Sustainability Strategy – 26 Stonehills, Welwyn Garden City

For Amsprop REAT Ltd

Prepared by: Andrew Mitchell BEng

Ref 03-19-74836 / 1 - May 2019

STROMA
BUILT ENVIRONMENT

Contents

1. Executive Summary

This report outlines how the proposed re-development at 26 Stonehills, Welwyn Garden City will meet Building Regulations 2013 part L1 by exceeding carbon dioxide emissions stipulated within building regulation, as required by Welwyn Garden City Borough Council.

The applicant is seeking planning permission to redevelop an existing building, converting the 1st and 2nd floor of retail space into apartments and the creation of a new 3rd floor, again for apartment.

The energy strategy will follow the Be Lean & Be Clean design philosophy. In line with policy the scheme will incorporate design features to exceed the predicted Carbon dioxide emission as defined within part L1A & L1B of the building regulations.

2. Planning policy

2.1 Policy – Energy

The adopted Welwyn Hatfield Plan 2005 emphasises the proptection and improvement of the urban and rural environment of the Borough.

The following policies are appropriate for this application –

Polcy SD1 – Sustainable Development.

Development proposals will be permitted where it can be demonstrated that the principles of sustainable development are satisfied and that meet with the objectives and policies of this plan.

Policy R3 – Energy Efficiency

The Council will expect all development to:

Include measures to maximise energy conservation through the design of building, site layout and provision of landscaping; and

Incorporate the best practical environmental option for energy supply.

Please note that the above polices do not refer to prescriptive standards beyond Building Regulations, which is aligned with the current national policy approach.

3. Energy strategy

3.1 Calculation methodology

The proposed scheme comprises of new build apartments (top floor), so these will be assessed under part L1A of the building regulations.

The lower floors will all be a change of use, from retail space to residential apartments. These will be assessed under part L1B of the approved documents.

As a result, this assessment is divided, new elements exceeding building regulation and first and second floors' meeting the technical requirements for a refurbishment.

The new build element will be using results based on the 2013 Part L1a methodologies. Calculation have been completed for all apartments. This assessment will demonstration that these elements will exceed the current requirements stipulated within building regulations.

The refurbishment element will use the same calculation methodology, but will follow thermal improvements requirements defined within the part L1B guidance. As a result, the carbon improvements for the lower two floor will be expressed as an improvement over the existing construction.

3.2 Key energy efficient design measures

Be Lean – Energy efficiency measures and savings

New build, top floor

During the design process the Design Team will explore a range of energy efficiency measures including enhanced U-values, specific construction details to reduce the effect of non-repeating thermal bridges, and the use of advanced ventilation system. The specific target for the dwellings is to exceed the requirements of Part L1A: 2013 using these measures alone. A range of options will be evaluated, and those presented below represent one way of delivering the required result: they are not finalised, but there is a commitment to achieve the resulting level of emissions, by this or another combination of specifications. The proposed specifications (indicative) for the building fabric are as follows:

Heat loss floors (including exposed upper floors etc.):	0.12 W/m^2K
External walls:	0.18 W/m^2K
Internal walls to unheated corridors:	0.20 W/m^2K
Main roofs:	0.11 W/m^2K

Doors and windows:	1.40 W/m^2K
Air leakage rate:	5 m^3/hrm^2

In addition to the above, a variety of improvements are proposed to the building services and fit-out specifications. These include:

Residential lighting: 100% of light fittings to have “A” rated (or equivalent) lamps

Hot water cylinders: selection of combination boilers to remove standing heat losses

Ventilation: all dwellings to have Energy Saving Trust “best practice” ventilation systems

Care will also be taken to reduce where possible the unregulated emissions by providing “best in class” (“A” rated or equivalent) white goods and energy display devices that show electricity use to encourage resident to save energy. The benefits are not included in the results for *unregulated energy use* as there is no established method for calculating the savings that might result.

Refurbishment, floor one and two

Site investigation have indicated that the external wall is solid brick. Under the guidance of part L1b the wall will exceed the Threshold U value and as a consequence the proposal is to upgrade the wall with internal insulation. All replacement windows and doors will meet the current best practice thermal performance. The proposed specifications (indicative) for the refurbishment building fabric are as follows:

External walls:	0.30 W/m^2K
Internal walls to unheated corridors:	0.20 W/m^2K
Doors and windows:	1.40 W/m^2K

Be Clean – Local Emissions savings

During this stage of the design methodology the team will look to minimise changes to air quality within the locality of the proposed development.

All the dwellings will have space and water heating delivered via a high-performance mains gas condensing boiler, selected to have a dry NOx rating below level 5 (Boiler Class BS EN 297:197) environmental rating.

4 Energy demand and efficiency

4.1 Energy results

Summary carbon dioxide emissions results, illustrating the improvement following the installation of the fabric and heating details defined within section 3.

Table 1: Carbon dioxide emissions -

Stage (Refurb elements)	*Carbon dioxide emissions (Tonnes CO_2/yr) Part L1A/L1B: 2013*	
	Original construction & Regulated baseline	*Improve construction*
Dwellings (refurb apartments)	*39.85*	*24.82*
Dwellings (new apartments)	*8.72*	*8.45*
Total emissions	***48.57***	***33.27***

Table 2: Regulated emissions savings

Stage	*Carbon dioxide emissions (Tonnes CO_2/yr) Part L1A/L1B: 2013*	
	(T CO_2/yr)	*Percentage*
Scheme savings	***15.3***	***31.5%***

5 Conclusion

The design team have developed an Energy Strategy which will be constantly reviewed as the development advances. The core strategy will be fabric first, in order to minimise the dwellings energy consumption for the life of the construction. Space and water heating will be provided via clean low NOx condensing combi gas boilers. The selection of Combination boiler will eliminate stranding losses.

As part of the refurbishment of floors one and two all the external thermal elements will be improved. External walls lined with insualtion to improve the U value value to a minimum 0.3 W/m^2K. High-performance double-glazed window units will be installed. Partitions to the un-heated communal areas will have a thermal resistance above the requirements of building regulations.

The new build, third floor, will be constructed to meet building regulations. Low U-values are proposed, and the design team will detail all junctions to limit heat loss at all junctions. All the third-floor apartment will need to be air pressure tested in line with current building regulations. The design team will target an air tightness of 5 m^3/hrm^2, half the regulatory target.

The predicted carbon dioxide emissions following the fabric improvements detailed above will be 31.5% lower than the existing and regulatory requirement. As a result, the clients proposal exceeds the requirements detailed within *Welwyn Hatfield Plan 2005*

Appendix 1

Carbon dioxide emission factors 2013

These factors are taken from SAP2012 version 9.92, Table 12 and are used in Part L1A: 2013 of the Building Regulations. They have superseded the factors used in Part L1A: 2010, and due to significant differences, can result in different level of emissions reduction, particularly with CHP systems and PV panels where grid displaced electricity is taken into account.

Fuel	**CO_2 emission factor $kgCO_2/kWh$**
Natural gas	0.216
LPG	0.241
Biogas	0.098
Heating oil	0.298
Biodiesel from any biomass source	0.123
House coal	0.394
Anthracite	0.394
Manufactured smokeless fuel	0.433
Dual fuel appliances (mineral + wood)	0.226
Wood pellets	0.039
Wood chips	0.016
Grid supplied electricity	0.519
Grid displaced electricity(1)	0.519

Note 1: Unlike in earlier editions of SAP the carbon emissions factors for grid-supplied electricity and grid-displaced electricity are now identical. This reduces the calculated emissions savings from local electricity sources such as PV panels, wind turbines and CHP units

Appendix 2 – Scheme SAP results

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 1 PL1B

Address : Flat 1 , 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	62.02	(1a) x	2.8	(2a) =	173.66	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.02	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	173.66	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.67	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.85	0.84	0.82	0.74	0.72	0.64	0.64	0.62	0.67	0.72	0.75	0.79

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.87	0.85	0.84	0.77	0.76	0.7	0.7	0.69	0.72	0.76	0.78	0.81	(24d)

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

(25)m=	0.87	0.85	0.84	0.77	0.76	0.7	0.7	0.69	0.72	0.76	0.78	0.81	(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			2.12	x	1.6	=	3.392			(26)
Windows			10.1	x1/[1/(4.8)+ 0.04]		=	40.67			(27)
Walls Type1	26.12	10.1	16.02	x	2.09	=	33.48			(29)
Walls Type2	27.8	2.12	25.68	x	0.18	=	4.73			(29)
Walls Type3	17.47	0	17.47	x	1.1	=	19.23			(29)
Total area of elements, m²			71.39							(31)
Party wall			19.15	x	0	=	0			(32)
Party floor			62.02							(32a)
Party ceiling			62.02							(32b)

** 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) = 101.5 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4724.4 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 10.71 (36)

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

Total fabric heat loss (33) + (36) = 112.21 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	49.59	48.78	47.98	44.24	43.54	40.28	40.28	39.68	41.54	43.54	44.96	46.44	(38)

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

(39)m=	161.81	160.99	160.2	156.45	155.75	152.49	152.49	151.89	153.75	155.75	157.17	158.65	

Average = Sum(39)$_{1…12}$ /12= 156.45 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	2.61	2.6	2.58	2.52	2.51	2.46	2.46	2.45	2.48	2.51	2.53	2.56

Average = Sum(40)$_{1\ldots12}$ /12= 2.52 (40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.04 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 82.61 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	90.87	87.56	84.26	80.95	77.65	74.35	74.35	77.65	80.95	84.26	87.56	90.87

Total = Sum(44)$_{1\ldots12}$ = 991.27 (44)

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

(45)m=	134.75	117.85	121.62	106.03	101.74	87.79	81.35	93.35	94.47	110.09	120.17	130.5

Total = Sum(45)$_{1\ldots12}$ = 1299.71 (45)

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

(46)m=	20.21	17.68	18.24	15.9	15.26	13.17	12.2	14	14.17	16.51	18.03	19.58

(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b — 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0 (55)

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

DER WorkSheet: New dwelling design stage

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

(61)m=	29.11	26.28	29.08	28.12	29.04	28.09	29.01	29.03	28.1	29.06	28.15	29.1	(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=	163.86	144.13	150.69	134.15	130.78	115.88	110.36	122.38	122.57	139.15	148.32	159.6	(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=	163.86	144.13	150.69	134.15	130.78	115.88	110.36	122.38	122.57	139.15	148.32	159.6	

Output from water heater (annual)$_{1...12}$ 1641.88 (64)

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

(65)m=	52.08	45.76	47.71	42.28	41.09	36.21	34.3	38.3	38.44	43.87	46.99	50.67	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	(66)

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

(67)m=	16.16	14.36	11.68	8.84	6.61	5.58	6.03	7.83	10.52	13.35	15.58	16.61	(67)

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

(68)m=	178.01	179.86	175.2	165.29	152.78	141.03	133.17	131.33	135.98	145.89	158.4	170.16	(68)

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

(69)m=	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	(71)

Water heating gains (Table 5)

(72)m=	70	68.09	64.12	58.73	55.23	50.29	46.11	51.47	53.38	58.97	65.27	68.1	(72)

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

(73)m=	320.75	318.88	307.57	289.43	271.19	253.47	241.88	247.21	256.45	274.78	295.83	311.44	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	10.1	x	46.75	x	0.85	x	0.7	=	194.7	(78)
South	0.9x	0.77	x	10.1	x	76.57	x	0.85	x	0.7	=	318.87	(78)
South	0.9x	0.77	x	10.1	x	97.53	x	0.85	x	0.7	=	406.19	(78)
South	0.9x	0.77	x	10.1	x	110.23	x	0.85	x	0.7	=	459.08	(78)
South	0.9x	0.77	x	10.1	x	114.87	x	0.85	x	0.7	=	478.39	(78)

South	0.9x	0.77	x	10.1	x	110.55	x	0.85	x	0.7	=	460.39	(78)
South	0.9x	0.77	x	10.1	x	108.01	x	0.85	x	0.7	=	449.82	(78)
South	0.9x	0.77	x	10.1	x	104.89	x	0.85	x	0.7	=	436.84	(78)
South	0.9x	0.77	x	10.1	x	101.89	x	0.85	x	0.7	=	424.31	(78)
South	0.9x	0.77	x	10.1	x	82.59	x	0.85	x	0.7	=	343.93	(78)
South	0.9x	0.77	x	10.1	x	55.42	x	0.85	x	0.7	=	230.79	(78)
South	0.9x	0.77	x	10.1	x	40.4	x	0.85	x	0.7	=	168.24	(78)

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

(83)m=	194.7	318.87	406.19	459.08	478.39	460.39	449.82	436.84	424.31	343.93	230.79	168.24	(83)

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

(84)m=	515.45	637.75	713.76	748.51	749.58	713.86	691.7	684.05	680.76	618.72	526.62	479.68	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.96	0.92	0.84	0.73	0.75	0.88	0.96	0.99	0.99	(86)

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

(87)m=	18.38	18.65	19.05	19.57	20.08	20.54	20.8	20.77	20.43	19.75	18.99	18.36	(87)

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

(88)m=	18.96	18.97	18.97	19.01	19.01	19.05	19.05	19.05	19.03	19.01	19	18.99	(88)

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

(89)m=	0.99	0.98	0.96	0.93	0.87	0.72	0.49	0.53	0.78	0.93	0.98	0.99	(89)

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

(90)m=	16.73	17	17.4	17.94	18.42	18.85	19.01	19	18.76	18.13	17.36	16.73	(90)

fLA = Living area ÷ (4) = 0.42 (91)

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

(92)m=	17.42	17.68	18.08	18.62	19.11	19.55	19.75	19.74	19.45	18.8	18.04	17.41	(92)

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

(93)m=	17.27	17.53	17.93	18.47	18.96	19.4	19.6	19.59	19.3	18.65	17.89	17.26	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.95	0.92	0.87	0.75	0.58	0.6	0.8	0.93	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	507.5	620.19	681.51	692.11	650.77	536.77	398.76	413.73	543.24	573.71	513.14	473.62	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2098.01	2034.07	1831.67	1496.95	1131.05	732.44	457.7	484.22	800.16	1254.26	1695.57	2072.06	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1183.34	950.13	855.72	579.48	357.33	0	0	0	0	506.33	851.35	1189.24	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6472.92 (98)

Space heating requirement in kWh/m²/year 104.37 (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)	1183.34	950.13	855.72	579.48	357.33	0	0	0	0	506.33	851.35	1189.24		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1304.68	1047.55	943.46	638.9	393.97	0	0	0	0	558.25	938.64	1311.18		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													7136.62	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	163.86	144.13	150.69	134.15	130.78	115.88	110.36	122.38	122.57	139.15	148.32	159.6		
Efficiency of water heater													87	(216)
(217)m=	90.23	90.19	90.13	89.98	89.68	87	87	87	87	89.88	90.13	90.25		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	181.59	159.8	167.2	149.08	145.83	133.19	126.86	140.67	140.89	154.83	164.56	176.85		
Total = Sum(219a)$_{1...12}$ =													1841.35	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		7136.62	
Water heating fuel used		1841.35	
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		285.46	(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	=	1541.51	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	397.73	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1939.24	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	148.16	(268)
Total CO2, kg/year		sum of (265)…(271) =		2126.32	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		34.28	(273)
EI rating (section 14)				73	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 2 PL1B

Address : Flat 2, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	65.8	(1a) x	2.8	(2a) =	184.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.24	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.11	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.67	(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

0.85	0.83	0.82	0.73	0.72	0.63	0.63	0.62	0.67	0.72	0.75	0.78

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]

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

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)

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]

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)
(24d)m=	0.86	0.85	0.83	0.77	0.76	0.7	0.7	0.69	0.72	0.76	0.78	0.81	(24d)
(25)m=	0.86	0.85	0.83	0.77	0.76	0.7	0.7	0.69	0.72	0.76	0.78	0.81	(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			2.12	x	1.6	=	3.392			(26)
Windows			10.99	x1/[1/(4.8)+ 0.04]		=	44.26			(27)
Walls Type1	26.94	10.99	15.95	x	2.09	=	33.34			(29)
Walls Type2	26.94	2.12	24.82	x	0.18	=	4.57			(29)
Total area of elements, m²			53.88							(31)
Party wall			38.3	x	0	=	0			(32)
Party floor			65.8							(32a)
Party ceiling			65.8							(32b)

** 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) =	85.55	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	5372	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		8.08	(36)

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

Total fabric heat loss	(33) + (36) =	93.64	(37)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	52.28	51.43	50.6	46.68	45.95	42.55	42.55	41.92	43.86	45.95	47.43	48.98	(38)
(39)m=	145.91	145.06	144.23	140.32	139.59	136.18	136.18	135.55	137.49	139.59	141.07	142.62	

Average = Sum(39)$_{1…12}$ /12= 140.32 (39)

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

(40)m=	2.22	2.2	2.19	2.13	2.12	2.07	2.07	2.06	2.09	2.12	2.14	2.17

Average = Sum(40)$_{1…12}$ /12= 2.13 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.14 (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 85.03 (43)

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

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

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

(44)m=	93.53	90.13	86.73	83.32	79.92	76.52	76.52	79.92	83.32	86.73	90.13	93.53

Total = Sum(44)$_{1…12}$ = 1020.3 (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=	138.7	121.31	125.18	109.13	104.72	90.36	83.73	96.09	97.23	113.32	123.69	134.32

Total = Sum(45)$_{1…12}$ = 1337.78 (45)

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

(46)m=	20.8	18.2	18.78	16.37	15.71	13.55	12.56	14.41	14.58	17	18.55	20.15	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

(61)m=	29.12	26.29	29.09	28.13	29.05	28.09	29.02	29.04	28.11	29.07	28.16	29.11	(61)

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

(62)m=	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43	(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=	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43	

Output from water heater (annual)$_{1...12}$ 1680.04 (64)

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

(65)m=	53.4	46.91	48.89	43.32	42.08	37.07	35.1	39.21	39.36	44.95	48.17	51.94	(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=	107	107	107	107	107	107	107	107	107	107	107	107	(66)

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

(67)m=	17.28	15.35	12.48	9.45	7.06	5.96	6.44	8.37	11.24	14.27	16.66	17.76	(67)

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

(68)m=	187.3	189.25	184.35	173.92	160.76	148.39	140.13	138.18	143.08	153.51	166.67	179.04	(68)

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

(69)m=	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	(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=	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	(71)

Water heating gains (Table 5)

(72)m=	71.77	69.8	65.72	60.16	56.56	51.48	47.17	52.7	54.66	60.41	66.9	69.81	(72)

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

(73)m=	334.45	332.49	320.65	301.64	282.48	263.94	251.84	257.36	267.08	286.29	308.33	324.71	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	10.99	x	46.75	x	0.63	x	0.7	=	157.03	(78)
South	0.9x	0.77	x	10.99	x	76.57	x	0.63	x	0.7	=	257.17	(78)
South	0.9x	0.77	x	10.99	x	97.53	x	0.63	x	0.7	=	327.59	(78)
South	0.9x	0.77	x	10.99	x	110.23	x	0.63	x	0.7	=	370.24	(78)
South	0.9x	0.77	x	10.99	x	114.87	x	0.63	x	0.7	=	385.82	(78)

