
Northeast 0.9x	0.77	x	1.57	x	41.38	x	0.63	x	0.7	=	19.85	(75)
Northeast 0.9x	0.77	x	2.51	x	41.38	x	0.63	x	0.7	=	31.74	(75)
Northeast 0.9x	0.77	x	1.57	x	67.96	x	0.63	x	0.7	=	32.61	(75)
Northeast 0.9x	0.77	x	2.51	x	67.96	x	0.63	x	0.7	=	52.13	(75)
Northeast 0.9x	0.77	x	1.57	x	91.35	x	0.63	x	0.7	=	43.83	(75)
Northeast 0.9x	0.77	x	2.51	x	91.35	x	0.63	x	0.7	=	70.07	(75)
Northeast 0.9x	0.77	x	1.57	x	97.38	x	0.63	x	0.7	=	46.73	(75)
Northeast 0.9x	0.77	x	2.51	x	97.38	x	0.63	x	0.7	=	74.7	(75)
Northeast 0.9x	0.77	x	1.57	x	91.1	x	0.63	x	0.7	=	43.71	(75)
Northeast 0.9x	0.77	x	2.51	x	91.1	x	0.63	x	0.7	=	69.88	(75)
Northeast 0.9x	0.77	x	1.57	x	72.63	x	0.63	x	0.7	=	34.85	(75)
Northeast 0.9x	0.77	x	2.51	x	72.63	x	0.63	x	0.7	=	55.71	(75)
Northeast 0.9x	0.77	x	1.57	x	50.42	x	0.63	x	0.7	=	24.19	(75)
Northeast 0.9x	0.77	x	2.51	x	50.42	x	0.63	x	0.7	=	38.68	(75)
Northeast 0.9x	0.77	x	1.57	x	28.07	x	0.63	x	0.7	=	13.47	(75)
Northeast 0.9x	0.77	x	2.51	x	28.07	x	0.63	x	0.7	=	21.53	(75)
Northeast 0.9x	0.77	x	1.57	x	14.2	x	0.63	x	0.7	=	6.81	(75)
Northeast 0.9x	0.77	x	2.51	x	14.2	x	0.63	x	0.7	=	10.89	(75)
Northeast 0.9x	0.77	x	1.57	x	9.21	x	0.63	x	0.7	=	4.42	(75)
Northeast 0.9x	0.77	x	2.51	x	9.21	x	0.63	x	0.7	=	7.07	(75)
Southwest 0.9x	0.77	x	1.5	x	36.79		0.63	x	0.7	=	50.6	(79)
Southwest 0.9x	0.77	x	1.5	x	62.67		0.63	x	0.7	=	86.19	(79)
Southwest 0.9x	0.77	x	1.5	x	85.75		0.63	x	0.7	=	117.93	(79)
Southwest 0.9x	0.77	x	1.5	x	106.25		0.63	x	0.7	=	146.12	(79)
Southwest 0.9x	0.77	x	1.5	x	119.01		0.63	x	0.7	=	163.67	(79)
Southwest 0.9x	0.77	x	1.5	x	118.15		0.63	x	0.7	=	162.49	(79)
Southwest 0.9x	0.77	x	1.5	x	113.91		0.63	x	0.7	=	156.65	(79)
Southwest 0.9x	0.77	x	1.5	x	104.39		0.63	x	0.7	=	143.56	(79)
Southwest 0.9x	0.77	x	1.5	x	92.85		0.63	x	0.7	=	127.7	(79)
Southwest 0.9x	0.77	x	1.5	x	69.27		0.63	x	0.7	=	95.26	(79)
Southwest 0.9x	0.77	x	1.5	x	44.07		0.63	x	0.7	=	60.61	(79)
Southwest 0.9x	0.77	x	1.5	x	31.49		0.63	x	0.7	=	43.3	(79)
Rooflights 0.9x	1	x	0.8	x	39.98	x	0.63	x	0.7	=	25.41	(82)
Rooflights 0.9x	1	x	0.8	x	73.48	x	0.63	x	0.7	=	46.71	(82)
Rooflights 0.9x	1	x	0.8	x	112.11	x	0.63	x	0.7	=	71.27	(82)

Rooflights 0.9x	1	x	0.8	x	153.81	x	0.63	x	0.7	=	97.77	(82)
Rooflights 0.9x	1	x	0.8	x	182.63	x	0.63	x	0.7	=	116.09	(82)
Rooflights 0.9x	1	x	0.8	x	184.99	x	0.63	x	0.7	=	117.6	(82)
Rooflights 0.9x	1	x	0.8	x	176.88	x	0.63	x	0.7	=	112.44	(82)
Rooflights 0.9x	1	x	0.8	x	155.4	x	0.63	x	0.7	=	98.78	(82)
Rooflights 0.9x	1	x	0.8	x	126.86	x	0.63	x	0.7	=	80.64	(82)
Rooflights 0.9x	1	x	0.8	x	84.6	x	0.63	x	0.7	=	53.78	(82)
Rooflights 0.9x	1	x	0.8	x	48.93	x	0.63	x	0.7	=	31.1	(82)
Rooflights 0.9x	1	x	0.8	x	33.5	x	0.63	x	0.7	=	21.29	(82)

Solar gains in watts, calculated for each month

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

(83)m=	90.08	161.54	240.79	328.63	393.66	401.51	382.69	332.9	271.2	184.04	109.41	76.09	(83)
--------	-------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	-------	------

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

(84)m=	715.19	781.21	835.62	885.35	911.44	884.89	846.44	806.2	766.9	718.07	685.71	684.28	(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	0.99	0.97	0.92	0.8	0.65	0.69	0.88	0.97	0.99	1	(86)

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

(87)m=	19.33	19.49	19.77	20.19	20.56	20.85	20.96	20.94	20.74	20.28	19.78	19.36	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.61	19.63	19.64	19.69	19.7	19.75	19.75	19.75	19.73	19.7	19.68	19.66	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.95	0.88	0.7	0.49	0.54	0.81	0.96	0.99	0.99	(89)
--------	------	------	------	------	------	-----	------	------	------	------	------	------	------

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

(90)m=	18.13	18.3	18.59	19.04	19.39	19.67	19.73	19.74	19.58	19.14	18.63	18.2	(90)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =

0.35 (91)

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

(92)m=	18.55	18.72	19	19.45	19.8	20.09	20.17	20.16	19.99	19.54	19.03	18.61	(92)
--------	-------	-------	----	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.4	18.57	18.85	19.3	19.65	19.94	20.02	20.01	19.84	19.39	18.88	18.46	(93)
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8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.98	0.95	0.88	0.72	0.53	0.57	0.82	0.95	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	708.65	770.46	815.45	839.19	801.93	638.99	447.22	463.12	629.87	684.73	675.42	679.08	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	2155.33	2068.49	1851.59	1487.93	1127.96	725.77	464.22	487.1	793.69	1247.14	1701.55	2096.82	(97)
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SAP WorkSheet: New dwelling created by change of us

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

(98)m=	1076.33	872.27	770.89	467.09	242.57	0	0	0	0	418.43	738.82	1054.8	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													5641.2 (98)

Space heating requirement in kWh/m ² /year	59.05 (99)
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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		90.7 (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)												
1076.33	872.27	770.89	467.09	242.57	0	0	0	0	418.43	738.82	1054.8	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												
1186.69	961.71	849.93	514.98	267.44	0	0	0	0	461.34	814.58	1162.96	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												
												6219.63 (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	
Total (kWh/year) =Sum(215) _{1...5,10...12} =											0	(215)

Water heating

Output from water heater (calculated above)																
185.5	162.95	169.85	150.46	146.15	128.72	121.85	136.16	136.69	156.11	167.32	180.43					
Efficiency of water heater												87.2	(216)			
(217)m=	90.17	90.13	90.05	89.82	89.35	87.2	87.2	87.2	87.2	89.72	90.03	90.17		(217)		
Fuel for water heating, kWh/month																
(219)m = (64)m x 100 ÷ (217)m																
(219)m=	205.73	180.8	188.62	167.51	163.57	147.62	139.74	156.14	156.75	174	185.85	200.1				
													Total = Sum(219a) _{1...12} =		2066.41	(219)