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South	0.9x	0.77	x	10.99	x	110.55	x	0.63	x	0.7	=	371.3	(78)
South	0.9x	0.77	x	10.99	x	108.01	x	0.63	x	0.7	=	362.78	(78)
South	0.9x	0.77	x	10.99	x	104.89	x	0.63	x	0.7	=	352.31	(78)
South	0.9x	0.77	x	10.99	x	101.89	x	0.63	x	0.7	=	342.2	(78)
South	0.9x	0.77	x	10.99	x	82.59	x	0.63	x	0.7	=	277.38	(78)
South	0.9x	0.77	x	10.99	x	55.42	x	0.63	x	0.7	=	186.13	(78)
South	0.9x	0.77	x	10.99	x	40.4	x	0.63	x	0.7	=	135.68	(78)

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

(83)m=	157.03	257.17	327.59	370.24	385.82	371.3	362.78	352.31	342.2	277.38	186.13	135.68	(83)

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

(84)m=	491.48	589.66	648.23	671.88	668.3	635.23	614.62	609.66	609.29	563.67	494.45	460.39	(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	0.94	0.87	0.75	0.77	0.9	0.97	0.99	1	(86)

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

(87)m=	18.67	18.9	19.25	19.73	20.19	20.61	20.83	20.81	20.51	19.9	19.22	18.67	(87)

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

(88)m=	19.19	19.2	19.21	19.25	19.25	19.29	19.29	19.29	19.27	19.25	19.24	19.22	(88)

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

(89)m=	0.99	0.99	0.97	0.95	0.9	0.77	0.54	0.58	0.82	0.95	0.99	0.99	(89)

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

(90)m=	17.18	17.41	17.77	18.26	18.7	19.1	19.25	19.25	19.01	18.44	17.76	17.19	(90)

fLA = Living area ÷ (4) = 0.38 (91)

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

(92)m=	17.75	17.98	18.33	18.82	19.27	19.67	19.85	19.84	19.58	18.99	18.31	17.75	(92)

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

(93)m=	17.6	17.83	18.18	18.67	19.12	19.52	19.7	19.69	19.43	18.84	18.16	17.6	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.97	0.94	0.9	0.78	0.61	0.63	0.83	0.94	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	486.17	578.37	627.41	634.26	598.22	498.14	373.01	386.98	504.48	532.42	485.44	456.36	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1939.95	1875.35	1684.86	1370.93	1035.19	670.5	422.26	446.02	733.18	1150.77	1560.79	1911.55	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1081.62	871.57	786.74	530.4	325.11	0	0	0	0	460.05	774.25	1082.66	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	5912.4	(98)
Space heating requirement in kWh/m²/year	89.85	(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)	1081.62	871.57	786.74	530.4	325.11	0	0	0	0	460.05	774.25	1082.66		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1192.52	960.94	867.41	584.79	358.44	0	0	0	0	507.22	853.64	1193.67		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													6518.64	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43		
Efficiency of water heater													87	(216)
(217)m=	90.18	90.14	90.07	89.91	89.59	87	87	87	87	89.8	90.07	90.2		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	186.08	163.73	171.27	152.66	149.31	136.16	129.6	143.82	144.07	158.56	168.59	181.2		
Total = Sum(219a)$_{1...12}$ =													1885.04	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			6518.64	
Water heating fuel used			1885.04	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			305.13	(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	=	1408.03	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	407.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1815.19	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	158.36	(268)
Total CO2, kg/year		sum of (265)…(271) =		2012.48	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		30.58	(273)
EI rating (section 14)				76	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 4 PL1B

Address : Flat 4, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	65.33	(1a)	x	2.8	(2a)	=	182.92	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.33	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			182.92	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.11	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.67	(21)

Infiltration rate modified for monthly wind speed

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

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

0.85	0.83	0.82	0.73	0.72	0.63	0.63	0.62	0.67	0.72	0.75	0.78

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.86	0.85	0.83	0.77	0.76	0.7	0.7	0.69	0.72	0.76	0.78	0.81	(24d)

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

(25)m=	0.86	0.85	0.83	0.77	0.76	0.7	0.7	0.69	0.72	0.76	0.78	0.81	(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			2.12	x	1.6	=	3.392			(26)
Windows			13.88	x1/[1/(4.8)+ 0.04]		=	55.89			(27)
Walls Type1	26.4	13.88	12.52	x	2.09	=	26.17			(29)
Walls Type2	40.77	2.12	38.65	x	0.18	=	7.12			(29)
Walls Type3	11.17	0	11.17	x	0.24	=	2.64			(29)
Total area of elements, m²			78.34							(31)
Party wall			25.54	x	0	=	0			(32)
Party floor			65.33							(32a)
Party ceiling			65.33							(32b)

** 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) = 95.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5083.9 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 11.75 (36)

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

Total fabric heat loss (33) + (36) = 106.96 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.94	51.1	50.27	46.38	45.65	42.26	42.26	41.64	43.57	45.65	47.13	48.66	(38)

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

(39)m=	158.9	158.06	157.23	153.34	152.61	149.22	149.22	148.6	150.53	152.61	154.08	155.62	

Average = Sum(39)$_{1…12}$ /12= 153.34 (39)

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

(40)m=	2.43	2.42	2.41	2.35	2.34	2.28	2.28	2.27	2.3	2.34	2.36	2.38

Average = Sum(40)$_{1…12}$ /12= 2.35 (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 — 2.13 (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 — 84.73 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	93.2	89.82	86.43	83.04	79.65	76.26	76.26	79.65	83.04	86.43	89.82	93.2

Total = Sum(44)$_{1…12}$ = 1016.78 (44)

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

(45)m=	138.22	120.89	124.75	108.76	104.35	90.05	83.44	95.75	96.9	112.92	123.27	133.86

Total = Sum(45)$_{1…12}$ = 1333.16 (45)

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

(46)m=	20.73	18.13	18.71	16.31	15.65	13.51	12.52	14.36	14.53	16.94	18.49	20.08	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b — 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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

Enter (50) or (54) in (55) — 0 (55)

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

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

(61)m=	29.12	26.29	29.08	28.13	29.05	28.09	29.02	29.04	28.11	29.07	28.16	29.11	(61)

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

(62)m=	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97	(62)

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

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

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

Output from water heater

(64)m=	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97	

Output from water heater (annual)$_{1...12}$ 1675.41 (64)

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

(65)m=	53.24	46.77	48.75	43.19	41.96	36.96	35	39.1	39.25	44.81	48.02	51.79	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	(66)

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

(67)m=	16.63	14.77	12.01	9.09	6.8	5.74	6.2	8.06	10.82	13.74	16.03	17.09	(67)

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

(68)m=	186.16	188.09	183.23	172.86	159.78	147.49	139.27	137.34	142.21	152.57	165.65	177.95	(68)

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

(69)m=	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	(71)

Water heating gains (Table 5)

(72)m=	71.56	69.59	65.52	59.99	56.4	51.34	47.04	52.55	54.51	60.23	66.7	69.6	(72)

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

(73)m=	332.26	330.37	318.68	299.86	280.89	262.48	250.43	255.86	265.45	284.46	306.3	322.56	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	13.88	x	19.64	x	0.63	x	0.7	=	83.31	(80)
West	0.9x	0.77	x	13.88	x	38.42	x	0.63	x	0.7	=	162.98	(80)
West	0.9x	0.77	x	13.88	x	63.27	x	0.63	x	0.7	=	268.4	(80)
West	0.9x	0.77	x	13.88	x	92.28	x	0.63	x	0.7	=	391.44	(80)
West	0.9x	0.77	x	13.88	x	113.09	x	0.63	x	0.7	=	479.73	(80)

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West	0.9x	0.77	x	13.88	x	115.77	x	0.63	x	0.7	=	491.09	(80)
West	0.9x	0.77	x	13.88	x	110.22	x	0.63	x	0.7	=	467.54	(80)
West	0.9x	0.77	x	13.88	x	94.68	x	0.63	x	0.7	=	401.61	(80)
West	0.9x	0.77	x	13.88	x	73.59	x	0.63	x	0.7	=	312.16	(80)
West	0.9x	0.77	x	13.88	x	45.59	x	0.63	x	0.7	=	193.39	(80)
West	0.9x	0.77	x	13.88	x	24.49	x	0.63	x	0.7	=	103.88	(80)
West	0.9x	0.77	x	13.88	x	16.15	x	0.63	x	0.7	=	68.51	(80)

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

(83)m=	83.31	162.98	268.4	391.44	479.73	491.09	467.54	401.61	312.16	193.39	103.88	68.51	(83)

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

(84)m=	415.57	493.35	587.07	691.3	760.62	753.57	717.97	657.47	577.61	477.84	410.18	391.07	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.97	0.92	0.83	0.72	0.77	0.92	0.98	0.99	1	(86)

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

(87)m=	18.39	18.6	19.01	19.6	20.15	20.61	20.83	20.79	20.39	19.68	18.96	18.39	(87)

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

(88)m=	19.06	19.07	19.08	19.11	19.12	19.15	19.15	19.16	19.14	19.12	19.11	19.09	(88)

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

(89)m=	0.99	0.99	0.98	0.95	0.87	0.71	0.49	0.56	0.84	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=	16.81	17.02	17.44	18.04	18.57	18.98	19.12	19.11	18.82	18.13	17.4	16.83	(90)

fLA = Living area ÷ (4) = 0.41 (91)

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

(92)m=	17.46	17.68	18.09	18.69	19.22	19.66	19.83	19.8	19.47	18.77	18.05	17.47	(92)

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

(93)m=	17.31	17.53	17.94	18.54	19.07	19.51	19.68	19.65	19.32	18.62	17.9	17.32	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.94	0.87	0.74	0.57	0.63	0.85	0.96	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	412.42	486.99	571.9	650.84	663.53	558.15	407.98	412.53	492.11	459.79	405.29	388.63	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2068.05	1995.96	1798.48	1477.43	1125.22	732.06	459.26	483.24	785.77	1224.05	1663.84	2042.47	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1231.79	1014.02	912.57	595.14	343.49	0	0	0	0	568.61	906.16	1230.45	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	6802.25 (98)
Space heating requirement in kWh/m²/year		104.12 (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)	1231.79	1014.02	912.57	595.14	343.49	0	0	0	0	568.61	906.16	1230.45		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1358.09	1118	1006.15	656.17	378.71	0	0	0	0	626.92	999.07	1356.62		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													7499.72	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97		
Efficiency of water heater													87	(216)
(217)m=	90.24	90.21	90.15	89.98	89.63	87	87	87	87	89.94	90.15	90.25		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	185.43	163.14	170.64	152.12	148.83	135.8	129.27	143.44	143.69	157.88	167.96	180.57		
Total = Sum(219a)$_{1...12}$ =													1878.77	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			7499.72	
Water heating fuel used			1878.77	
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			293.68	(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	=	1619.94	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	405.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2025.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	152.42	(268)
Total CO2, kg/year		sum of (265)…(271) =		2217.1	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		33.94	(273)
EI rating (section 14)				73	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 5 PL1B

Address : Flat 5, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	51.39	(1a)	x	2.8	(2a)	=	143.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.39	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		143.89	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.89	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.69	(21)

Infiltration rate modified for monthly wind speed

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

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

0.88	0.86	0.84	0.76	0.74	0.65	0.65	0.64	0.69	0.74	0.78	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(24d)

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

(25)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows			9.25	x1/[1/(4.8)+ 0.04]		=	37.25			(27)
Walls Type1	16.97	9.25	7.72	x	2.09	=	16.13			(29)
Walls Type2	40.71	2.12	38.59	x	0.18	=	7.11			(29)
Total area of elements, m²			57.68							(31)
Party wall			23.74	x	0	=	0			(32)
Party floor			51.39							(32a)
Party ceiling			51.39							(32b)

** 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) = 63.88 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4072.1 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 8.65 (36)

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

Total fabric heat loss (33) + (36) = 72.53 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.06	41.35	40.65	37.38	36.77	33.91	33.91	33.39	35.01	36.77	38.01	39.3	(38)

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

(39)m=	114.6	113.89	113.19	109.91	109.3	106.45	106.45	105.92	107.55	109.3	110.54	111.84	

Average = Sum(39)$_{1…12}$ /12= 109.91 (39)

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

(40)m=	2.23	2.22	2.2	2.14	2.13	2.07	2.07	2.06	2.09	2.13	2.15	2.18

Average = Sum(40)$_{1…12}$ /12= 2.14 (40)

Number of days in month (Table 1a)

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

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.73 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.31 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	82.84	79.83	76.82	73.81	70.79	67.78	67.78	70.79	73.81	76.82	79.83	82.84

Total = Sum(44)$_{1…12}$ = 903.76 (44)

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

(45)m=	122.86	107.45	110.88	96.67	92.75	80.04	74.17	85.11	86.13	100.37	109.56	118.98

Total = Sum(45)$_{1…12}$ = 1184.97 (45)

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

(46)m=	18.43	16.12	16.63	14.5	13.91	12.01	11.13	12.77	12.92	15.06	16.43	17.85

(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

(56)

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

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

(57)

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

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

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

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

(59)

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

(61)m=	29.08	26.25	29.05	28.1	29.02	28.07	29	29.01	28.09	29.04	28.12	29.07	(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=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	(62)

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

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

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

Output from water heater

(64)m=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	

Output from water heater (annual)$_{1...12}$ 1526.86 (64)

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

(65)m=	48.12	42.29	44.13	39.17	38.1	33.63	31.91	35.55	35.66	40.63	43.46	46.83	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	(66)

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

(67)m=	13.74	12.2	9.92	7.51	5.61	4.74	5.12	6.66	8.94	11.35	13.24	14.12	(67)

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

(68)m=	150.84	152.41	148.46	140.07	129.47	119.5	112.85	111.28	115.23	123.62	134.23	144.19	(68)

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

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(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=	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	(71)

Water heating gains (Table 5)

(72)m=	64.68	62.93	59.31	54.4	51.2	46.71	42.89	47.79	49.53	54.61	60.36	62.94	(72)

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

(73)m=	281.22	279.51	269.67	253.94	238.25	222.92	212.83	217.69	225.65	241.55	259.79	273.21	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.25	x	10.63	x	0.63	x	0.7	=	30.06	(74)
North	0.9x	0.77	x	9.25	x	20.32	x	0.63	x	0.7	=	57.45	(74)
North	0.9x	0.77	x	9.25	x	34.53	x	0.63	x	0.7	=	97.61	(74)
North	0.9x	0.77	x	9.25	x	55.46	x	0.63	x	0.7	=	156.79	(74)
North	0.9x	0.77	x	9.25	x	74.72	x	0.63	x	0.7	=	211.22	(74)

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North	0.9x	0.77	x	9.25	x	79.99	x	0.63	x	0.7	=	226.11	(74)
North	0.9x	0.77	x	9.25	x	74.68	x	0.63	x	0.7	=	211.1	(74)
North	0.9x	0.77	x	9.25	x	59.25	x	0.63	x	0.7	=	167.48	(74)
North	0.9x	0.77	x	9.25	x	41.52	x	0.63	x	0.7	=	117.36	(74)
North	0.9x	0.77	x	9.25	x	24.19	x	0.63	x	0.7	=	68.38	(74)
North	0.9x	0.77	x	9.25	x	13.12	x	0.63	x	0.7	=	37.08	(74)
North	0.9x	0.77	x	9.25	x	8.86	x	0.63	x	0.7	=	25.06	(74)

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

(83)m=	30.06	57.45	97.61	156.79	211.22	226.11	211.1	167.48	117.36	68.38	37.08	25.06	(83)

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

(84)m=	311.28	336.95	367.28	410.73	449.47	449.03	423.93	385.18	343.02	309.93	296.88	298.27	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.96	0.89	0.8	0.85	0.95	0.99	1	1	(86)

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

(87)m=	18.55	18.71	19.04	19.57	20.09	20.56	20.8	20.75	20.35	19.71	19.08	18.57	(87)

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

(88)m=	19.18	19.19	19.2	19.24	19.25	19.29	19.29	19.29	19.27	19.25	19.23	19.22	(88)

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

(89)m=	1	0.99	0.99	0.97	0.93	0.8	0.6	0.67	0.91	0.98	0.99	1	(89)

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

(90)m=	17.05	17.21	17.55	18.1	18.62	19.07	19.24	19.22	18.89	18.25	17.62	17.09	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

(92)m=	17.78	17.94	18.28	18.81	19.33	19.79	20	19.96	19.6	18.96	18.33	17.81	(92)

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

(93)m=	17.63	17.79	18.13	18.66	19.18	19.64	19.85	19.81	19.45	18.81	18.18	17.66	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.99	0.97	0.93	0.83	0.68	0.74	0.91	0.98	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	309.42	334.19	362.2	398.37	416.54	371.41	288.57	284.82	313.37	302.93	294.29	296.75	(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=	1527.72	1468.01	1316.09	1073.11	817.91	536.99	345.45	361.28	575.45	897.67	1224.67	1504.97	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	906.41	761.93	709.69	485.81	298.62	0	0	0	0	442.48	669.88	898.91	(98)

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	5173.74	(98)
Space heating requirement in kWh/m²/year		100.68	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		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)	906.41	761.93	709.69	485.81	298.62	0	0	0	0	442.48	669.88	898.91		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	999.35	840.05	782.46	535.63	329.24	0	0	0	0	487.85	738.56	991.08		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													5704.23	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05		
Efficiency of water heater													87	(216)
(217)m=	90.15	90.13	90.07	89.92	89.6	87	87	87	87	89.84	90.05	90.16		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	168.53	148.35	155.36	138.75	135.92	124.27	118.58	131.18	131.28	144.05	152.9	164.21		
Total = Sum(219a)$_{1...12}$ =													1713.38	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			5704.23	
Water heating fuel used			1713.38	
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			242.56	(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	=	1232.11	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	370.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1602.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	125.89	(268)
Total CO2, kg/year		sum of (265)…(271) =		1767.02	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		34.38	(273)
EI rating (section 14)				75	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 6 PL1B

Address : Flat 6, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	55.75	(1a)	x	2.8	(2a)	=	156.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.75	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			156.1	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.88	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.68	(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

0.87	0.85	0.83	0.75	0.73	0.65	0.65	0.63	0.68	0.73	0.77	0.8

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(24d)

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

(25)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(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			2.12	x	1.6	=	3.392			(26)
Windows			9.25	x1/[1/(4.8)+ 0.04]		=	37.25			(27)
Walls Type1	16.91	9.25	7.66	x	2.09	=	16.01			(29)
Walls Type2	19.01	2.12	16.89	x	0.18	=	3.11			(29)
Total area of elements, m²			35.92							(31)
Party wall			49.59	x	0	=	0			(32)
Party floor			55.75							(32a)
Party ceiling			55.75							(32b)

** 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) = 59.76 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 5.39 (36)

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

Total fabric heat loss (33) + (36) = 65.15 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.15	44.4	43.66	40.19	39.54	36.52	36.52	35.96	37.69	39.54	40.85	42.23	(38)

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

(39)m=	110.3	109.54	108.81	105.34	104.69	101.67	101.67	101.11	102.83	104.69	106	107.37	

Average = Sum(39)$_{1…12}$ /12= 105.34 (39)

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

(40)m=	1.98	1.96	1.95	1.89	1.88	1.82	1.82	1.81	1.84	1.88	1.9	1.93

Average = $Sum(40)_{1...12}$ /12= 1.89 (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 1.86 (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 78.36 (43)