Annual totals

Space heating fuel used, main system 1	kWh/year	6219.63
Water heating fuel used	kWh/year	2066.41
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		443.38 (232)

10a. Fuel costs - individual heating systems:

Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
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SAP WorkSheet: New dwelling created by change of us

Space heating - main system 1	(211) x	3.48	x 0.01 =	216.44	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	71.91	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	13.19	x 0.01 =	58.48	(250)
Additional standing charges (Table 12)				120	(251)

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

Total energy cost (245)...(247) + (250)...(254) = 476.73 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.42	(257)
SAP rating (Section 12)		80.13	(258)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1343.44	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	446.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1789.79	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	230.11	(268)
Total CO2, kg/year		sum of (265)...(271) =		2058.82	(272)
CO2 emissions per m²		(272) ÷ (4) =		21.55	(273)
EI rating (section 14)				80	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	7587.95	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2521.03	(264)
Space and water heating	(261) + (262) + (263) + (264) =			10108.97	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1361.18	(268)
'Total Primary Energy		sum of (265)...(271) =		11700.4	(272)



Primary energy kWh/m²/year

$(272) \div (4) =$

122.47

(273)

User Details:

Assessor Name: James Mcglashan **Stroma Number:** STRO000976
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.12

Property Address: Flat 5

Address : Apartment 5, 173-175 Field End Road, PINNER, HA5 1QR

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	52.02 (1a)	x	2.63 (2a)	=	136.81 (3a)
First floor	38.7 (1b)	x	2.9 (2b)	=	112.23 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.72 (4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	249.04 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (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			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.87 (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) =		0.74 (21)

Infiltration rate modified for monthly wind speed

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

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

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

	0.94	0.92	0.91	0.81	0.8	0.7	0.7	0.68	0.74	0.8	0.83	0.87
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × 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
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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
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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
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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=	0.94	0.93	0.91	0.83	0.82	0.75	0.75	0.73	0.77	0.82	0.85	0.88
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.94	0.93	0.91	0.83	0.82	0.75	0.75	0.73	0.77	0.82	0.85	0.88
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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			2.25	x 1.8	= 4.05		(26)
Windows Type 1			1.5	x 1/[1/(1.6) + 0.04]	= 2.26		(27)
Windows Type 2			1.57	x 1/[1/(1.6) + 0.04]	= 2.36		(27)
Windows Type 3			2.51	x 1/[1/(1.6) + 0.04]	= 3.77		(27)
Rooflights			0.8008	x 1/[1/(1.7) + 0.04]	= 1.36136		(27b)
Floor			7.23	x 0.2	= 1.446		(28)
Walls Type1	33.72	8.32	25.4	x 0.3	= 7.62		(29)
Walls Type2	17.63	0	17.63	x 0.3	= 5.29		(29)
Walls Type3	19.91	0	19.91	x 0.28	= 5.57		(29)
Walls Type4	5.55	2.51	3.04	x 0.28	= 0.85		(29)
Roof Type1	51.71	1.6	50.11	x 0.18	= 9.02		(30)
Roof Type2	14.32	0	14.32	x 0.16	= 2.29		(30)
Total area of elements, m²			150.07				(31)
Party wall			53.75	x 0	= 0		(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 51.59 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 144.6 (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

22.51 (36)

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

Total fabric heat loss

(33) + (36) =

74.1 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	77.66	76.24	74.85	68.31	67.09	61.39	61.39	60.34	63.59	67.09	69.56	72.15

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	151.77	150.34	148.95	142.42	141.19	135.5	135.5	134.44	137.69	141.19	143.67	146.25
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Average = Sum(39)_{1...12} / 12 =

142.41 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.67	1.66	1.64	1.57	1.56	1.49	1.49	1.48	1.52	1.56	1.58	1.61
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Average = Sum(40)_{1...12} / 12 =

1.57 (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

2.64

(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

96.79

(43)

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

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

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

(44)m=	106.47	102.6	98.73	94.86	90.98	87.11	87.11	90.98	94.86	98.73	102.6	106.47
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

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

1161.5 (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=	157.89	138.09	142.5	124.24	119.21	102.87	95.32	109.38	110.69	129	140.81	152.91
--------	--------	--------	-------	--------	--------	--------	-------	--------	--------	-----	--------	--------

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

1522.91 (45)

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

(46)m=	23.68	20.71	21.38	18.64	17.88	15.43	14.3	16.41	16.6	19.35	21.12	22.94
--------	-------	-------	-------	-------	-------	-------	------	-------	------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year $(47) \times (51) \times (52) \times (53) =$

0
0

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

0

 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=

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

 (56)

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

(57)m=

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

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

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

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

(59)m=

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

 (59)

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

(61)m=

25.32	22.86	25.28	24.43	25.22	24.37	25.15	25.19	24.39	25.25	24.48	25.31
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (61)

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

(62)m=

183.22	160.96	167.79	148.67	144.42	127.23	120.47	134.57	135.08	154.25	165.29	178.22
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

183.22	160.96	167.79	148.67	144.42	127.23	120.47	134.57	135.08	154.25	165.29	178.22
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) _{1...12}	1820.17
---	---------

 (64)

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

(65)m=

58.83	51.63	53.7	47.42	45.94	40.29	37.98	42.67	42.9	49.2	52.94	57.17
-------	-------	------	-------	-------	-------	-------	-------	------	------	-------	-------

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13	158.13

 (66)

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

(67)m=

59.93	53.23	43.29	32.78	24.5	20.68	22.35	29.05	38.99	49.51	57.78	61.6
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

 (67)

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

(68)m=

358.8	362.52	353.14	333.17	307.95	284.26	268.42	264.7	274.08	294.06	319.27	342.97
-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (68)

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

(69)m=

53.45	53.45	53.45	53.45	53.45	53.45	53.45	53.45	53.45	53.45	53.45	53.45
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-105.42	-105.42	-105.42	-105.42	-105.42	-105.42	-105.42	-105.42	-105.42	-105.42	-105.42	-105.42
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

79.07	76.83	72.18	65.86	61.75	55.97	51.05	57.35	59.59	66.13	73.53	76.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