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

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

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

(44)m=	86.19	83.06	79.93	76.79	73.66	70.52	70.52	73.66	76.79	79.93	83.06	86.19

Total = $Sum(44)_{1...12}$ = 940.3 (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=	127.82	111.8	115.36	100.58	96.51	83.28	77.17	88.55	89.61	104.43	113.99	123.79

Total = $Sum(45)_{1...12}$ = 1232.88 (45)

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

(46)m=	19.17	16.77	17.3	15.09	14.48	12.49	11.58	13.28	13.44	15.66	17.1	18.57	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	29.09	26.26	29.06	28.11	29.03	28.08	29	29.02	28.09	29.05	28.13	29.08	(61)

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

(62)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	(62)

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

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

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

Output from water heater

(64)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	

Output from water heater (annual)$_{1…12}$ 1574.89 (64)

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

(65)m=	49.77	43.74	45.62	40.47	39.35	34.71	32.91	36.7	36.82	41.99	44.94	48.43	(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=	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	(66)

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

(67)m=	14.97	13.3	10.82	8.19	6.12	5.17	5.58	7.26	9.74	12.37	14.44	15.39	(67)

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

(68)m=	162.12	163.8	159.56	150.53	139.14	128.44	121.28	119.6	123.84	132.86	144.26	154.96	(68)

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

(69)m=	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	(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=	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	(71)

Water heating gains (Table 5)

(72)m=	66.9	65.09	61.32	56.21	52.88	48.21	44.23	49.33	51.14	56.43	62.41	65.1	(72)

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

(73)m=	297.88	296.07	285.59	268.82	252.04	235.7	224.99	230.07	238.61	255.55	274.99	289.34	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.25	x	10.63	x	0.63	x	0.7	=	30.06	(74)
North	0.9x	0.77	x	9.25	x	20.32	x	0.63	x	0.7	=	57.45	(74)
North	0.9x	0.77	x	9.25	x	34.53	x	0.63	x	0.7	=	97.61	(74)
North	0.9x	0.77	x	9.25	x	55.46	x	0.63	x	0.7	=	156.79	(74)
North	0.9x	0.77	x	9.25	x	74.72	x	0.63	x	0.7	=	211.22	(74)

North	0.9x	0.77	x	9.25	x	79.99	x	0.63	x	0.7	=	226.11	(74)
North	0.9x	0.77	x	9.25	x	74.68	x	0.63	x	0.7	=	211.1	(74)
North	0.9x	0.77	x	9.25	x	59.25	x	0.63	x	0.7	=	167.48	(74)
North	0.9x	0.77	x	9.25	x	41.52	x	0.63	x	0.7	=	117.36	(74)
North	0.9x	0.77	x	9.25	x	24.19	x	0.63	x	0.7	=	68.38	(74)
North	0.9x	0.77	x	9.25	x	13.12	x	0.63	x	0.7	=	37.08	(74)
North	0.9x	0.77	x	9.25	x	8.86	x	0.63	x	0.7	=	25.06	(74)

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

(83)m=	30.06	57.45	97.61	156.79	211.22	226.11	211.1	167.48	117.36	68.38	37.08	25.06	(83)

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

(84)m=	327.94	353.52	383.2	425.61	463.25	461.81	436.09	397.56	355.97	323.94	312.08	314.4	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.96	0.89	0.79	0.84	0.95	0.99	1	1	(86)

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

(87)m=	18.78	18.93	19.24	19.73	20.21	20.64	20.85	20.8	20.45	19.86	19.28	18.8	(87)

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

(88)m=	19.35	19.36	19.37	19.41	19.42	19.45	19.45	19.46	19.44	19.42	19.4	19.38	(88)

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

(89)m=	1	0.99	0.99	0.98	0.93	0.8	0.6	0.67	0.91	0.98	0.99	1	(89)

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

(90)m=	17.4	17.55	17.87	18.38	18.86	19.27	19.41	19.4	19.1	18.52	17.93	17.44	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	18.05	18.2	18.51	19.01	19.49	19.91	20.08	20.06	19.73	19.14	18.56	18.08	(92)

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

(93)m=	17.9	18.05	18.36	18.86	19.34	19.76	19.93	19.91	19.58	18.99	18.41	17.93	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.93	0.83	0.67	0.73	0.92	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	326.34	351.12	378.69	414.17	431.09	381.76	293.53	291.64	326.09	317.42	309.8	313.11	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1499.6	1440.09	1290.44	1049.54	800.03	524.89	338.96	354.45	563.76	878.85	1198.89	1473.95	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	872.9	731.79	678.34	457.47	274.49	0	0	0	0	417.7	640.14	863.66	(98)

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	4936.51	(98)
Space heating requirement in kWh/m²/year	88.55	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		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)	872.9	731.79	678.34	457.47	274.49	0	0	0	0	417.7	640.14	863.66		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	962.41	806.82	747.9	504.38	302.64	0	0	0	0	460.53	705.78	952.22		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													5442.68	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87		
Efficiency of water heater													87	(216)
(217)m=	90.12	90.09	90.03	89.86	89.51	87	87	87	87	89.78	90	90.12		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	174.12	153.24	160.42	143.2	140.25	127.99	122.04	135.14	135.29	148.68	157.91	169.63		
Total = Sum(219a)$_{1...12}$ =													1767.91	(219)

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			5442.68	
Water heating fuel used			1767.91	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			264.43	(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	=	1175.62	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	381.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1557.49	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	137.24	(268)
Total CO2, kg/year		sum of (265)…(271) =		1733.65	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		31.1	(273)
EI rating (section 14)				77	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 7 PL1B

Address : Flat 7, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	55.75	(1a) x	2.8	(2a) =	156.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.75	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	156.1	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.88	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.68	(21)

Infiltration rate modified for monthly wind speed

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

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

0.87	0.85	0.83	0.75	0.73	0.65	0.65	0.63	0.68	0.73	0.77	0.8

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(24d)

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

(25)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(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			2.12	x	1.6	=	3.392			(26)
Windows			9.25	x1/[1/(4.8)+ 0.04]		=	37.25			(27)
Walls Type1	16.91	9.25	7.66	x	2.09	=	16.01			(29)
Walls Type2	19.01	2.12	16.89	x	0.18	=	3.11			(29)
Total area of elements, m²			35.92							(31)
Party wall			49.59	x	0	=	0			(32)
Party floor			55.75							(32a)
Party ceiling			55.75							(32b)

** 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) = 59.76 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 5.39 (36)

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

Total fabric heat loss (33) + (36) = 65.15 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.15	44.4	43.66	40.19	39.54	36.52	36.52	35.96	37.69	39.54	40.85	42.23	(38)

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

(39)m=	110.3	109.54	108.81	105.34	104.69	101.67	101.67	101.11	102.83	104.69	106	107.37	

Average = Sum(39)$_{1…12}$ /12= 105.34 (39)

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

(40)m=	1.98	1.96	1.95	1.89	1.88	1.82	1.82	1.81	1.84	1.88	1.9	1.93

Average = Sum(40)$_{1…12}$ /12= 1.89 (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 1.86 (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 78.36 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	86.19	83.06	79.93	76.79	73.66	70.52	70.52	73.66	76.79	79.93	83.06	86.19

Total = Sum(44)$_{1…12}$ = 940.3 (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=	127.82	111.8	115.36	100.58	96.51	83.28	77.17	88.55	89.61	104.43	113.99	123.79

Total = Sum(45)$_{1…12}$ = 1232.88 (45)

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

(46)m=	19.17	16.77	17.3	15.09	14.48	12.49	11.58	13.28	13.44	15.66	17.1	18.57	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

(61)m=	29.09	26.26	29.06	28.11	29.03	28.08	29	29.02	28.09	29.05	28.13	29.08	(61)

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

(62)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	(62)

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

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

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

Output from water heater

(64)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	

Output from water heater (annual)$_{1...12}$ 1574.89 (64)

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

(65)m=	49.77	43.74	45.62	40.47	39.35	34.71	32.91	36.7	36.82	41.99	44.94	48.43	(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=	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	(66)

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

(67)m=	14.97	13.3	10.82	8.19	6.12	5.17	5.58	7.26	9.74	12.37	14.44	15.39	(67)

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

(68)m=	162.12	163.8	159.56	150.53	139.14	128.44	121.28	119.6	123.84	132.86	144.26	154.96	(68)

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

(69)m=	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	(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=	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	(71)

Water heating gains (Table 5)

(72)m=	66.9	65.09	61.32	56.21	52.88	48.21	44.23	49.33	51.14	56.43	62.41	65.1	(72)

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

(73)m=	297.88	296.07	285.59	268.82	252.04	235.7	224.99	230.07	238.61	255.55	274.99	289.34	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.25	x	10.63	x	0.63	x	0.7	=	30.06	(74)
North	0.9x	0.77	x	9.25	x	20.32	x	0.63	x	0.7	=	57.45	(74)
North	0.9x	0.77	x	9.25	x	34.53	x	0.63	x	0.7	=	97.61	(74)
North	0.9x	0.77	x	9.25	x	55.46	x	0.63	x	0.7	=	156.79	(74)
North	0.9x	0.77	x	9.25	x	74.72	x	0.63	x	0.7	=	211.22	(74)

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North	0.9x	0.77	x	9.25	x	79.99	x	0.63	x	0.7	=	226.11	(74)
North	0.9x	0.77	x	9.25	x	74.68	x	0.63	x	0.7	=	211.1	(74)
North	0.9x	0.77	x	9.25	x	59.25	x	0.63	x	0.7	=	167.48	(74)
North	0.9x	0.77	x	9.25	x	41.52	x	0.63	x	0.7	=	117.36	(74)
North	0.9x	0.77	x	9.25	x	24.19	x	0.63	x	0.7	=	68.38	(74)
North	0.9x	0.77	x	9.25	x	13.12	x	0.63	x	0.7	=	37.08	(74)
North	0.9x	0.77	x	9.25	x	8.86	x	0.63	x	0.7	=	25.06	(74)

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

(83)m=	30.06	57.45	97.61	156.79	211.22	226.11	211.1	167.48	117.36	68.38	37.08	25.06	(83)

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

(84)m=	327.94	353.52	383.2	425.61	463.25	461.81	436.09	397.56	355.97	323.94	312.08	314.4	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.96	0.89	0.79	0.84	0.95	0.99	1	1	(86)

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

(87)m=	18.78	18.93	19.24	19.73	20.21	20.64	20.85	20.8	20.45	19.86	19.28	18.8	(87)

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

(88)m=	19.35	19.36	19.37	19.41	19.42	19.45	19.45	19.46	19.44	19.42	19.4	19.38	(88)

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

(89)m=	1	0.99	0.99	0.98	0.93	0.8	0.6	0.67	0.91	0.98	0.99	1	(89)

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

(90)m=	17.4	17.55	17.87	18.38	18.86	19.27	19.41	19.4	19.1	18.52	17.93	17.44	(90)

fLA = Living area ÷ (4) = 0.47 (91)

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

(92)m=	18.05	18.2	18.51	19.01	19.49	19.91	20.08	20.06	19.73	19.14	18.56	18.08	(92)

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

(93)m=	17.9	18.05	18.36	18.86	19.34	19.76	19.93	19.91	19.58	18.99	18.41	17.93	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.93	0.83	0.67	0.73	0.92	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	326.34	351.12	378.69	414.17	431.09	381.76	293.53	291.64	326.09	317.42	309.8	313.11	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1499.6	1440.09	1290.44	1049.54	800.03	524.89	338.96	354.45	563.76	878.85	1198.89	1473.95	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	872.9	731.79	678.34	457.47	274.49	0	0	0	0	417.7	640.14	863.66	(98)

	Total per year (kWh/year) = Sum(98)1...5,9...12 =	4936.51	(98)
Space heating requirement in kWh/m²/year		88.55	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		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)	872.9	731.79	678.34	457.47	274.49	0	0	0	0	417.7	640.14	863.66		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	962.41	806.82	747.9	504.38	302.64	0	0	0	0	460.53	705.78	952.22		(211)
Total (kWh/year) =Sum(211)1...5,10...12=													5442.68	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)
Water heating														
Output from water heater (calculated above)	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87		
Efficiency of water heater													87	(216)
(217)m=	90.12	90.09	90.03	89.86	89.51	87	87	87	87	89.78	90	90.12		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	174.12	153.24	160.42	143.2	140.25	127.99	122.04	135.14	135.29	148.68	157.91	169.63		
Total = Sum(219a)1...12 =													1767.91	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			5442.68	
Water heating fuel used			1767.91	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			264.43	(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	=	1175.62	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	381.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1557.49	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	137.24	(268)
Total CO2, kg/year		sum of (265)…(271) =		1733.65	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		31.1	(273)
EI rating (section 14)				77	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 8 PL1B

Address : Flat 8, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.39	(1a) x	2.8	(2a) =	143.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	143.89	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.89	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.69	(21)

Infiltration rate modified for monthly wind speed

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

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

0.88	0.86	0.84	0.76	0.74	0.65	0.65	0.64	0.69	0.74	0.78	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(24d)

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

(25)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows			9.25	x1/[1/(4.8)+ 0.04]		=	37.25			(27)
Walls Type1	16.97	9.25	7.72	x	2.09	=	16.13			(29)
Walls Type2	11.48	2.12	9.36	x	0.18	=	1.72			(29)
Total area of elements, m²			28.45							(31)
Party wall			52.98	x	0	=	0			(32)
Party floor			51.39							(32a)
Party ceiling			51.39							(32b)

* *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) = 58.5 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3597.3 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 4.27 (36)

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

Total fabric heat loss (33) + (36) = 62.77 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.06	41.35	40.65	37.38	36.77	33.91	33.91	33.39	35.01	36.77	38.01	39.3	(38)

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

(39)m=	104.83	104.12	103.42	100.15	99.53	96.68	96.68	96.15	97.78	99.53	100.77	102.07	

Average = Sum(39)$_{1…12}$ /12= 100.14 (39)

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

(40)m=	2.04	2.03	2.01	1.95	1.94	1.88	1.88	1.87	1.9	1.94	1.96	1.99

Average = Sum(40)$_{1…12}$ /12= 1.95 (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 1.73 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.31 (43)

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

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

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

(44)m=	82.84	79.83	76.82	73.81	70.79	67.78	67.78	70.79	73.81	76.82	79.83	82.84

Total = Sum(44)$_{1…12}$ = 903.76 (44)

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

(45)m=	122.86	107.45	110.88	96.67	92.75	80.04	74.17	85.11	86.13	100.37	109.56	118.98

Total = Sum(45)$_{1…12}$ = 1184.97 (45)

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

(46)m=	18.43	16.12	16.63	14.5	13.91	12.01	11.13	12.77	12.92	15.06	16.43	17.85	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	29.08	26.25	29.05	28.1	29.02	28.07	29	29.01	28.09	29.04	28.12	29.07	(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=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	(62)

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

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

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

Output from water heater

(64)m=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	

Output from water heater (annual)$_{1...12}$ 1526.86 (64)

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

(65)m=	48.12	42.29	44.13	39.17	38.1	33.63	31.91	35.55	35.66	40.63	43.46	46.83	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	(66)

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

(67)m=	13.74	12.2	9.92	7.51	5.61	4.74	5.12	6.66	8.94	11.35	13.24	14.12	(67)

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

(68)m=	150.84	152.41	148.46	140.07	129.47	119.5	112.85	111.28	115.23	123.62	134.23	144.19	(68)

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

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(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=	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	(71)

Water heating gains (Table 5)

(72)m=	64.68	62.93	59.31	54.4	51.2	46.71	42.89	47.79	49.53	54.61	60.36	62.94	(72)

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

(73)m=	281.22	279.51	269.67	253.94	238.25	222.92	212.83	217.69	225.65	241.55	259.79	273.21	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.25	x	10.63	x	0.63	x	0.7	=	30.06	(74)
North	0.9x	0.77	x	9.25	x	20.32	x	0.63	x	0.7	=	57.45	(74)
North	0.9x	0.77	x	9.25	x	34.53	x	0.63	x	0.7	=	97.61	(74)
North	0.9x	0.77	x	9.25	x	55.46	x	0.63	x	0.7	=	156.79	(74)
North	0.9x	0.77	x	9.25	x	74.72	x	0.63	x	0.7	=	211.22	(74)

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North	0.9x	0.77	x	9.25	x	79.99	x	0.63	x	0.7	=	226.11	(74)
North	0.9x	0.77	x	9.25	x	74.68	x	0.63	x	0.7	=	211.1	(74)
North	0.9x	0.77	x	9.25	x	59.25	x	0.63	x	0.7	=	167.48	(74)
North	0.9x	0.77	x	9.25	x	41.52	x	0.63	x	0.7	=	117.36	(74)
North	0.9x	0.77	x	9.25	x	24.19	x	0.63	x	0.7	=	68.38	(74)
North	0.9x	0.77	x	9.25	x	13.12	x	0.63	x	0.7	=	37.08	(74)
North	0.9x	0.77	x	9.25	x	8.86	x	0.63	x	0.7	=	25.06	(74)

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

(83)m=	30.06	57.45	97.61	156.79	211.22	226.11	211.1	167.48	117.36	68.38	37.08	25.06	(83)

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

(84)m=	311.28	336.95	367.28	410.73	449.47	449.03	423.93	385.18	343.02	309.93	296.88	298.27	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.95	0.88	0.78	0.83	0.95	0.99	1	1	(86)

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

(87)m=	18.73	18.89	19.21	19.71	20.21	20.64	20.85	20.8	20.44	19.83	19.24	18.75	(87)

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

(88)m=	19.31	19.32	19.33	19.37	19.38	19.41	19.41	19.42	19.4	19.38	19.36	19.34	(88)

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

(89)m=	1	0.99	0.99	0.97	0.92	0.79	0.58	0.66	0.9	0.98	0.99	1	(89)

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

(90)m=	17.32	17.48	17.8	18.33	18.82	19.23	19.37	19.36	19.06	18.47	17.86	17.36	(90)

fLA = Living area ÷ (4) = 0.49 (91)

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

(92)m=	18.01	18.16	18.49	19	19.49	19.92	20.09	20.06	19.73	19.13	18.53	18.04	(92)

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

(93)m=	17.86	18.01	18.34	18.85	19.34	19.77	19.94	19.91	19.58	18.98	18.38	17.89	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.99	0.97	0.92	0.82	0.66	0.72	0.91	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	309.58	334.39	362.42	398.37	415.17	366.1	280.21	278.37	312.07	303.06	294.46	296.9	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1421.28	1365.31	1224.11	996.73	760.71	499.64	322.85	337.51	536.04	834.19	1136.91	1397.13	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	827.1	692.78	641.1	430.82	257.08	0	0	0	0	395.16	606.56	818.57	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4669.19 (98)

Space heating requirement in kWh/m²/year 90.86 (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)	827.1	692.78	641.1	430.82	257.08	0	0	0	0	395.16	606.56	818.57		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	911.91	763.81	706.84	475	283.44	0	0	0	0	435.68	668.75	902.51		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													5147.95	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05		
Efficiency of water heater													87	(216)
(217)m=	90.11	90.08	90.01	89.84	89.48	87	87	87	87	89.76	89.99	90.11		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	168.62	148.43	155.45	138.87	136.1	124.27	118.58	131.18	131.28	144.18	153	164.29		
Total = Sum(219a)$_{1...12}$ =													1714.23	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			5147.95	
Water heating fuel used			1714.23	
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			242.56	(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	=	1111.96	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	370.27	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1482.23	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	125.89	(268)
Total CO2, kg/year		sum of (265)…(271) =		1647.05	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		32.05	(273)
EI rating (section 14)				77	(274)