606.97	601.75	577.77	540.95	503.36	470.06	450.98	460.26	481.82	518.86	559.74	590.57
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	1.57	x	11.28	x	0.63	x	0.7	=	5.41	(75)
Northeast 0.9x	0.77	x	2.51	x	11.28	x	0.63	x	0.7	=	8.66	(75)
Northeast 0.9x	0.77	x	1.57	x	22.97	x	0.63	x	0.7	=	11.02	(75)
Northeast 0.9x	0.77	x	2.51	x	22.97	x	0.63	x	0.7	=	17.62	(75)
Northeast 0.9x	0.77	x	1.57	x	41.38	x	0.63	x	0.7	=	19.85	(75)
Northeast 0.9x	0.77	x	2.51	x	41.38	x	0.63	x	0.7	=	31.74	(75)
Northeast 0.9x	0.77	x	1.57	x	67.96	x	0.63	x	0.7	=	32.61	(75)
Northeast 0.9x	0.77	x	2.51	x	67.96	x	0.63	x	0.7	=	52.13	(75)
Northeast 0.9x	0.77	x	1.57	x	91.35	x	0.63	x	0.7	=	43.83	(75)
Northeast 0.9x	0.77	x	2.51	x	91.35	x	0.63	x	0.7	=	70.07	(75)
Northeast 0.9x	0.77	x	1.57	x	97.38	x	0.63	x	0.7	=	46.73	(75)
Northeast 0.9x	0.77	x	2.51	x	97.38	x	0.63	x	0.7	=	74.7	(75)
Northeast 0.9x	0.77	x	1.57	x	91.1	x	0.63	x	0.7	=	43.71	(75)
Northeast 0.9x	0.77	x	2.51	x	91.1	x	0.63	x	0.7	=	69.88	(75)
Northeast 0.9x	0.77	x	1.57	x	72.63	x	0.63	x	0.7	=	34.85	(75)
Northeast 0.9x	0.77	x	2.51	x	72.63	x	0.63	x	0.7	=	55.71	(75)
Northeast 0.9x	0.77	x	1.57	x	50.42	x	0.63	x	0.7	=	24.19	(75)
Northeast 0.9x	0.77	x	2.51	x	50.42	x	0.63	x	0.7	=	38.68	(75)
Northeast 0.9x	0.77	x	1.57	x	28.07	x	0.63	x	0.7	=	13.47	(75)
Northeast 0.9x	0.77	x	2.51	x	28.07	x	0.63	x	0.7	=	21.53	(75)
Northeast 0.9x	0.77	x	1.57	x	14.2	x	0.63	x	0.7	=	6.81	(75)
Northeast 0.9x	0.77	x	2.51	x	14.2	x	0.63	x	0.7	=	10.89	(75)
Northeast 0.9x	0.77	x	1.57	x	9.21	x	0.63	x	0.7	=	4.42	(75)
Northeast 0.9x	0.77	x	2.51	x	9.21	x	0.63	x	0.7	=	7.07	(75)
Southwest 0.9x	0.77	x	1.5	x	36.79		0.63	x	0.7	=	50.6	(79)
Southwest 0.9x	0.77	x	1.5	x	62.67		0.63	x	0.7	=	86.19	(79)
Southwest 0.9x	0.77	x	1.5	x	85.75		0.63	x	0.7	=	117.93	(79)
Southwest 0.9x	0.77	x	1.5	x	106.25		0.63	x	0.7	=	146.12	(79)
Southwest 0.9x	0.77	x	1.5	x	119.01		0.63	x	0.7	=	163.67	(79)
Southwest 0.9x	0.77	x	1.5	x	118.15		0.63	x	0.7	=	162.49	(79)
Southwest 0.9x	0.77	x	1.5	x	113.91		0.63	x	0.7	=	156.65	(79)
Southwest 0.9x	0.77	x	1.5	x	104.39		0.63	x	0.7	=	143.56	(79)
Southwest 0.9x	0.77	x	1.5	x	92.85		0.63	x	0.7	=	127.7	(79)
Southwest 0.9x	0.77	x	1.5	x	69.27		0.63	x	0.7	=	95.26	(79)
Southwest 0.9x	0.77	x	1.5	x	44.07		0.63	x	0.7	=	60.61	(79)
Southwest 0.9x	0.77	x	1.5	x	31.49		0.63	x	0.7	=	43.3	(79)
Rooflights 0.9x	1	x	0.8	x	39.98	x	0.63	x	0.7	=	25.41	(82)
Rooflights 0.9x	1	x	0.8	x	73.48	x	0.63	x	0.7	=	46.71	(82)
Rooflights 0.9x	1	x	0.8	x	112.11	x	0.63	x	0.7	=	71.27	(82)

Rooflights 0.9x	1	x	0.8	x	153.81	x	0.63	x	0.7	=	97.77	(82)
Rooflights 0.9x	1	x	0.8	x	182.63	x	0.63	x	0.7	=	116.09	(82)
Rooflights 0.9x	1	x	0.8	x	184.99	x	0.63	x	0.7	=	117.6	(82)
Rooflights 0.9x	1	x	0.8	x	176.88	x	0.63	x	0.7	=	112.44	(82)
Rooflights 0.9x	1	x	0.8	x	155.4	x	0.63	x	0.7	=	98.78	(82)
Rooflights 0.9x	1	x	0.8	x	126.86	x	0.63	x	0.7	=	80.64	(82)
Rooflights 0.9x	1	x	0.8	x	84.6	x	0.63	x	0.7	=	53.78	(82)
Rooflights 0.9x	1	x	0.8	x	48.93	x	0.63	x	0.7	=	31.1	(82)
Rooflights 0.9x	1	x	0.8	x	33.5	x	0.63	x	0.7	=	21.29	(82)

Solar gains in watts, calculated for each month

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

(83)m=	90.08	161.54	240.79	328.63	393.66	401.51	382.69	332.9	271.2	184.04	109.41	76.09	(83)
--------	-------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--------	-------	------