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User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 9 PL1B

Address : Flat 9, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	58.52	(1a) x	2.8	(2a) =	163.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.52	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	163.86	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.68	(21)

Infiltration rate modified for monthly wind speed

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

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

0.86	0.84	0.83	0.74	0.73	0.64	0.64	0.63	0.68	0.73	0.76	0.79

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.87	0.86	0.84	0.78	0.76	0.71	0.71	0.7	0.73	0.76	0.79	0.82	(24d)

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

(25)m=	0.87	0.86	0.84	0.78	0.76	0.71	0.71	0.7	0.73	0.76	0.79	0.82	(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			2.12	x	1.6	=	3.392			(26)
Windows Type 1			9.25	x1/[1/(4.8)+ 0.04]		=	37.25			(27)
Windows Type 2			4.63	x1/[1/(4.8)+ 0.04]		=	18.64			(27)
Windows Type 3			4.63	x1/[1/(4.8)+ 0.04]		=	18.64			(27)
Walls Type1	39.81	18.51	21.3	x	2.09	=	44.52			(29)
Walls Type2	3.39	2.12	1.27	x	0.18	=	0.23			(29)
Total area of elements, m²			43.2							(31)
Party wall			54.29	x	0	=	0			(32)
Party floor			58.52							(32a)
Party ceiling			58.52							(32b)

** 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) = 122.68 (33)

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

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 6.48 (36)

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

Total fabric heat loss (33) + (36) = 129.16 (37)

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

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

DER WorkSheet: New dwelling design stage

(38)m=	47.11	46.33	45.57	41.98	41.31	38.18	38.18	37.6	39.39	41.31	42.67	44.09	(38)

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

(39)m=	176.27	175.49	174.73	171.14	170.47	167.34	167.34	166.76	168.55	170.47	171.83	173.25	

Average = Sum(39)$_{1...12}$ /12= 171.14 (39)

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

(40)m=	3.01	3	2.99	2.92	2.91	2.86	2.86	2.85	2.88	2.91	2.94	2.96	

Average = Sum(40)$_{1...12}$ /12= 2.92 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.94 (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 80.26 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	88.29	85.08	81.87	78.66	75.45	72.24	72.24	75.45	78.66	81.87	85.08	88.29	

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

Total = Sum(44)$_{1...12}$ = 963.16 (44)

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

(45)m=	130.93	114.51	118.17	103.02	98.85	85.3	79.04	90.7	91.79	106.97	116.76	126.8	

Total = Sum(45)$_{1...12}$ = 1262.85 (45)

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

(46)m=	19.64	17.18	17.73	15.45	14.83	12.8	11.86	13.61	13.77	16.05	17.51	19.02	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	29.1	26.27	29.07	28.11	29.03	28.08	29.01	29.03	28.1	29.05	28.14	29.09	(61)

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

(62)m=	160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89	(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=	160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89	

Output from water heater (annual)$_{1...12}$	1604.93	(64)

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

(65)m=	50.81	44.64	46.56	41.28	40.13	35.38	33.53	37.42	37.54	42.83	45.86	49.43	(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=	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	(66)

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

(67)m=	15.08	13.4	10.9	8.25	6.17	5.21	5.62	7.31	9.81	12.46	14.54	15.5	(67)

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

(68)m=	169.2	170.96	166.53	157.11	145.22	134.05	126.58	124.83	129.25	138.67	150.56	161.73	(68)

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

(69)m=	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	(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=	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	(71)

Water heating gains (Table 5)

(72)m=	68.29	66.43	62.58	57.34	53.93	49.14	45.07	50.29	52.14	57.57	63.69	66.44	(72)

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

(73)m=	307.67	305.88	295.1	277.79	260.41	243.49	232.37	237.52	246.3	263.79	283.89	298.77	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.63	x	10.63	x	0.63	x	0.7	=	15.05	(74)
North	0.9x	0.77	x	4.63	x	20.32	x	0.63	x	0.7	=	28.75	(74)

North	0.9x	0.77	x	4.63	x	34.53	x	0.63	x	0.7	=	48.86	(74)
North	0.9x	0.77	x	4.63	x	55.46	x	0.63	x	0.7	=	78.48	(74)
North	0.9x	0.77	x	4.63	x	74.72	x	0.63	x	0.7	=	105.72	(74)
North	0.9x	0.77	x	4.63	x	79.99	x	0.63	x	0.7	=	113.18	(74)
North	0.9x	0.77	x	4.63	x	74.68	x	0.63	x	0.7	=	105.67	(74)
North	0.9x	0.77	x	4.63	x	59.25	x	0.63	x	0.7	=	83.83	(74)
North	0.9x	0.77	x	4.63	x	41.52	x	0.63	x	0.7	=	58.75	(74)
North	0.9x	0.77	x	4.63	x	24.19	x	0.63	x	0.7	=	34.23	(74)
North	0.9x	0.77	x	4.63	x	13.12	x	0.63	x	0.7	=	18.56	(74)
North	0.9x	0.77	x	4.63	x	8.86	x	0.63	x	0.7	=	12.54	(74)
Northeast	0.9x	0.77	x	4.63	x	11.28	x	0.63	x	0.7	=	15.97	(75)
Northeast	0.9x	0.77	x	4.63	x	22.97	x	0.63	x	0.7	=	32.5	(75)
Northeast	0.9x	0.77	x	4.63	x	41.38	x	0.63	x	0.7	=	58.55	(75)
Northeast	0.9x	0.77	x	4.63	x	67.96	x	0.63	x	0.7	=	96.16	(75)
Northeast	0.9x	0.77	x	4.63	x	91.35	x	0.63	x	0.7	=	129.25	(75)
Northeast	0.9x	0.77	x	4.63	x	97.38	x	0.63	x	0.7	=	137.8	(75)
Northeast	0.9x	0.77	x	4.63	x	91.1	x	0.63	x	0.7	=	128.91	(75)
Northeast	0.9x	0.77	x	4.63	x	72.63	x	0.63	x	0.7	=	102.77	(75)
Northeast	0.9x	0.77	x	4.63	x	50.42	x	0.63	x	0.7	=	71.34	(75)
Northeast	0.9x	0.77	x	4.63	x	28.07	x	0.63	x	0.7	=	39.71	(75)
Northeast	0.9x	0.77	x	4.63	x	14.2	x	0.63	x	0.7	=	20.09	(75)
Northeast	0.9x	0.77	x	4.63	x	9.21	x	0.63	x	0.7	=	13.04	(75)
East	0.9x	0.77	x	9.25	x	19.64	x	0.63	x	0.7	=	55.52	(76)
East	0.9x	0.77	x	9.25	x	38.42	x	0.63	x	0.7	=	108.61	(76)
East	0.9x	0.77	x	9.25	x	63.27	x	0.63	x	0.7	=	178.87	(76)
East	0.9x	0.77	x	9.25	x	92.28	x	0.63	x	0.7	=	260.87	(76)
East	0.9x	0.77	x	9.25	x	113.09	x	0.63	x	0.7	=	319.7	(76)
East	0.9x	0.77	x	9.25	x	115.77	x	0.63	x	0.7	=	327.27	(76)
East	0.9x	0.77	x	9.25	x	110.22	x	0.63	x	0.7	=	311.58	(76)
East	0.9x	0.77	x	9.25	x	94.68	x	0.63	x	0.7	=	267.64	(76)
East	0.9x	0.77	x	9.25	x	73.59	x	0.63	x	0.7	=	208.03	(76)
East	0.9x	0.77	x	9.25	x	45.59	x	0.63	x	0.7	=	128.88	(76)
East	0.9x	0.77	x	9.25	x	24.49	x	0.63	x	0.7	=	69.23	(76)
East	0.9x	0.77	x	9.25	x	16.15	x	0.63	x	0.7	=	45.66	(76)

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

(83)m=	86.53	169.86	286.28	435.51	554.68	578.25	546.15	454.24	338.12	202.82	107.88	71.24	(83)

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

(84)m=	394.2	475.74	581.37	713.3	815.09	821.74	778.52	691.76	584.42	466.61	391.77	370.01	(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	0.96	0.9	0.81	0.7	0.76	0.91	0.98	0.99	1	(86)

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

(87)m=	17.94	18.17	18.64	19.32	19.97	20.51	20.77	20.7	20.23	19.4	18.58	17.93	(87)

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

(88)m=	18.74	18.75	18.76	18.79	18.79	18.82	18.82	18.83	18.81	18.79	18.78	18.77	(88)

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

(89)m=	0.99	0.99	0.97	0.93	0.85	0.67	0.44	0.52	0.82	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=	16.16	16.4	16.86	17.54	18.16	18.63	18.79	18.77	18.43	17.64	16.82	16.17	(90)

fLA = Living area ÷ (4) = 0.48 (91)

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

(92)m=	17.02	17.25	17.72	18.4	19.03	19.53	19.74	19.7	19.3	18.49	17.67	17.02	(92)

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

(93)m=	16.87	17.1	17.57	18.25	18.88	19.38	19.59	19.55	19.15	18.34	17.52	16.87	(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	0.93	0.85	0.71	0.55	0.62	0.84	0.96	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	390.13	467.64	562.14	661.35	691.33	586.68	429.91	428.05	491.71	445.65	385.63	366.8	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2215.4	2141.25	1933.72	1599.63	1224.2	800.08	500.24	525.24	850.32	1318.97	1789.75	2194.36	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1358	1124.66	1020.45	675.57	396.46	0	0	0	0	649.75	1010.96	1359.7	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 7595.55 (98)

Space heating requirement in kWh/m²/year 129.79 (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)													
	1358	1124.66	1020.45	675.57	396.46	0	0	0	0	649.75	1010.96	1359.7	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1497.25	1239.98	1125.09	744.84	437.11	0	0	0	0	716.38	1114.62	1499.12	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 8374.37 (211)

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

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

Water heating

Output from water heater (calculated above)

	160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89		
Efficiency of water heater													87	(216)
(217)m=	90.3	90.27	90.22	90.08	89.77	87	87	87	87	90.04	90.22	90.3		(217)

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

(219)m=	177.23	155.95	163.2	145.58	142.46	130.33	124.2	137.62	137.8	151.07	160.61	172.63		
								Total = Sum(219a)$_{1...12}$ =					1798.67	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			8374.37	
Water heating fuel used			1798.67	
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			266.39	(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	=	1808.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	388.51	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2197.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	138.26	(268)
Total CO2, kg/year		sum of (265)…(271) =		2374.56	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		40.58	(273)
EI rating (section 14)				69	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 10 PL1B

Address : Flat 10, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	50.27	(1a)	x	2.8	(2a)	=	140.76	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.27	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			140.76	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.89	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.69	(21)

Infiltration rate modified for monthly wind speed

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

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

0.88	0.86	0.85	0.76	0.74	0.66	0.66	0.64	0.69	0.74	0.78	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	0.89	0.87	0.86	0.79	0.78	0.72	0.72	0.7	0.74	0.78	0.8	0.83	(24d)

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

(25)m=	0.89	0.87	0.86	0.79	0.78	0.72	0.72	0.7	0.74	0.78	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows			9.25	x	1/[1/(4.8)+ 0.04]	=	37.25			(27)
Walls Type1	16.86	9.25	7.61	x	2.09	=	15.9			(29)
Walls Type2	40.24	2.12	38.12	x	0.18	=	7.02			(29)
Total area of elements, m²			57.1							(31)
Party wall			23.38	x	0	=	0			(32)
Party floor			50.27							(32a)
Party ceiling			50.27							(32b)

** 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) = 63.57 (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 8.57 (36)

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

Total fabric heat loss (33) + (36) = 72.13 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.27	40.57	39.88	36.66	36.05	33.24	33.24	32.72	34.33	36.05	37.27	38.55	(38)

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

(39)m=	113.4	112.7	112.01	108.79	108.18	105.37	105.37	104.85	106.46	108.18	109.41	110.68	

Average = Sum(39)$_{1…12}$ /12= 108.78 (39)

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

(40)m=	2.26	2.24	2.23	2.16	2.15	2.1	2.1	2.09	2.12	2.15	2.18	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 1.7 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.53 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.98	79	76.02	73.04	70.06	67.08	67.08	70.06	73.04	76.02	79	81.98	
										Total = Sum(44)$_{1…12}$ =		894.34	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	121.58	106.33	109.72	95.66	91.79	79.21	73.4	84.22	85.23	99.33	108.42	117.74	
										Total = Sum(45)$_{1…12}$ =		1172.63	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.24	15.95	16.46	14.35	13.77	11.88	11.01	12.63	12.78	14.9	16.26	17.66	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	29.07	26.25	29.05	28.09	29.02	28.07	29	29.01	28.08	29.04	28.12	29.07	(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=	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81	(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=	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81	

Output from water heater (annual)$_{1...12}$ 1514.49 (64)

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

(65)m=	47.69	41.92	43.75	38.83	37.77	33.35	31.65	35.26	35.36	40.29	43.08	46.42	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	(66)

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

(67)m=	13.42	11.92	9.7	7.34	5.49	4.63	5.01	6.51	8.73	11.09	12.94	13.8	(67)

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

(68)m=	147.94	149.47	145.6	137.37	126.97	117.2	110.67	109.14	113.01	121.24	131.64	141.41	(68)

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

(69)m=	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	(71)

Water heating gains (Table 5)

(72)m=	64.1	62.38	58.8	53.93	50.77	46.32	42.54	47.39	49.11	54.15	59.83	62.39	(72)

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

(73)m=	276.93	275.24	265.57	250.11	234.7	219.63	209.69	214.5	222.32	237.95	255.88	269.06	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	9.25	x	19.64	x	0.63	x	0.7	=	55.52	(76)
East	0.9x	0.77	x	9.25	x	38.42	x	0.63	x	0.7	=	108.61	(76)
East	0.9x	0.77	x	9.25	x	63.27	x	0.63	x	0.7	=	178.87	(76)
East	0.9x	0.77	x	9.25	x	92.28	x	0.63	x	0.7	=	260.87	(76)
East	0.9x	0.77	x	9.25	x	113.09	x	0.63	x	0.7	=	319.7	(76)

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East	0.9x	0.77	x	9.25	x	115.77	x	0.63	x	0.7	=	327.27	(76)
East	0.9x	0.77	x	9.25	x	110.22	x	0.63	x	0.7	=	311.58	(76)
East	0.9x	0.77	x	9.25	x	94.68	x	0.63	x	0.7	=	267.64	(76)
East	0.9x	0.77	x	9.25	x	73.59	x	0.63	x	0.7	=	208.03	(76)
East	0.9x	0.77	x	9.25	x	45.59	x	0.63	x	0.7	=	128.88	(76)
East	0.9x	0.77	x	9.25	x	24.49	x	0.63	x	0.7	=	69.23	(76)
East	0.9x	0.77	x	9.25	x	16.15	x	0.63	x	0.7	=	45.66	(76)

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

(83)m=	55.52	108.61	178.87	260.87	319.7	327.27	311.58	267.64	208.03	128.88	69.23	45.66	(83)

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

(84)m=	332.45	383.85	444.44	510.98	554.41	546.9	521.27	482.15	430.35	366.83	325.11	314.72	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.97	0.93	0.84	0.72	0.76	0.92	0.98	0.99	1	(86)

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

(87)m=	18.57	18.77	19.15	19.7	20.22	20.65	20.86	20.82	20.46	19.79	19.11	18.58	(87)

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

(88)m=	19.17	19.18	19.19	19.23	19.23	19.27	19.27	19.28	19.26	19.23	19.22	19.2	(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	0.72	0.5	0.57	0.84	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=	17.06	17.26	17.65	18.22	18.72	19.11	19.24	19.23	18.96	18.32	17.64	17.09	(90)

fLA = Living area ÷ (4) = 0.46 (91)

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

(92)m=	17.75	17.95	18.33	18.9	19.4	19.82	19.98	19.95	19.64	18.99	18.31	17.77	(92)

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

(93)m=	17.6	17.8	18.18	18.75	19.25	19.67	19.83	19.8	19.49	18.84	18.16	17.62	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.95	0.88	0.75	0.58	0.64	0.86	0.96	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	329.88	379.06	433.73	483.54	488.79	411.84	303.99	307.94	368.99	353.33	321.2	312.7	(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=	1508.06	1453.59	1308.47	1071.28	817.09	533.77	339.93	356.9	574.22	891.38	1210.17	1485.06	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	876.56	722.08	650.81	423.18	244.26	0	0	0	0	400.31	640.06	872.23	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	4829.49	(98)
Space heating requirement in kWh/m²/year	96.07	(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)	876.56	722.08	650.81	423.18	244.26	0	0	0	0	400.31	640.06	872.23		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	966.44	796.12	717.54	466.57	269.3	0	0	0	0	441.36	705.69	961.67		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													5324.68	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81		
Efficiency of water heater													87	(216)
(217)m=	90.14	90.11	90.03	89.84	89.44	87	87	87	87	89.77	90.03	90.15		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	167.13	147.14	154.15	137.76	135.07	123.31	117.69	130.15	130.24	142.99	151.67	162.85		
Total = Sum(219a)$_{1...12}$ =													1700.15	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		5324.68	
Water heating fuel used		1700.15	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		237.08	(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	=	1150.13	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	367.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1517.36	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	123.04	(268)
Total CO2, kg/year		sum of (265)…(271) =		1679.33	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		33.41	(273)
EI rating (section 14)				76	(274)

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User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 11 PL1B

Address : Flat 11, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	62.02	(1a) x	2.6	(2a) =	161.25	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.02	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	161.25	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.68	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.86	0.85	0.83	0.75	0.73	0.64	0.64	0.63	0.68	0.73	0.76	0.8

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	0.87	0.86	0.84	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(24d)

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

(25)m=	0.87	0.86	0.84	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(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			2.12	x	1.6	=	3.392			(26)
Windows			8.74	x1/[1/(4.8)+ 0.04]		=	35.19			(27)
Walls Type1	24.26	8.74	15.52	x	2.09	=	32.44			(29)
Walls Type2	25.82	2.12	23.7	x	0.18	=	4.36			(29)
Walls Type3	16.22	0	16.22	x	1.1	=	17.85			(29)
Roof	62.02	0	62.02	x	0.11	=	6.82			(30)
Total area of elements, m²			128.32							(31)
Party wall			17.78	x	0	=	0			(32)
Party floor			62.02							(32a)

** 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) = 100.06 (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 19.25 (36)

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

Total fabric heat loss (33) + (36) = 119.31 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	46.45	45.68	44.93	41.38	40.71	37.62	37.62	37.05	38.81	40.71	42.06	43.46	(38)

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

(39)m=	165.76	164.99	164.24	160.69	160.03	156.94	156.94	156.36	158.13	160.03	161.37	162.77	

Average = $Sum(39)_{1…12}$ /12= 160.69 (39)

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

(40)m=	2.67	2.66	2.65	2.59	2.58	2.53	2.53	2.52	2.55	2.58	2.6	2.62

Average = Sum(40)$_{1...12}$ /12= 2.59 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.04 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 82.61 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	90.87	87.56	84.26	80.95	77.65	74.35	74.35	77.65	80.95	84.26	87.56	90.87

Total = Sum(44)$_{1...12}$ = 991.27 (44)

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

(45)m=	134.75	117.85	121.62	106.03	101.74	87.79	81.35	93.35	94.47	110.09	120.17	130.5

Total = Sum(45)$_{1...12}$ = 1299.71 (45)

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

(46)m=	20.21	17.68	18.24	15.9	15.26	13.17	12.2	14	14.17	16.51	18.03	19.58	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

(61)m=	29.11	26.28	29.08	28.12	29.04	28.09	29.01	29.03	28.1	29.06	28.15	29.1	(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=	163.86	144.13	150.69	134.15	130.78	115.88	110.36	122.38	122.57	139.15	148.32	159.6	(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=	163.86	144.13	150.69	134.15	130.78	115.88	110.36	122.38	122.57	139.15	148.32	159.6	

Output from water heater (annual)$_{1...12}$ 1641.88 (64)

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

(65)m=	52.08	45.76	47.71	42.28	41.09	36.21	34.3	38.3	38.44	43.87	46.99	50.67	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	(66)

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

(67)m=	17	15.1	12.28	9.3	6.95	5.87	6.34	8.24	11.06	14.04	16.39	17.47	(67)

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

(68)m=	178.01	179.86	175.2	165.29	152.78	141.03	133.17	131.33	135.98	145.89	158.4	170.16	(68)

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

(69)m=	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	(71)

Water heating gains (Table 5)

(72)m=	70	68.09	64.12	58.73	55.23	50.29	46.11	51.47	53.38	58.97	65.27	68.1	(72)

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

(73)m=	321.59	319.62	308.18	289.89	271.53	253.76	242.19	247.61	257	275.47	296.63	312.3	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	8.74	x	46.75	x	0.63	x	0.7	=	124.88	(78)
South	0.9x	0.77	x	8.74	x	76.57	x	0.63	x	0.7	=	204.52	(78)
South	0.9x	0.77	x	8.74	x	97.53	x	0.63	x	0.7	=	260.52	(78)
South	0.9x	0.77	x	8.74	x	110.23	x	0.63	x	0.7	=	294.44	(78)
South	0.9x	0.77	x	8.74	x	114.87	x	0.63	x	0.7	=	306.83	(78)

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South	0.9x	0.77	x	8.74	x	110.55	x	0.63	x	0.7	=	295.28	(78)
South	0.9x	0.77	x	8.74	x	108.01	x	0.63	x	0.7	=	288.51	(78)
South	0.9x	0.77	x	8.74	x	104.89	x	0.63	x	0.7	=	280.18	(78)
South	0.9x	0.77	x	8.74	x	101.89	x	0.63	x	0.7	=	272.14	(78)
South	0.9x	0.77	x	8.74	x	82.59	x	0.63	x	0.7	=	220.59	(78)
South	0.9x	0.77	x	8.74	x	55.42	x	0.63	x	0.7	=	148.02	(78)
South	0.9x	0.77	x	8.74	x	40.4	x	0.63	x	0.7	=	107.91	(78)

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

(83)m=	124.88	204.52	260.52	294.44	306.83	295.28	288.51	280.18	272.14	220.59	148.02	107.91	(83)

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

(84)m=	446.46	524.14	568.7	584.33	578.36	549.04	530.7	527.79	529.14	496.06	444.66	420.21	(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	0.98	0.96	0.91	0.83	0.84	0.93	0.98	0.99	1	(86)

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

(87)m=	18.24	18.46	18.83	19.35	19.88	20.39	20.7	20.67	20.28	19.58	18.84	18.23	(87)

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

(88)m=	18.92	18.93	18.94	18.97	18.97	19	19	19.01	18.99	18.97	18.96	18.95	(88)

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

(89)m=	0.99	0.99	0.98	0.96	0.92	0.82	0.6	0.64	0.86	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=	16.57	16.79	17.17	17.7	18.22	18.71	18.93	18.92	18.61	17.94	17.2	16.58	(90)

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

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

(92)m=	17.27	17.49	17.86	18.39	18.9	19.41	19.66	19.65	19.3	18.62	17.88	17.27	(92)

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

(93)m=	17.12	17.34	17.71	18.24	18.75	19.26	19.51	19.5	19.15	18.47	17.73	17.12	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.97	0.95	0.92	0.83	0.68	0.71	0.87	0.95	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	441.48	514.81	552.93	557.81	531.1	457.64	361.79	372.88	458.36	473.13	436.87	416.27	(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=	2124.48	2051.79	1840.82	1500.11	1128.95	730.6	457.33	483.95	798.3	1259.18	1714.95	2102.53	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1252.16	1032.85	958.19	678.46	444.79	0	0	0	0	584.82	920.21	1254.57	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	7126.06	(98)
Space heating requirement in kWh/m²/year	114.9	(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)	1252.16	1032.85	958.19	678.46	444.79	0	0	0	0	584.82	920.21	1254.57		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1380.55	1138.75	1056.44	748.02	490.4	0	0	0	0	644.78	1014.57	1383.21		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													7856.73	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	163.86	144.13	150.69	134.15	130.78	115.88	110.36	122.38	122.57	139.15	148.32	159.6		
Efficiency of water heater													87	(216)
(217)m=	90.26	90.23	90.18	90.07	89.83	87	87	87	87	89.96	90.17	90.27		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	181.55	159.74	167.1	148.94	145.58	133.19	126.86	140.67	140.89	154.68	164.49	176.81		
Total = Sum(219a)$_{1...12}$ =													1840.49	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			7856.73	
Water heating fuel used			1840.49	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			300.25	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1697.05	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	397.55	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2094.6	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	155.83	(268)
Total CO2, kg/year		sum of (265)…(271) =		2289.35	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		36.91	(273)
EI rating (section 14)				71	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 12 PL1B

Address : Flat 12, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	65.8	(1a)	x	2.6	(2a)	=	171.08	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.8	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			171.08	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			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			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.67	(21)

Infiltration rate modified for monthly wind speed

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

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

0.86	0.84	0.82	0.74	0.72	0.64	0.64	0.62	0.67	0.72	0.76	0.79

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

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

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

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

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

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

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

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

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

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

(24d)m=	0.87	0.85	0.84	0.77	0.76	0.7	0.7	0.69	0.73	0.76	0.79	0.81	(24d)

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

(25)m=	0.87	0.85	0.84	0.77	0.76	0.7	0.7	0.69	0.73	0.76	0.79	0.81	(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			2.12	x	1.6	=	3.392			(26)
Windows			8.74	x1/[1/(4.8)+ 0.04]		=	35.19			(27)
Walls Type1	25.01	8.74	16.27	x	2.09	=	34			(29)
Walls Type2	25.01	2.12	22.89	x	0.18	=	4.22			(29)
Roof	50.14	0	50.14	x	0.11	=	5.52			(30)
Total area of elements, m²			100.16							(31)
Party wall			35.57	x	0	=	0			(32)
Party floor			65.8							(32a)
Party ceiling			15.66							(32b)

** 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) =	82.32	(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		15.02	(36)

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

Total fabric heat loss	(33) + (36) =	97.35	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	48.94	48.14	47.35	43.65	42.95	39.73	39.73	39.13	40.97	42.95	44.35	45.82	(38)

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

(39)m=	146.29	145.48	144.69	140.99	140.3	137.07	137.07	136.48	138.32	140.3	141.7	143.17	

Average = Sum(39)$_{1…12}$ /12= 140.99 (39)

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

(40)m=	2.22	2.21	2.2	2.14	2.13	2.08	2.08	2.07	2.1	2.13	2.15	2.18

Average = Sum(40)$_{1\ldots12}$ /12= 2.14 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.14 (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 85.03 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	93.53	90.13	86.73	83.32	79.92	76.52	76.52	79.92	83.32	86.73	90.13	93.53	
									Total = Sum(44)$_{1\ldots12}$ =			1020.3	(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=	138.7	121.31	125.18	109.13	104.72	90.36	83.73	96.09	97.23	113.32	123.69	134.32	
									Total = Sum(45)$_{1\ldots12}$ =			1337.78	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	20.8	18.2	18.78	16.37	15.71	13.55	12.56	14.41	14.58	17	18.55	20.15	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	29.12	26.29	29.09	28.13	29.05	28.09	29.02	29.04	28.11	29.07	28.16	29.11	(61)

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

(62)m=	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43	(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=	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43	

Output from water heater (annual)$_{1...12}$ 1680.04 (64)

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

(65)m=	53.4	46.91	48.89	43.32	42.08	37.07	35.1	39.21	39.36	44.95	48.17	51.94	(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=	107	107	107	107	107	107	107	107	107	107	107	107	(66)

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

(67)m=	18.12	16.1	13.09	9.91	7.41	6.25	6.76	8.78	11.79	14.97	17.47	18.63	(67)

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

(68)m=	187.3	189.25	184.35	173.92	160.76	148.39	140.13	138.18	143.08	153.51	166.67	179.04	(68)

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

(69)m=	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	(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=	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	(71)

Water heating gains (Table 5)

(72)m=	71.77	69.8	65.72	60.16	56.56	51.48	47.17	52.7	54.66	60.41	66.9	69.81	(72)

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

(73)m=	335.3	333.24	321.26	302.1	282.83	264.23	252.16	257.76	267.63	286.99	309.14	325.58	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	8.74	x	46.75	x	0.63	x	0.7	=	124.88	(78)
South	0.9x	0.77	x	8.74	x	76.57	x	0.63	x	0.7	=	204.52	(78)
South	0.9x	0.77	x	8.74	x	97.53	x	0.63	x	0.7	=	260.52	(78)
South	0.9x	0.77	x	8.74	x	110.23	x	0.63	x	0.7	=	294.44	(78)
South	0.9x	0.77	x	8.74	x	114.87	x	0.63	x	0.7	=	306.83	(78)

South	0.9x	0.77	x	8.74	x	110.55	x	0.63	x	0.7	=	295.28	(78)
South	0.9x	0.77	x	8.74	x	108.01	x	0.63	x	0.7	=	288.51	(78)
South	0.9x	0.77	x	8.74	x	104.89	x	0.63	x	0.7	=	280.18	(78)
South	0.9x	0.77	x	8.74	x	101.89	x	0.63	x	0.7	=	272.14	(78)
South	0.9x	0.77	x	8.74	x	82.59	x	0.63	x	0.7	=	220.59	(78)
South	0.9x	0.77	x	8.74	x	55.42	x	0.63	x	0.7	=	148.02	(78)
South	0.9x	0.77	x	8.74	x	40.4	x	0.63	x	0.7	=	107.91	(78)

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

(83)m=	124.88	204.52	260.52	294.44	306.83	295.28	288.51	280.18	272.14	220.59	148.02	107.91	(83)

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

(84)m=	460.17	537.76	581.77	596.54	589.65	559.51	540.66	537.94	539.78	507.58	457.16	433.48	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.98	0.95	0.9	0.8	0.82	0.92	0.98	0.99	1	(86)

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

(87)m=	18.63	18.84	19.17	19.64	20.1	20.54	20.79	20.77	20.45	19.83	19.17	18.63	(87)

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

(88)m=	19.19	19.2	19.2	19.24	19.25	19.28	19.28	19.28	19.27	19.25	19.23	19.22	(88)

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

(89)m=	0.99	0.99	0.98	0.96	0.92	0.81	0.6	0.63	0.86	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=	17.13	17.34	17.68	18.17	18.62	19.05	19.23	19.22	18.96	18.37	17.7	17.15	(90)

fLA = Living area ÷ (4) = 0.37 (91)

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

(92)m=	17.69	17.9	18.24	18.72	19.18	19.61	19.81	19.8	19.52	18.92	18.25	17.7	(92)

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

(93)m=	17.54	17.75	18.09	18.57	19.03	19.46	19.66	19.65	19.37	18.77	18.1	17.55	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.98	0.96	0.92	0.82	0.66	0.69	0.86	0.96	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	455.99	529.61	567.41	571.13	541.82	461.59	356.67	368.9	465.02	485.47	450.34	430.24	(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=	1937.54	1869.98	1677.41	1363.87	1028.12	666.22	420.04	443.76	728.37	1145.98	1559.19	1911.89	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1102.28	900.73	825.84	570.77	361.81	0	0	0	0	491.42	798.37	1102.34	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	6153.56	(98)
Space heating requirement in kWh/m²/year	93.52	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.7	(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)	1102.28	900.73	825.84	570.77	361.81	0	0	0	0	491.42	798.37	1102.34		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1215.3	993.09	910.52	629.29	398.91	0	0	0	0	541.81	880.23	1215.37		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													6784.52	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)
Water heating Output from water heater (calculated above)	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43		
Efficiency of water heater													87	(216)
(217)m=	90.19	90.16	90.1	89.96	89.67	87	87	87	87	89.84	90.09	90.2		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	186.06	163.7	171.22	152.58	149.17	136.16	129.6	143.82	144.07	158.49	168.56	181.18		
Total = Sum(219a)$_{1...12}$ =													1884.61	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			6784.52	
Water heating fuel used			1884.61	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			320.04	(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	=	1465.46	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	407.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1872.53	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	166.1	(268)
Total CO2, kg/year		sum of (265)…(271) =		2077.56	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		31.57	(273)
EI rating (section 14)				75	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 13 PL1B

Address : Flat 13, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	83.17	(1a)	x	2.6	(2a)	=	216.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	83.17	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			216.24	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.89	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.69	(21)

Infiltration rate modified for monthly wind speed

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

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

0.88	0.86	0.84	0.76	0.74	0.65	0.65	0.64	0.69	0.74	0.77	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(24d)

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

(25)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows Type 1			2.91	x1/[1/(4.8)+ 0.04]		=	11.72			(27)
Windows Type 2			8	x1/[1/(4.8)+ 0.04]		=	32.21			(27)
Walls Type1	47.42	10.91	36.51	x	2.09	=	76.31			(29)
Walls Type2	5.93	2.12	3.81	x	0.18	=	0.7			(29)
Roof	18.21	0	18.21	x	0.11	=	2			(30)
Total area of elements, m²			71.56							(31)
Party wall			41.5	x	0	=	0			(32)
Party floor			83.17							(32a)
Party ceiling			64.96							(32b)

** 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) =	126.34	(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 10.73 (36)

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

Total fabric heat loss (33) + (36) = 137.07 (37)

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

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

DER WorkSheet: New dwelling design stage

(38)m=	63.2	62.13	61.08	56.16	55.24	50.96	50.96	50.16	52.61	55.24	57.1	59.05	(38)

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

(39)m=	200.27	199.2	198.15	193.23	192.31	188.03	188.03	187.23	189.68	192.31	194.17	196.12	

Average = $Sum(39)_{1...12}$ /12= 193.23 (39)

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

(40)m=	2.41	2.4	2.38	2.32	2.31	2.26	2.26	2.25	2.28	2.31	2.33	2.36

Average = $Sum(40)_{1...12}$ /12= 2.32 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.52 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 94.06 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	103.46	99.7	95.94	92.18	88.41	84.65	84.65	88.41	92.18	95.94	99.7	103.46

Total = $Sum(44)_{1...12}$ = 1128.67 (44)

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

(45)m=	153.43	134.19	138.47	120.72	115.84	99.96	92.63	106.29	107.56	125.35	136.83	148.59

Total = $Sum(45)_{1...12}$ = 1479.87 (45)

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

(46)m=	23.01	20.13	20.77	18.11	17.38	14.99	13.89	15.94	16.13	18.8	20.52	22.29	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

DER WorkSheet: New dwelling design stage

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

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

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

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

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

(61)m=	29.15	26.32	29.12	28.16	29.08	28.12	29.04	29.06	28.14	29.1	28.19	29.15	(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=	182.58	160.52	167.6	148.88	144.91	128.08	121.67	135.35	135.7	154.45	165.03	177.74	(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=	182.58	160.52	167.6	148.88	144.91	128.08	121.67	135.35	135.7	154.45	165.03	177.74

Output from water heater (annual)$_{1...12}$	1822.5	(64)

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

(65)m=	58.3	51.2	53.32	47.18	45.79	40.27	38.06	42.61	42.8	48.96	52.54	56.69	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	(66)

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

(67)m=	21.92	19.47	15.83	11.99	8.96	7.56	8.17	10.62	14.26	18.11	21.13	22.53	(67)

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

(68)m=	225.94	228.28	222.37	209.8	193.92	179	169.03	166.68	172.59	185.17	201.05	215.97	(68)

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

(69)m=	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	(71)

Water heating gains (Table 5)

(72)m=	78.37	76.19	71.67	65.53	61.54	55.92	51.15	57.27	59.44	65.8	72.98	76.2	(72)

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

(73)m=	390.03	387.75	373.68	351.12	328.22	306.29	292.16	298.38	310.1	332.88	358.96	378.5	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	8	x	46.75	x	0.63	x	0.7	=	114.3	(78)
South	0.9x	0.77	x	8	x	76.57	x	0.63	x	0.7	=	187.2	(78)

South	0.9x	0.77	x	8	x	97.53	x	0.63	x	0.7	=	238.46	(78)
South	0.9x	0.77	x	8	x	110.23	x	0.63	x	0.7	=	269.51	(78)
South	0.9x	0.77	x	8	x	114.87	x	0.63	x	0.7	=	280.85	(78)
South	0.9x	0.77	x	8	x	110.55	x	0.63	x	0.7	=	270.28	(78)
South	0.9x	0.77	x	8	x	108.01	x	0.63	x	0.7	=	264.08	(78)
South	0.9x	0.77	x	8	x	104.89	x	0.63	x	0.7	=	256.46	(78)
South	0.9x	0.77	x	8	x	101.89	x	0.63	x	0.7	=	249.1	(78)
South	0.9x	0.77	x	8	x	82.59	x	0.63	x	0.7	=	201.91	(78)
South	0.9x	0.77	x	8	x	55.42	x	0.63	x	0.7	=	135.49	(78)
South	0.9x	0.77	x	8	x	40.4	x	0.63	x	0.7	=	98.77	(78)
West	0.9x	0.77	x	2.91	x	19.64	x	0.63	x	0.7	=	17.47	(80)
West	0.9x	0.77	x	2.91	x	38.42	x	0.63	x	0.7	=	34.17	(80)
West	0.9x	0.77	x	2.91	x	63.27	x	0.63	x	0.7	=	56.27	(80)
West	0.9x	0.77	x	2.91	x	92.28	x	0.63	x	0.7	=	82.07	(80)
West	0.9x	0.77	x	2.91	x	113.09	x	0.63	x	0.7	=	100.58	(80)
West	0.9x	0.77	x	2.91	x	115.77	x	0.63	x	0.7	=	102.96	(80)
West	0.9x	0.77	x	2.91	x	110.22	x	0.63	x	0.7	=	98.02	(80)
West	0.9x	0.77	x	2.91	x	94.68	x	0.63	x	0.7	=	84.2	(80)
West	0.9x	0.77	x	2.91	x	73.59	x	0.63	x	0.7	=	65.45	(80)
West	0.9x	0.77	x	2.91	x	45.59	x	0.63	x	0.7	=	40.54	(80)
West	0.9x	0.77	x	2.91	x	24.49	x	0.63	x	0.7	=	21.78	(80)
West	0.9x	0.77	x	2.91	x	16.15	x	0.63	x	0.7	=	14.36	(80)

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

(83)m=	131.77	221.37	294.73	351.58	381.43	373.24	362.1	340.66	314.55	242.46	157.27	113.13	(83)

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

(84)m=	521.8	609.12	668.41	702.7	709.65	679.53	654.26	639.04	624.65	575.34	516.23	491.64	(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	0.99	0.99	0.98	0.96	0.92	0.83	0.85	0.94	0.98	0.99	1	(86)