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

(84)m=	697.05	763.29	818.57	869.59	897.02	871.57	833.67	793.16	753.02	702.89	669.15	666.66	(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	0.97	0.92	0.8	0.65	0.69	0.88	0.97	0.99	1	(86)

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

(87)m=	19.26	19.42	19.71	20.15	20.53	20.84	20.95	20.93	20.72	20.24	19.72	19.29	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.56	19.57	19.58	19.64	19.65	19.69	19.69	19.7	19.67	19.65	19.63	19.6	(88)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------	------

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

(89)m=	0.99	0.99	0.98	0.95	0.88	0.7	0.49	0.54	0.81	0.96	0.99	0.99	(89)
--------	------	------	------	------	------	-----	------	------	------	------	------	------	------

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

(90)m=	18.03	18.2	18.49	18.96	19.32	19.62	19.68	19.68	19.52	19.06	18.53	18.09	(90)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.37 (91)

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

(92)m=	18.48	18.65	18.95	19.4	19.77	20.07	20.15	20.15	19.97	19.5	18.97	18.53	(92)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(93)m=	18.33	18.5	18.8	19.25	19.62	19.92	20	20	19.82	19.35	18.82	18.38	(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	0.97	0.94	0.88	0.72	0.53	0.58	0.82	0.95	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	690.04	751.81	797.24	821.73	786.09	628.47	441.79	457	617.04	668.62	658.25	661.05	(95)
--------	--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	2129.82	2044.98	1831.53	1474.31	1118.31	720.67	460.86	483.66	787.27	1235.52	1684.3	2074.19	(97)
--------	---------	---------	---------	---------	---------	--------	--------	--------	--------	---------	--------	---------	------

SAP WorkSheet: New dwelling created by change of us

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

(98)m=	1071.2	869.01	769.51	469.86	247.17	0	0	0	0	421.77	738.75	1051.38	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													5638.65 (98)

Space heating requirement in kWh/m ² /year	62.15 (99)
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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		90.7 (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)

1071.2	869.01	769.51	469.86	247.17	0	0	0	0	421.77	738.75	1051.38
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	---------

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

1181.03	958.12	848.42	518.04	272.51	0	0	0	0	465.02	814.5	1159.18		
Total (kWh/year) =Sum(211) _{1...5,10...12} =												6216.82	(211)

Space heating fuel (secondary), kWh/month

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

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

Water heating

Output from water heater (calculated above)

183.22	160.96	167.79	148.67	144.42	127.23	120.47	134.57	135.08	154.25	165.29	178.22
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater 87.2 (216)

(217)m=	90.17	90.13	90.05	89.83	89.38	87.2	87.2	87.2	87.2	89.74	90.04	90.18	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

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

(219)m=	203.19	178.57	186.32	165.49	161.59	145.91	138.16	154.33	154.91	171.89	183.57	197.64	
Total = Sum(219a) _{1...12} =													2041.57 (219)

Annual totals

Space heating fuel used, main system 1 kWh/year kWh/year 6216.82

Water heating fuel used 2041.57

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 423.39 (232)

10a. Fuel costs - individual heating systems:

Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
------------------	--------------------------	---------------------

SAP WorkSheet: New dwelling created by change of us

Space heating - main system 1	(211) x	3.48	x 0.01 =	216.35	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	71.05	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	13.19	x 0.01 =	55.84	(250)
Additional standing charges (Table 12)				120	(251)

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

Total energy cost (245)...(247) + (250)...(254) = 473.13 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.46	(257)
SAP rating (Section 12)		79.58	(258)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1342.83	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	440.98	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1783.81	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	219.74	(268)
Total CO2, kg/year		sum of (265)...(271) =		2042.47	(272)
CO2 emissions per m²		(272) ÷ (4) =		22.51	(273)
EI rating (section 14)				80	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	7584.52	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2490.71	(264)
Space and water heating	(261) + (262) + (263) + (264) =			10075.23	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1299.8	(268)
'Total Primary Energy		sum of (265)...(271) =		11605.28	(272)



Primary energy kWh/m²/year

$(272) \div (4) =$

127.92

(273)