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

(87)m=	18.41	18.61	18.96	19.47	19.97	20.45	20.73	20.7	20.33	19.66	18.97	18.4	(87)

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

(88)m=	19.08	19.08	19.09	19.13	19.13	19.17	19.17	19.17	19.15	19.13	19.12	19.11	(88)

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

(89)m=	0.99	0.99	0.98	0.97	0.93	0.83	0.63	0.67	0.88	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=	16.83	17.04	17.4	17.92	18.42	18.89	19.1	19.09	18.77	18.12	17.43	16.85	(90)

fLA = Living area ÷ (4) = | 0.31 | (91)

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

(92)m=	17.32	17.53	17.88	18.4	18.9	19.38	19.61	19.59	19.26	18.6	17.91	17.34	(92)

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

(93)m=	17.17	17.38	17.73	18.25	18.75	19.23	19.46	19.44	19.11	18.45	17.76	17.19	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.96	0.93	0.84	0.67	0.71	0.88	0.97	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	517.89	601.65	654.73	676.67	657.31	568.7	441.38	452.51	550.9	555.27	510.05	488.6	(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=	2577.88	2485.07	2225.81	1807.15	1355.99	869.93	537.3	568.92	949.39	1510.26	2069.27	2546.64	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1532.63	1265.66	1168.88	813.94	519.82	0	0	0	0	710.51	1122.64	1531.18	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 8665.27 (98)

Space heating requirement in kWh/m²/year 104.19 (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)														
	1532.63	1265.66	1168.88	813.94	519.82	0	0	0	0	710.51	1122.64	1531.18		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	1689.78	1395.44	1288.74	897.4	573.12	0	0	0	0	783.36	1237.75	1688.18		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													9553.77	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	182.58	160.52	167.6	148.88	144.91	128.08	121.67	135.35	135.7	154.45	165.03	177.74		
Efficiency of water heater													87	(216)
(217)m=	90.29	90.27	90.22	90.11	89.87	87	87	87	87	90.02	90.21	90.3		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	202.22	177.82	185.77	165.23	161.25	147.21	139.85	155.58	155.98	171.59	182.94	196.83		
Total = Sum(219a)$_{1...12}$ =													2042.25	(219)

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Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			9553.77	
Water heating fuel used			2042.25	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			387.12	(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	=	2063.61	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	441.13	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2504.74	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	200.92	(268)
Total CO2, kg/year		sum of (265)…(271) =		2744.58	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		33	(273)
EI rating (section 14)				71	(274)

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User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 14 PL1B

Address : Flat 14, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	65.33	(1a) x	2.6	(2a) =	169.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.33	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	169.86	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.67	(21)

Infiltration rate modified for monthly wind speed

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

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

0.86	0.84	0.82	0.74	0.72	0.64	0.64	0.62	0.67	0.72	0.76	0.79

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.87	0.85	0.84	0.77	0.76	0.7	0.7	0.69	0.73	0.76	0.79	0.81	(24d)

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

(25)m=	0.87	0.85	0.84	0.77	0.76	0.7	0.7	0.69	0.73	0.76	0.79	0.81	(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			2.12	x	1.6	=	3.392			(26)
Windows			8.74	x1/[1/(4.8)+ 0.04]		=	35.19			(27)
Walls Type1	24.52	8.74	15.78	x	2.09	=	32.98			(29)
Walls Type2	37.86	2.12	35.74	x	0.18	=	6.58			(29)
Walls Type3	10.37	0	10.37	x	0.73	=	7.52			(29)
Roof	36.23	0	36.23	x	0.11	=	3.99			(30)
Total area of elements, m²			108.98							(31)
Party wall			23.71	x	0	=	0			(32)
Party floor			65.33							(32a)
Party ceiling			29.1							(32b)

** 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) = 89.66 (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 16.35 (36)

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

Total fabric heat loss (33) + (36) = 106 (37)

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

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

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	48.63	47.83	47.05	43.36	42.67	39.47	39.47	38.87	40.7	42.67	44.07	45.53	(38)

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

(39)m=	154.64	153.84	153.05	149.37	148.68	145.47	145.47	144.88	146.71	148.68	150.07	151.53	

Average = Sum(39)$_{1...12}$ /12= 149.36 (39)

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

(40)m=	2.37	2.35	2.34	2.29	2.28	2.23	2.23	2.22	2.25	2.28	2.3	2.32	

Average = Sum(40)$_{1...12}$ /12= 2.29 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.13 (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 84.73 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	93.2	89.82	86.43	83.04	79.65	76.26	76.26	79.65	83.04	86.43	89.82	93.2	

Total = Sum(44)$_{1...12}$ = 1016.78 (44)

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

(45)m=	138.22	120.89	124.75	108.76	104.35	90.05	83.44	95.75	96.9	112.92	123.27	133.86	

Total = Sum(45)$_{1...12}$ = 1333.16 (45)

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

(46)m=	20.73	18.13	18.71	16.31	15.65	13.51	12.52	14.36	14.53	16.94	18.49	20.08	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	29.12	26.29	29.08	28.13	29.05	28.09	29.02	29.04	28.11	29.07	28.16	29.11	(61)

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

(62)m=	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97	(62)

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

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

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

Output from water heater

(64)m=	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97	

Output from water heater (annual)$_{1...12}$ | 1675.41 | (64)

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

(65)m=	53.24	46.77	48.75	43.19	41.96	36.96	35	39.1	39.25	44.81	48.02	51.79	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	17.98	15.97	12.99	9.83	7.35	6.21	6.71	8.72	11.7	14.85	17.34	18.48	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	186.16	188.09	183.23	172.86	159.78	147.49	139.27	137.34	142.21	152.57	165.65	177.95	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	(71)
Water heating gains (Table 5)													
(72)m=	71.56	69.59	65.52	59.99	56.4	51.34	47.04	52.55	54.51	60.23	66.7	69.6	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	333.62	331.58	319.65	300.6	281.44	262.95	250.93	256.52	266.33	285.58	307.61	323.95	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	8.74	x	19.64	x	0.63	x	0.7	=	52.46	(80)
West	0.9x	0.77	x	8.74	x	38.42	x	0.63	x	0.7	=	102.62	(80)

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West	0.9x	0.77	x	8.74	x	63.27	x	0.63	x	0.7	=	169.01	(80)
West	0.9x	0.77	x	8.74	x	92.28	x	0.63	x	0.7	=	246.49	(80)
West	0.9x	0.77	x	8.74	x	113.09	x	0.63	x	0.7	=	302.08	(80)
West	0.9x	0.77	x	8.74	x	115.77	x	0.63	x	0.7	=	309.23	(80)
West	0.9x	0.77	x	8.74	x	110.22	x	0.63	x	0.7	=	294.4	(80)
West	0.9x	0.77	x	8.74	x	94.68	x	0.63	x	0.7	=	252.88	(80)
West	0.9x	0.77	x	8.74	x	73.59	x	0.63	x	0.7	=	196.56	(80)
West	0.9x	0.77	x	8.74	x	45.59	x	0.63	x	0.7	=	121.77	(80)
West	0.9x	0.77	x	8.74	x	24.49	x	0.63	x	0.7	=	65.41	(80)
West	0.9x	0.77	x	8.74	x	16.15	x	0.63	x	0.7	=	43.14	(80)

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

(83)m=	52.46	102.62	169.01	246.49	302.08	309.23	294.4	252.88	196.56	121.77	65.41	43.14	(83)

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

(84)m=	386.08	434.2	488.66	547.09	583.52	572.18	545.33	509.41	462.89	407.35	373.02	367.09	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.96	0.9	0.81	0.85	0.95	0.99	1	1	(86)
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)													
(87)m=	18.41	18.59	18.95	19.49	20.02	20.5	20.76	20.72	20.31	19.64	18.96	18.42	(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)													
(88)m=	19.1	19.11	19.11	19.15	19.16	19.19	19.19	19.19	19.17	19.16	19.14	19.13	(88)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)													
(89)m=	1	0.99	0.99	0.97	0.93	0.81	0.6	0.66	0.9	0.98	0.99	1	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m=	16.86	17.04	17.4	17.96	18.48	18.94	19.13	19.11	18.78	18.11	17.43	16.88	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

(92)m=	17.55	17.73	18.09	18.64	19.16	19.63	19.85	19.82	19.46	18.79	18.11	17.56	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m=	17.4	17.58	17.94	18.49	19.01	19.48	19.7	19.67	19.31	18.64	17.96	17.41	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.97	0.92	0.83	0.68	0.73	0.9	0.97	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	383.74	430.27	480.71	528.28	538.96	474.6	370.58	370.66	417.67	396.96	369.64	365.23	(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)

DER WorkSheet: New dwelling design stage

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

(97)m=	2025.45	1950.06	1750.88	1431.79	1086.85	710.19	451.4	474.15	764.23	1195.06	1629.9	2001.99	(97)

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

(98)m=	1221.43	1021.3	945	650.53	407.63	0	0	0	0	593.78	907.39	1217.75

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6964.82 (98)

Space heating requirement in kWh/m²/year 106.61 (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)	1221.43	1021.3	945	650.53	407.63	0	0	0	0	593.78	907.39	1217.75		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1346.67	1126.02	1041.9	717.23	449.43	0	0	0	0	654.67	1000.43	1342.62		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													7678.96	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97		
Efficiency of water heater													87	(216)
(217)m=	90.24	90.22	90.16	90.03	89.76	87	87	87	87	89.96	90.15	90.25		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	185.44	163.13	170.61	152.03	148.62	135.8	129.27	143.44	143.69	157.84	167.96	180.58		
Total = Sum(219a)$_{1...12}$ =													1878.41	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			7678.96	
Water heating fuel used			1878.41	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			317.59	(232)

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

DER WorkSheet: New dwelling design stage

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	1658.66	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	405.74	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2064.39	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	164.83	(268)
Total CO2, kg/year			sum of (265)…(271) =		2268.15	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		34.72	(273)
EI rating (section 14)					72	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 15 PL1B

Address : Flat 15, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	51.39	(1a)	x	2.6	(2a)	=	133.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.39	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			133.61	(5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.9	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.7	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

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

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

0.89	0.87	0.85	0.77	0.75	0.66	0.66	0.64	0.7	0.75	0.78	0.82

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.9	0.88	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(24d)

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

(25)m=	0.9	0.88	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(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			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(4.8)+ 0.04]		=	23.44			(27)
Walls Type1	15.76	5.82	9.94	x	2.09	=	20.77			(29)
Walls Type2	37.8	2.12	35.68	x	0.18	=	6.57			(29)
Roof	6.3	0	6.3	x	0.11	=	0.69			(30)
Total area of elements, m²			59.86							(31)
Party wall			22.05	x	0	=	0			(32)
Party floor			51.39							(32a)
Party ceiling			45.09							(32b)

** 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) = 54.87 (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 8.98 (36)

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

Total fabric heat loss (33) + (36) = 63.85 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.47	38.79	38.13	35.02	34.43	31.72	31.72	31.22	32.76	34.43	35.61	36.84	(38)

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

(39)m=	103.32	102.64	101.98	98.86	98.28	95.57	95.57	95.06	96.61	98.28	99.46	100.69	

Average = Sum(39)$_{1…12}$ /12= 98.86 (39)

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

(40)m=	2.01	2	1.98	1.92	1.91	1.86	1.86	1.85	1.88	1.91	1.94	1.96

Average = Sum(40)$_{1\ldots12}$ /12= 1.92 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.73 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.31 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	82.84	79.83	76.82	73.81	70.79	67.78	67.78	70.79	73.81	76.82	79.83	82.84

Total = Sum(44)$_{1\ldots12}$ = 903.76 (44)

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

(45)m=	122.86	107.45	110.88	96.67	92.75	80.04	74.17	85.11	86.13	100.37	109.56	118.98

Total = Sum(45)$_{1\ldots12}$ = 1184.97 (45)

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

(46)m=	18.43	16.12	16.63	14.5	13.91	12.01	11.13	12.77	12.92	15.06	16.43	17.85	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.08	26.25	29.05	28.1	29.02	28.07	29	29.01	28.09	29.04	28.12	29.07	(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=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	

Output from water heater (annual)$_{1...12}$ 1526.86 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	48.12	42.29	44.13	39.17	38.1	33.63	31.91	35.55	35.66	40.63	43.46	46.83	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	15.12	13.43	10.92	8.27	6.18	5.22	5.64	7.33	9.84	12.49	14.58	15.54	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	150.84	152.41	148.46	140.07	129.47	119.5	112.85	111.28	115.23	123.62	134.23	144.19	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(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=	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	(71)
Water heating gains (Table 5)													
(72)m=	64.68	62.93	59.31	54.4	51.2	46.71	42.89	47.79	49.53	54.61	60.36	62.94	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	282.6	280.73	270.66	254.7	238.82	223.4	213.34	218.36	226.55	242.69	261.13	274.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)

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North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.91	36.14	61.42	98.65	132.89	142.27	132.82	105.38	73.84	43.02	23.33	15.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	301.52	316.88	332.08	353.35	371.71	365.66	346.17	323.74	300.4	285.72	284.46	290.4	(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	0.99	0.97	0.93	0.85	0.88	0.96	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.75	18.88	19.18	19.64	20.11	20.56	20.79	20.75	20.39	19.81	19.24	18.77	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.33	19.34	19.34	19.38	19.39	19.43	19.43	19.44	19.41	19.39	19.38	19.36	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.95	0.86	0.67	0.73	0.93	0.98	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.35	17.49	17.79	18.28	18.75	19.19	19.37	19.35	19.04	18.46	17.88	17.39	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.01	18.15	18.45	18.93	19.4	19.84	20.05	20.02	19.68	19.1	18.53	18.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.86	18	18.3	18.78	19.25	19.69	19.9	19.87	19.53	18.95	18.38	17.89	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.98	0.95	0.87	0.74	0.78	0.93	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	300.03	314.87	328.78	346.2	353.4	319.24	255.89	254.08	280.09	280.63	282.43	289.18	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1401.4	1344.77	1203.24	976.61	741.69	486.43	314.96	329.59	524.67	820.85	1121.5	1378.94	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	819.42	692.09	650.6	453.89	288.89	0	0	0	0	401.92	604.13	810.78	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4721.73 (98)

Space heating requirement in kWh/m²/year 91.88 (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)	819.42	692.09	650.6	453.89	288.89	0	0	0	0	401.92	604.13	810.78		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	903.44	763.06	717.31	500.43	318.52	0	0	0	0	443.13	666.08	893.91		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													5205.87	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05		
Efficiency of water heater													87	(216)
(217)m=	90.1	90.08	90.02	89.88	89.57	87	87	87	87	89.77	89.99	90.11		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	168.62	148.43	155.44	138.82	135.96	124.27	118.58	131.18	131.28	144.16	153	164.3		
Total = Sum(219a)$_{1...12}$ =													1714.02	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			5205.87	
Water heating fuel used			1714.02	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			266.99	(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	=	1124.47	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	370.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1494.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	138.57	(268)
Total CO2, kg/year	sum of (265)…(271) =			1672.19	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			32.54	(273)
EI rating (section 14)				77	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 16 PL1B

Address : Flat 16, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	55.75	(1a)	x	2.6	(2a)	=	144.95	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.75	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			144.95	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.89	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.69	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.88	0.86	0.84	0.76	0.74	0.65	0.65	0.64	0.69	0.74	0.77	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.88	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.88	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(4.8)+ 0.04]		=	23.44			(27)
Walls Type1	15.7	5.82	9.88	x	2.09	=	20.65			(29)
Walls Type2	17.65	2.12	15.53	x	0.18	=	2.86			(29)
Roof	6.28	0	6.28	x	0.11	=	0.69			(30)
Total area of elements, m²			39.63							(31)
Party wall			46.05	x	0	=	0			(32)
Party floor			55.75							(32a)
Party ceiling			49.47							(32b)

** 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) = 51.03 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.94 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 56.97 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.33	41.62	40.91	37.62	37.01	34.14	34.14	33.61	35.24	37.01	38.25	39.55	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	99.3	98.59	97.89	94.6	93.98	91.11	91.11	90.58	92.22	93.98	95.23	96.53	

Average = Sum(39)$_{1…12}$ /12= 94.59 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.78	1.77	1.76	1.7	1.69	1.63	1.63	1.62	1.65	1.69	1.71	1.73

Average = Sum(40)$_{1...12}$ /12= 1.7 (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 1.86 (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 78.36 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	86.19	83.06	79.93	76.79	73.66	70.52	70.52	73.66	76.79	79.93	83.06	86.19

Total = Sum(44)$_{1...12}$ = 940.3 (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=	127.82	111.8	115.36	100.58	96.51	83.28	77.17	88.55	89.61	104.43	113.99	123.79

Total = Sum(45)$_{1...12}$ = 1232.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.17	16.77	17.3	15.09	14.48	12.49	11.58	13.28	13.44	15.66	17.1	18.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.09	26.26	29.06	28.11	29.03	28.08	29	29.02	28.09	29.05	28.13	29.08	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	

Output from water heater (annual)$_{1...12}$ | 1574.89 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	49.77	43.74	45.62	40.47	39.35	34.71	32.91	36.7	36.82	41.99	44.94	48.43	(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=	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.54	14.69	11.95	9.04	6.76	5.71	6.17	8.02	10.76	13.66	15.94	17	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	162.12	163.8	159.56	150.53	139.14	128.44	121.28	119.6	123.84	132.86	144.26	154.96	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	(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=	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	(71)

Water heating gains (Table 5)

(72)m=	66.9	65.09	61.32	56.21	52.88	48.21	44.23	49.33	51.14	56.43	62.41	65.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	299.44	297.46	286.72	269.67	252.68	236.24	225.57	230.83	239.62	256.85	276.5	290.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)

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North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.91	36.14	61.42	98.65	132.89	142.27	132.82	105.38	73.84	43.02	23.33	15.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	318.36	333.61	348.13	368.33	385.57	378.51	358.4	336.21	313.47	299.87	299.83	306.71	(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	1	0.99	0.97	0.92	0.84	0.87	0.96	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.97	19.1	19.37	19.81	20.23	20.64	20.84	20.81	20.48	19.96	19.43	19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.48	19.49	19.5	19.54	19.55	19.59	19.59	19.6	19.57	19.55	19.54	19.52	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.96	0.86	0.67	0.73	0.93	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.68	17.82	18.1	18.56	18.98	19.39	19.54	19.53	19.25	18.71	18.18	17.73	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.31	18.44	18.71	19.16	19.59	19.99	20.17	20.14	19.84	19.31	18.78	18.34	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.16	18.29	18.56	19.01	19.44	19.84	20.02	19.99	19.69	19.16	18.63	18.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.98	0.95	0.87	0.73	0.78	0.93	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	317.09	331.88	345.23	361.79	367.88	330.76	263.09	262.53	293.05	295.17	298.07	305.69	(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=	1375.99	1319.69	1180.6	956.22	727.13	477.5	311.44	325.58	515.75	804.74	1098.38	1350.57	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	787.82	663.81	621.52	427.98	267.28	0	0	0	0	379.12	576.22	777.39	

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 4501.15 (98)

Space heating requirement in kWh/m²/year 80.74 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 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)	787.82	663.81	621.52	427.98	267.28	0	0	0	0	379.12	576.22	777.39		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	868.6	731.87	685.24	471.87	294.69	0	0	0	0	417.99	635.31	857.1		(211)
Total (kWh/year) =$Sum(211)_{1...5,10...12}$=													4962.68	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =$Sum(215)_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87		
Efficiency of water heater													87	(216)
(217)m=	90.06	90.04	89.98	89.82	89.48	87	87	87	87	89.71	89.94	90.07		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	174.22	153.33	160.51	143.27	140.29	127.99	122.04	135.14	135.29	148.79	158.02	169.73		
Total = $Sum(219a)_{1...12}$ =													1768.62	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4962.68	
Water heating fuel used			1768.62	
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			292.06	(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	=	1071.94	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	382.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1453.96	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	151.58	(268)
Total CO2, kg/year		sum of (265)…(271) =		1644.46	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		29.5	(273)
EI rating (section 14)				78	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 17 PL1B

Address : Flat 17, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	55.75	(1a) x	2.6	(2a) =	144.95	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		144.95	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.89	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.69	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.88	0.86	0.84	0.76	0.74	0.65	0.65	0.64	0.69	0.74	0.77	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.88	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.88	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(4.8)+ 0.04]		=	23.44			(27)
Walls Type1	15.7	5.82	9.88	x	2.09	=	20.65			(29)
Walls Type2	17.65	2.12	15.53	x	0.18	=	2.87			(29)
Roof	6.28	0	6.28	x	0.11	=	0.69			(30)
Total area of elements, m²			39.63							(31)
Party wall			46.05	x	0	=	0			(32)
Party floor			55.75							(32a)
Party ceiling			49.47							(32b)

** 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) = 51.03 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.94 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 56.98 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.33	41.62	40.91	37.62	37.01	34.14	34.14	33.61	35.24	37.01	38.25	39.55	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	99.31	98.59	97.89	94.6	93.98	91.12	91.12	90.59	92.22	93.98	95.23	96.53	

Average = Sum(39)$_{1…12}$ /12= 94.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.78	1.77	1.76	1.7	1.69	1.63	1.63	1.62	1.65	1.69	1.71	1.73

Average = Sum(40)$_{1…12}$ /12= 1.7 (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 1.86 (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 78.36 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	86.19	83.06	79.93	76.79	73.66	70.52	70.52	73.66	76.79	79.93	83.06	86.19	
										Total = Sum(44)$_{1…12}$ =		940.3	(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=	127.82	111.8	115.36	100.58	96.51	83.28	77.17	88.55	89.61	104.43	113.99	123.79	
										Total = Sum(45)$_{1…12}$ =		1232.88	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	19.17	16.77	17.3	15.09	14.48	12.49	11.58	13.28	13.44	15.66	17.1	18.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.09	26.26	29.06	28.11	29.03	28.08	29	29.02	28.09	29.05	28.13	29.08	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	

Output from water heater (annual)1…12 | 1574.89 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	49.77	43.74	45.62	40.47	39.35	34.71	32.91	36.7	36.82	41.99	44.94	48.43	(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=	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.54	14.69	11.95	9.04	6.76	5.71	6.17	8.02	10.76	13.66	15.94	17	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	162.12	163.8	159.56	150.53	139.14	128.44	121.28	119.6	123.84	132.86	144.26	154.96	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	(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=	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	(71)

Water heating gains (Table 5)

(72)m=	66.9	65.09	61.32	56.21	52.88	48.21	44.23	49.33	51.14	56.43	62.41	65.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	299.44	297.46	286.72	269.67	252.68	236.24	225.57	230.83	239.62	256.85	276.5	290.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)

North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.91	36.14	61.42	98.65	132.89	142.27	132.82	105.38	73.84	43.02	23.33	15.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	318.36	333.61	348.13	368.33	385.57	378.51	358.4	336.21	313.47	299.87	299.83	306.71	(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	1	0.99	0.97	0.92	0.84	0.87	0.96	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.97	19.1	19.37	19.81	20.23	20.64	20.84	20.81	20.48	19.96	19.43	19	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.48	19.49	19.5	19.54	19.55	19.59	19.59	19.6	19.57	19.55	19.53	19.52	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.96	0.86	0.67	0.73	0.93	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.68	17.82	18.09	18.56	18.98	19.39	19.54	19.53	19.25	18.71	18.18	17.73	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.31	18.44	18.71	19.16	19.59	19.99	20.17	20.14	19.84	19.31	18.78	18.34	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.16	18.29	18.56	19.01	19.44	19.84	20.02	19.99	19.69	19.16	18.63	18.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.98	0.95	0.87	0.73	0.78	0.93	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	317.09	331.88	345.23	361.79	367.88	330.77	263.1	262.53	293.05	295.17	298.07	305.69	(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=	1376.06	1319.75	1180.65	956.26	727.17	477.53	311.45	325.59	515.78	804.78	1098.43	1350.63	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	787.87	663.85	621.56	428.02	267.31	0	0	0	0	379.15	576.26	777.44	(98)

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Total per year (kWh/year) = Sum(98)1...5,9...12 =	4501.44 (98)
Space heating requirement in kWh/m²/year	80.74 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		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)	787.87	663.85	621.56	428.02	267.31	0	0	0	0	379.15	576.26	777.44		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	868.65	731.91	685.29	471.9	294.72	0	0	0	0	418.02	635.35	857.15		(211)
Total (kWh/year) =Sum(211)1...5,10...12=													4963	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87		
Efficiency of water heater													87	(216)
(217)m=	90.06	90.04	89.98	89.82	89.48	87	87	87	87	89.71	89.94	90.07		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	174.22	153.33	160.51	143.27	140.29	127.99	122.04	135.14	135.29	148.79	158.02	169.73		
Total = Sum(219a)1...12 =													1768.62	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4963	
Water heating fuel used			1768.62	
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			292.06	(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	=	1072.01	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	382.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1454.03	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	151.58	(268)
Total CO2, kg/year		sum of (265)…(271) =		1644.53	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		29.5	(273)
EI rating (section 14)				78	(274)

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User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 18 PL1B

Address : Flat 18, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	51.39	(1a)	x	2.6	(2a)	=	133.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.39	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			133.61	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.9	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.7	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.89	0.87	0.85	0.77	0.75	0.66	0.66	0.64	0.7	0.75	0.78	0.82

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.9	0.88	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.9	0.88	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(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			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(4.8)+ 0.04]		=	23.44			(27)
Walls Type1	15.76	5.82	9.94	x	2.09	=	20.77			(29)
Walls Type2	10.66	2.12	8.54	x	0.18	=	1.57			(29)
Roof	6.3	0	6.3	x	0.11	=	0.69			(30)
Total area of elements, m²			32.72							(31)
Party wall			49.19	x	0	=	0			(32)
Party floor			51.39							(32a)
Party ceiling			45.09							(32b)

** 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) = 49.87 (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 4.91 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 54.78 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.47	38.79	38.13	35.02	34.43	31.72	31.72	31.22	32.76	34.43	35.61	36.84	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.25	93.57	92.91	89.79	89.21	86.5	86.5	85.99	87.54	89.21	90.39	91.62	

Average = $Sum(39)_{1…12}$ /12= 89.79 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.83	1.82	1.81	1.75	1.74	1.68	1.68	1.67	1.7	1.74	1.76	1.78

Average = Sum(40)$_{1…12}$ /12= 1.75 (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 1.73 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	82.84	79.83	76.82	73.81	70.79	67.78	67.78	70.79	73.81	76.82	79.83	82.84	
											Total = Sum(44)$_{1…12}$ =	903.76	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	122.86	107.45	110.88	96.67	92.75	80.04	74.17	85.11	86.13	100.37	109.56	118.98	
											Total = Sum(45)$_{1…12}$ =	1184.97	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.43	16.12	16.63	14.5	13.91	12.01	11.13	12.77	12.92	15.06	16.43	17.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (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)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.08	26.25	29.05	28.1	29.02	28.07	29	29.01	28.09	29.04	28.12	29.07	(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=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	

Output from water heater (annual)$_{1...12}$ 1526.86 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	48.12	42.29	44.13	39.17	38.1	33.63	31.91	35.55	35.66	40.63	43.46	46.83	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.12	13.43	10.92	8.27	6.18	5.22	5.64	7.33	9.84	12.49	14.58	15.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	150.84	152.41	148.46	140.07	129.47	119.5	112.85	111.28	115.23	123.62	134.23	144.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(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=	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	(71)

Water heating gains (Table 5)

(72)m=	64.68	62.93	59.31	54.4	51.2	46.71	42.89	47.79	49.53	54.61	60.36	62.94	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	282.6	280.73	270.66	254.7	238.82	223.4	213.34	218.36	226.55	242.69	261.13	274.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)

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North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.91	36.14	61.42	98.65	132.89	142.27	132.82	105.38	73.84	43.02	23.33	15.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	301.52	316.88	332.08	353.35	371.71	365.66	346.17	323.74	300.4	285.72	284.46	290.4	(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	0.99	0.97	0.92	0.83	0.86	0.96	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.93	19.06	19.34	19.79	20.23	20.64	20.84	20.81	20.48	19.94	19.4	18.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.45	19.46	19.46	19.51	19.52	19.55	19.55	19.56	19.54	19.52	19.5	19.48	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.95	0.85	0.66	0.72	0.92	0.98	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.61	17.75	18.04	18.51	18.95	19.36	19.51	19.49	19.21	18.67	18.12	17.66	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.24	18.37	18.66	19.12	19.56	19.96	20.14	20.12	19.81	19.27	18.73	18.28	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.09	18.22	18.51	18.97	19.41	19.81	19.99	19.97	19.66	19.12	18.58	18.13	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.98	0.95	0.86	0.72	0.77	0.93	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	300.17	315.03	328.95	346.27	352.72	315.72	249.16	248.76	279.11	280.73	282.58	289.31	(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=	1299.72	1246.72	1115.5	903.85	687.37	451.01	293.33	306.74	486.87	760.04	1037.53	1275.88	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	743.66	626.1	585.19	401.45	248.98	0	0	0	0	356.6	543.57	734.01	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	4239.56	(98)
Space heating requirement in kWh/m²/year	82.5	(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)	743.66	626.1	585.19	401.45	248.98	0	0	0	0	356.6	543.57	734.01		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	819.92	690.29	645.19	442.62	274.51	0	0	0	0	393.17	599.3	809.27		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													4674.27	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05		
Efficiency of water heater													87	(216)
(217)m=	90.05	90.03	89.96	89.79	89.45	87	87	87	87	89.68	89.93	90.06		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	168.72	148.52	155.54	138.94	136.14	124.27	118.58	131.18	131.28	144.3	153.11	164.4		
Total = Sum(219a)$_{1...12}$ =													1714.96	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4674.27	
Water heating fuel used			1714.96	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			266.99	(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	=	1009.64	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	370.43	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1380.07	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	138.57	(268)
Total CO2, kg/year		sum of (265)…(271) =		1557.57	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		30.31	(273)
EI rating (section 14)				78	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 19 PL1B

Address : Flat 19, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	58.52	(1a)	x	2.6	(2a)	=	152.15	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.52	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			152.15	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.88	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.68	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.87	0.85	0.84	0.75	0.73	0.65	0.65	0.63	0.68	0.73	0.77	0.8

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.8	0.82	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.8	0.82	(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			2.12	x	1.6	=	3.392			(26)
Windows Type 1			5.82	x1/[1/(4.8)+ 0.04]		=	23.44			(27)
Windows Type 2			2.91	x1/[1/(4.8)+ 0.04]		=	11.72			(27)
Windows Type 3			2.91	x1/[1/(4.8)+ 0.04]		=	11.72			(27)
Walls Type1	36.97	11.64	25.33	x	2.09	=	52.94			(29)
Walls Type2	3.15	2.12	1.03	x	0.18	=	0.19			(29)
Roof	8.8	0	8.8	x	0.11	=	0.97			(30)
Total area of elements, m²			48.92							(31)
Party wall			50.41	x	0	=	0			(32)
Party floor			58.52							(32a)
Party ceiling			49.72							(32b)

** 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) = 104.36 (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 7.34 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 111.7 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.15	43.41	42.69	39.28	38.64	35.68	35.68	35.13	36.82	38.64	39.93	41.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	155.85	155.11	154.39	150.98	150.34	147.38	147.38	146.83	148.52	150.34	151.63	152.98	

Average = Sum(39)$_{1\ldots12}$ /12= 150.98 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	2.66	2.65	2.64	2.58	2.57	2.52	2.52	2.51	2.54	2.57	2.59	2.61	

Average = Sum(40)$_{1\ldots12}$ /12= 2.58 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.94 (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 80.26 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	88.29	85.08	81.87	78.66	75.45	72.24	72.24	75.45	78.66	81.87	85.08	88.29	

Total = Sum(44)$_{1\ldots12}$ = 963.16 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	130.93	114.51	118.17	103.02	98.85	85.3	79.04	90.7	91.79	106.97	116.76	126.8	

Total = Sum(45)$_{1\ldots12}$ = 1262.85 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.64	17.18	17.73	15.45	14.83	12.8	11.86	13.61	13.77	16.05	17.51	19.02	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.1	26.27	29.07	28.11	29.03	28.08	29.01	29.03	28.1	29.05	28.14	29.09	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89	(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=	160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89

Output from water heater (annual)$_{1...12}$ | 1604.93 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	50.81	44.64	46.56	41.28	40.13	35.38	33.53	37.42	37.54	42.83	45.86	49.43	(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=	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.2	13.5	10.98	8.31	6.21	5.25	5.67	7.37	9.89	12.56	14.65	15.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	169.2	170.96	166.53	157.11	145.22	134.05	126.58	124.83	129.25	138.67	150.56	161.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	(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=	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	(71)

Water heating gains (Table 5)

(72)m=	68.29	66.43	62.58	57.34	53.93	49.14	45.07	50.29	52.14	57.57	63.69	66.44	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	307.78	305.98	295.18	277.85	260.46	243.53	232.41	237.57	246.37	263.89	284	298.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	2.91	x	10.63	x	0.63	x	0.7	=	9.46	(74)
North	0.9x	0.77	x	2.91	x	20.32	x	0.63	x	0.7	=	18.07	(74)
North	0.9x	0.77	x	2.91	x	34.53	x	0.63	x	0.7	=	30.71	(74)
North	0.9x	0.77	x	2.91	x	55.46	x	0.63	x	0.7	=	49.33	(74)
North	0.9x	0.77	x	2.91	x	74.72	x	0.63	x	0.7	=	66.45	(74)
North	0.9x	0.77	x	2.91	x	79.99	x	0.63	x	0.7	=	71.13	(74)
North	0.9x	0.77	x	2.91	x	74.68	x	0.63	x	0.7	=	66.41	(74)
North	0.9x	0.77	x	2.91	x	59.25	x	0.63	x	0.7	=	52.69	(74)
North	0.9x	0.77	x	2.91	x	41.52	x	0.63	x	0.7	=	36.92	(74)
North	0.9x	0.77	x	2.91	x	24.19	x	0.63	x	0.7	=	21.51	(74)
North	0.9x	0.77	x	2.91	x	13.12	x	0.63	x	0.7	=	11.67	(74)
North	0.9x	0.77	x	2.91	x	8.86	x	0.63	x	0.7	=	7.88	(74)
Northeast	0.9x	0.77	x	2.91	x	11.28	x	0.63	x	0.7	=	10.03	(75)
Northeast	0.9x	0.77	x	2.91	x	22.97	x	0.63	x	0.7	=	20.43	(75)
Northeast	0.9x	0.77	x	2.91	x	41.38	x	0.63	x	0.7	=	36.8	(75)
Northeast	0.9x	0.77	x	2.91	x	67.96	x	0.63	x	0.7	=	60.44	(75)
Northeast	0.9x	0.77	x	2.91	x	91.35	x	0.63	x	0.7	=	81.24	(75)
Northeast	0.9x	0.77	x	2.91	x	97.38	x	0.63	x	0.7	=	86.61	(75)
Northeast	0.9x	0.77	x	2.91	x	91.1	x	0.63	x	0.7	=	81.02	(75)
Northeast	0.9x	0.77	x	2.91	x	72.63	x	0.63	x	0.7	=	64.59	(75)
Northeast	0.9x	0.77	x	2.91	x	50.42	x	0.63	x	0.7	=	44.84	(75)
Northeast	0.9x	0.77	x	2.91	x	28.07	x	0.63	x	0.7	=	24.96	(75)
Northeast	0.9x	0.77	x	2.91	x	14.2	x	0.63	x	0.7	=	12.63	(75)
Northeast	0.9x	0.77	x	2.91	x	9.21	x	0.63	x	0.7	=	8.19	(75)
East	0.9x	0.77	x	5.82	x	19.64	x	0.63	x	0.7	=	34.93	(76)
East	0.9x	0.77	x	5.82	x	38.42	x	0.63	x	0.7	=	68.34	(76)
East	0.9x	0.77	x	5.82	x	63.27	x	0.63	x	0.7	=	112.54	(76)
East	0.9x	0.77	x	5.82	x	92.28	x	0.63	x	0.7	=	164.14	(76)
East	0.9x	0.77	x	5.82	x	113.09	x	0.63	x	0.7	=	201.15	(76)
East	0.9x	0.77	x	5.82	x	115.77	x	0.63	x	0.7	=	205.92	(76)
East	0.9x	0.77	x	5.82	x	110.22	x	0.63	x	0.7	=	196.04	(76)
East	0.9x	0.77	x	5.82	x	94.68	x	0.63	x	0.7	=	168.4	(76)
East	0.9x	0.77	x	5.82	x	73.59	x	0.63	x	0.7	=	130.89	(76)
East	0.9x	0.77	x	5.82	x	45.59	x	0.63	x	0.7	=	81.09	(76)
East	0.9x	0.77	x	5.82	x	24.49	x	0.63	x	0.7	=	43.56	(76)
East	0.9x	0.77	x	5.82	x	16.15	x	0.63	x	0.7	=	28.73	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	54.42	106.83	180.05	273.9	348.84	363.66	343.47	285.68	212.65	127.56	67.85	44.81	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	362.21	412.82	475.23	551.75	609.3	607.19	575.89	523.25	459.03	391.45	351.85	343.7	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	1	0.99	0.99	0.98	0.94	0.87	0.78	0.83	0.94	0.98	0.99	1		(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.18	18.37	18.77	19.36	19.95	20.47	20.75	20.69	20.24	19.5	18.77	18.18		(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	18.93	18.93	18.94	18.97	18.98	19.01	19.01	19.02	19	18.98	18.97	18.96		(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.96	0.9	0.76	0.55	0.62	0.88	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=	16.51	16.71	17.11	17.71	18.29	18.77	18.96	18.94	18.58	17.86	17.12	16.53		(90)
									fLA = Living area ÷ (4) =				0.48	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.3	17.5	17.9	18.5	19.08	19.58	19.81	19.77	19.37	18.64	17.9	17.31		(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.15	17.35	17.75	18.35	18.93	19.43	19.66	19.62	19.22	18.49	17.75	17.16		(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.99	0.98	0.96	0.9	0.79	0.64	0.7	0.89	0.97	0.99	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	359.46	408.11	465.43	527.27	549.78	482.71	370.48	366.9	407.88	379.53	347.9	341.48		(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=	2003.43	1930.68	1736.18	1426.1	1086.55	711.66	450.54	472.6	760.53	1185.95	1615.51	1983		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	1223.12	1023.17	945.44	647.16	399.35	0	0	0	0	599.98	912.68	1221.29		
									Total per year (kWh/year) = Sum(98)1...5,9...12 =				6972.18	(98)
Space heating requirement in kWh/m²/year													119.14	(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)														
	1223.12	1023.17	945.44	647.16	399.35	0	0	0	0	599.98	912.68	1221.29		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	1348.53	1128.08	1042.38	713.51	440.3	0	0	0	0	661.5	1006.26	1346.51		
									Total (kWh/year) =Sum(211)1...5,10...12=				7687.07	(211)

DER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89

Efficiency of water heater 87 (216)

(217)m=	90.26	90.24	90.18	90.05	89.77	87	87	87	87	89.99	90.17	90.27	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	177.3	156.02	163.26	145.61	142.45	130.33	124.2	137.62	137.8	151.15	160.69	172.7

Total = Sum(219a)$_{1...12}$ = 1799.13 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			7687.07	
Water heating fuel used			1799.13	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			268.43	(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	=	1660.41	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	388.61	(264)
Space and water heating	(261) + (262) + (263) + (264) =			2049.02	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	139.31	(268)
Total CO2, kg/year		sum of (265)…(271) =		2227.26	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		38.06	(273)
EI rating (section 14)				71	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 20 PL1B

Address : Flat 20, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.27	(1a) x	2.6	(2a) =	130.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.27	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	130.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.9	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.7	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.89	0.87	0.86	0.77	0.75	0.66	0.66	0.65	0.7	0.75	0.79	0.82

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.9	0.88	0.87	0.8	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.9	0.88	0.87	0.8	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(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			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(4.8)+ 0.04]		=	23.44			(27)
Walls Type1	15.65	5.82	9.83	x	2.09	=	20.54			(29)
Walls Type2	37.36	2.12	35.24	x	0.18	=	6.49			(29)
Roof	2.84	0	2.84	x	0.11	=	0.31			(30)
Total area of elements, m²			55.85							(31)
Party wall			21.71	x	0	=	0			(32)
Party floor			50.27							(32a)
Party ceiling			47.43							(32b)

** 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) = 54.18 (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 8.38 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 62.55 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.74	38.07	37.42	34.35	33.77	31.1	31.1	30.6	32.13	33.77	34.93	36.15	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	101.29	100.62	99.97	96.9	96.32	93.65	93.65	93.16	94.68	96.32	97.49	98.7

Average = $Sum(39)_{1...12}$ /12= 96.9 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	2.01	2	1.99	1.93	1.92	1.86	1.86	1.85	1.88	1.92	1.94	1.96

Average = Sum(40)$_{1…12}$ /12= 1.93 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.53 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.98	79	76.02	73.04	70.06	67.08	67.08	70.06	73.04	76.02	79	81.98	
										Total = Sum(44)$_{1…12}$ =		894.34	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	121.58	106.33	109.72	95.66	91.79	79.21	73.4	84.22	85.23	99.33	108.42	117.74	
										Total = Sum(45)$_{1…12}$ =		1172.63	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.24	15.95	16.46	14.35	13.77	11.88	11.01	12.63	12.78	14.9	16.26	17.66	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (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)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.07	26.25	29.05	28.09	29.02	28.07	29	29.01	28.08	29.04	28.12	29.07	(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=	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81	(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=	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81	

Output from water heater (annual)$_{1...12}$ 1514.49 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	47.69	41.92	43.75	38.83	37.77	33.35	31.65	35.26	35.36	40.29	43.08	46.42	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.76	13.11	10.66	8.07	6.03	5.09	5.5	7.15	9.6	12.19	14.23	15.17	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.94	149.47	145.6	137.37	126.97	117.2	110.67	109.14	113.01	121.24	131.64	141.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	(71)

Water heating gains (Table 5)

(72)m=	64.1	62.38	58.8	53.93	50.77	46.32	42.54	47.39	49.11	54.15	59.83	62.39	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	278.26	276.42	266.53	250.84	235.25	220.09	210.19	215.15	223.19	239.05	257.17	270.43	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	5.82	x	19.64	x	0.63	x	0.7	=	34.93	(76)
East	0.9x	0.77	x	5.82	x	38.42	x	0.63	x	0.7	=	68.34	(76)
East	0.9x	0.77	x	5.82	x	63.27	x	0.63	x	0.7	=	112.54	(76)
East	0.9x	0.77	x	5.82	x	92.28	x	0.63	x	0.7	=	164.14	(76)
East	0.9x	0.77	x	5.82	x	113.09	x	0.63	x	0.7	=	201.15	(76)

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East	0.9x	0.77	x	5.82	x	115.77	x	0.63	x	0.7	=	205.92	(76)
East	0.9x	0.77	x	5.82	x	110.22	x	0.63	x	0.7	=	196.04	(76)
East	0.9x	0.77	x	5.82	x	94.68	x	0.63	x	0.7	=	168.4	(76)
East	0.9x	0.77	x	5.82	x	73.59	x	0.63	x	0.7	=	130.89	(76)
East	0.9x	0.77	x	5.82	x	45.59	x	0.63	x	0.7	=	81.09	(76)
East	0.9x	0.77	x	5.82	x	24.49	x	0.63	x	0.7	=	43.56	(76)
East	0.9x	0.77	x	5.82	x	16.15	x	0.63	x	0.7	=	28.73	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	34.93	68.34	112.54	164.14	201.15	205.92	196.04	168.4	130.89	81.09	43.56	28.73	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	313.2	344.76	379.07	414.97	436.4	426	406.23	383.55	354.08	320.14	300.73	299.16	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.95	0.89	0.78	0.82	0.94	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	18.77	18.93	19.26	19.75	20.21	20.63	20.84	20.81	20.47	19.88	19.28	18.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.32	19.33	19.34	19.38	19.39	19.43	19.43	19.43	19.41	19.39	19.37	19.36	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.97	0.93	0.8	0.59	0.65	0.89	0.98	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.37	17.54	17.87	18.38	18.84	19.24	19.39	19.38	19.1	18.51	17.91	17.41	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.02	18.18	18.51	19.01	19.48	19.89	20.06	20.04	19.74	19.14	18.54	18.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.87	18.03	18.36	18.86	19.33	19.74	19.91	19.89	19.59	18.99	18.39	17.9	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.97	0.92	0.82	0.66	0.71	0.9	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	311.35	341.78	373.23	401.26	403.15	350.06	269.34	272.19	317.51	311.84	298.02	297.68	(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=	1374.57	1321.66	1185.88	965.43	734.5	481.09	310.14	325.19	519.5	808.64	1100.75	1351.94	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	791.04	658.48	604.61	406.21	246.52	0	0	0	0	369.63	577.96	784.37	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	4438.81	(98)
Space heating requirement in kWh/m²/year	88.3	(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)	791.04	658.48	604.61	406.21	246.52	0	0	0	0	369.63	577.96	784.37		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	872.14	726	666.6	447.86	271.8	0	0	0	0	407.53	637.22	864.79		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													4893.94	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81		
Efficiency of water heater													87	(216)
(217)m=	90.09	90.06	89.99	89.81	89.45	87	87	87	87	89.72	89.97	90.1		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	167.23	147.22	154.22	137.8	135.06	123.31	117.69	130.15	130.24	143.08	151.76	162.95		
Total = Sum(219a)$_{1...12}$ =													1700.7	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4893.94	
Water heating fuel used			1700.7	
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			260.58	(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	=	1057.09	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	367.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1424.44	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	135.24	(268)
Total CO2, kg/year		sum of (265)…(271) =		1598.61	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		31.8	(273)
EI rating (section 14)				78	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 2 PL1B

Address : Flat 2, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	65.8	(1a)	x	2.8	(2a)	=	184.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.8	(4)						
Dwelling volume						(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.24	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.11	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.67	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(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

0.85	0.83	0.82	0.73	0.72	0.63	0.63	0.62	0.67	0.72	0.75	0.78

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.86	0.85	0.83	0.77	0.76	0.7	0.7	0.69	0.72	0.76	0.78	0.81	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.86	0.85	0.83	0.77	0.76	0.7	0.7	0.69	0.72	0.76	0.78	0.81	(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			2.12	x	1.6	=	3.392			(26)
Windows			10.99	x1/[1/(1.4)+ 0.04]		=	14.57			(27)
Walls Type1	26.94	10.99	15.95	x	0.3	=	4.79			(29)
Walls Type2	26.94	2.12	24.82	x	0.18	=	4.57			(29)
Total area of elements, m²			53.88							(31)
Party wall			38.3	x	0	=	0			(32)
Party floor			65.8							(32a)
Party ceiling			65.8							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.32 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5372 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.08 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	52.28	51.43	50.6	46.68	45.95	42.55	42.55	41.92	43.86	45.95	47.43	48.98	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	87.68	86.83	86	82.08	81.35	77.95	77.95	77.32	79.26	81.35	82.83	84.38	

Average = Sum(39)$_{1…12}$ /12= 82.08 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.33	1.32	1.31	1.25	1.24	1.18	1.18	1.18	1.2	1.24	1.26	1.28	

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 2.14 (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 85.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	93.53	90.13	86.73	83.32	79.92	76.52	76.52	79.92	83.32	86.73	90.13	93.53	

Total = Sum(44)$_{1…12}$ = 1020.3 (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=	138.7	121.31	125.18	109.13	104.72	90.36	83.73	96.09	97.23	113.32	123.69	134.32	

Total = Sum(45)$_{1…12}$ = 1337.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.8	18.2	18.78	16.37	15.71	13.55	12.56	14.41	14.58	17	18.55	20.15	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.12	26.29	29.09	28.13	29.05	28.09	29.02	29.04	28.11	29.07	28.16	29.11	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43	(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=	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43	

Output from water heater (annual)$_{1...12}$ 1680.04 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.4	46.91	48.89	43.32	42.08	37.07	35.1	39.21	39.36	44.95	48.17	51.94	(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=	107	107	107	107	107	107	107	107	107	107	107	107	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	17.28	15.35	12.48	9.45	7.06	5.96	6.44	8.37	11.24	14.27	16.66	17.76	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	187.3	189.25	184.35	173.92	160.76	148.39	140.13	138.18	143.08	153.51	166.67	179.04	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	(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=	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	(71)
Water heating gains (Table 5)													
(72)m=	71.77	69.8	65.72	60.16	56.56	51.48	47.17	52.7	54.66	60.41	66.9	69.81	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	334.45	332.49	320.65	301.64	282.48	263.94	251.84	257.36	267.08	286.29	308.33	324.71	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	10.99	x	46.75	x	0.63	x	0.7	=	157.03	(78)
South	0.9x	0.77	x	10.99	x	76.57	x	0.63	x	0.7	=	257.17	(78)
South	0.9x	0.77	x	10.99	x	97.53	x	0.63	x	0.7	=	327.59	(78)
South	0.9x	0.77	x	10.99	x	110.23	x	0.63	x	0.7	=	370.24	(78)
South	0.9x	0.77	x	10.99	x	114.87	x	0.63	x	0.7	=	385.82	(78)

South	0.9x	0.77	x	10.99	x	110.55	x	0.63	x	0.7	=	371.3	(78)
South	0.9x	0.77	x	10.99	x	108.01	x	0.63	x	0.7	=	362.78	(78)
South	0.9x	0.77	x	10.99	x	104.89	x	0.63	x	0.7	=	352.31	(78)
South	0.9x	0.77	x	10.99	x	101.89	x	0.63	x	0.7	=	342.2	(78)
South	0.9x	0.77	x	10.99	x	82.59	x	0.63	x	0.7	=	277.38	(78)
South	0.9x	0.77	x	10.99	x	55.42	x	0.63	x	0.7	=	186.13	(78)
South	0.9x	0.77	x	10.99	x	40.4	x	0.63	x	0.7	=	135.68	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	157.03	257.17	327.59	370.24	385.82	371.3	362.78	352.31	342.2	277.38	186.13	135.68	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	491.48	589.66	648.23	671.88	668.3	635.23	614.62	609.66	609.29	563.67	494.45	460.39	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.94	0.87	0.72	0.54	0.57	0.78	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.87	20.15	20.5	20.76	20.94	20.99	20.98	20.9	20.56	20.07	19.66	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.82	19.83	19.84	19.88	19.89	19.93	19.93	19.94	19.92	19.89	19.87	19.85	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.97	0.92	0.82	0.62	0.42	0.44	0.7	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=	18.61	18.83	19.11	19.49	19.73	19.9	19.93	19.94	19.87	19.56	19.07	18.65	(90)

fLA = Living area ÷ (4) = 0.38 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.01	19.23	19.51	19.87	20.12	20.3	20.33	20.33	20.26	19.94	19.45	19.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.86	19.08	19.36	19.72	19.97	20.15	20.18	20.18	20.11	19.79	19.3	18.89	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.92	0.83	0.64	0.45	0.47	0.71	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	487.23	578.34	623.2	616.73	553.77	409.08	275.91	288.46	434.87	518.41	485.39	457.37	(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=	1276.26	1231.06	1105.5	888.09	672.71	432.38	279.11	292.55	476.17	747.58	1010.81	1239.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	587.04	438.63	358.83	195.38	88.49	0	0	0	0	170.5	378.3	581.69	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2798.86	(98)
Space heating requirement in kWh/m²/year	42.54	(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)	587.04	438.63	358.83	195.38	88.49	0	0	0	0	170.5	378.3	581.69		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	647.23	483.6	395.62	215.41	97.57	0	0	0	0	187.99	417.09	641.33		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3085.85	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43		
Efficiency of water heater													87	(216)
(217)m=	89.85	89.74	89.55	89.14	88.44	87	87	87	87	88.98	89.61	89.86		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	186.77	164.47	172.26	153.99	151.25	136.16	129.6	143.82	144.07	160.02	169.46	181.87		
Total = Sum(219a)$_{1...12}$ =													1893.75	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3085.85	
Water heating fuel used			1893.75	
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			305.13	(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	=	666.54	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	409.05	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1075.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	158.36	(268)
Total CO2, kg/year		sum of (265)…(271) =		1272.88	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		19.34	(273)
EI rating (section 14)				85	(274)

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User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 3 PL1B

Address : Flat 3, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	83.17	(1a) x	2.8	(2a) =	232.88	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	83.17	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		232.88	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.88	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.68	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.87	0.85	0.83	0.75	0.73	0.65	0.65	0.63	0.68	0.73	0.77	0.8

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(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			2.12	x	1.6	=	3.392			(26)
Windows Type 1			9.97	x1/[1/(1.4)+ 0.04]		=	13.22			(27)
Windows Type 2			4.63	x1/[1/(1.4)+ 0.04]		=	6.14			(27)
Walls Type1	51.07	14.6	36.47	x	0.3	=	10.94			(29)
Walls Type2	6.38	2.12	4.26	x	0.18	=	0.78			(29)
Total area of elements, m²			57.45							(31)
Party wall			44.69	x	0	=	0			(32)
Party floor			83.17							(32a)
Party ceiling			83.17							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12537.6 (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 8.62 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.09 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	67.4	66.28	65.17	59.99	59.02	54.51	54.51	53.68	56.25	59.02	60.98	63.03	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	110.49	109.37	108.26	103.08	102.11	97.6	97.6	96.77	99.34	102.11	104.07	106.12	

Average = $\text{Sum}(39)_{1...12}$ /12= 103.08 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.33	1.31	1.3	1.24	1.23	1.17	1.17	1.16	1.19	1.23	1.25	1.28

Average = Sum(40)1…12 /12= 1.24 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.52 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 94.06 (43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	103.46	99.7	95.94	92.18	88.41	84.65	84.65	88.41	92.18	95.94	99.7	103.46	
Total = Sum(44)1…12 =												1128.67	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	153.43	134.19	138.47	120.72	115.84	99.96	92.63	106.29	107.56	125.35	136.83	148.59	
Total = Sum(45)1…12 =												1479.87	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	23.01	20.13	20.77	18.11	17.38	14.99	13.89	15.94	16.13	18.8	20.52	22.29	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (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)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.15	26.32	29.12	28.16	29.08	28.12	29.04	29.06	28.14	29.1	28.19	29.15	(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=	182.58	160.52	167.6	148.88	144.91	128.08	121.67	135.35	135.7	154.45	165.03	177.74	(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=	182.58	160.52	167.6	148.88	144.91	128.08	121.67	135.35	135.7	154.45	165.03	177.74	

Output from water heater (annual)$_{1...12}$ | 1822.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	58.3	51.2	53.32	47.18	45.79	40.27	38.06	42.61	42.8	48.96	52.54	56.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.66	18.35	14.92	11.3	8.44	7.13	7.7	10.01	13.44	17.06	19.92	21.23	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	225.94	228.28	222.37	209.8	193.92	179	169.03	166.68	172.59	185.17	201.05	215.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	(71)

Water heating gains (Table 5)

(72)m=	78.37	76.19	71.67	65.53	61.54	55.92	51.15	57.27	59.44	65.8	72.98	76.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	388.77	386.62	372.77	350.43	327.71	305.86	291.69	297.77	309.28	331.84	357.75	377.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	9.97	x	46.75	x	0.63	x	0.7	=	142.45	(78)
South	0.9x	0.77	x	9.97	x	76.57	x	0.63	x	0.7	=	233.3	(78)
South	0.9x	0.77	x	9.97	x	97.53	x	0.63	x	0.7	=	297.18	(78)
South	0.9x	0.77	x	9.97	x	110.23	x	0.63	x	0.7	=	335.88	(78)
South	0.9x	0.77	x	9.97	x	114.87	x	0.63	x	0.7	=	350.01	(78)

South	0.9x	0.77	x	9.97	x	110.55	x	0.63	x	0.7	=	336.83	(78)
South	0.9x	0.77	x	9.97	x	108.01	x	0.63	x	0.7	=	329.11	(78)
South	0.9x	0.77	x	9.97	x	104.89	x	0.63	x	0.7	=	319.61	(78)
South	0.9x	0.77	x	9.97	x	101.89	x	0.63	x	0.7	=	310.44	(78)
South	0.9x	0.77	x	9.97	x	82.59	x	0.63	x	0.7	=	251.64	(78)
South	0.9x	0.77	x	9.97	x	55.42	x	0.63	x	0.7	=	168.85	(78)
South	0.9x	0.77	x	9.97	x	40.4	x	0.63	x	0.7	=	123.09	(78)
West	0.9x	0.77	x	4.63	x	19.64	x	0.63	x	0.7	=	27.79	(80)
West	0.9x	0.77	x	4.63	x	38.42	x	0.63	x	0.7	=	54.36	(80)
West	0.9x	0.77	x	4.63	x	63.27	x	0.63	x	0.7	=	89.53	(80)
West	0.9x	0.77	x	4.63	x	92.28	x	0.63	x	0.7	=	130.58	(80)
West	0.9x	0.77	x	4.63	x	113.09	x	0.63	x	0.7	=	160.02	(80)
West	0.9x	0.77	x	4.63	x	115.77	x	0.63	x	0.7	=	163.81	(80)
West	0.9x	0.77	x	4.63	x	110.22	x	0.63	x	0.7	=	155.96	(80)
West	0.9x	0.77	x	4.63	x	94.68	x	0.63	x	0.7	=	133.97	(80)
West	0.9x	0.77	x	4.63	x	73.59	x	0.63	x	0.7	=	104.13	(80)
West	0.9x	0.77	x	4.63	x	45.59	x	0.63	x	0.7	=	64.51	(80)
West	0.9x	0.77	x	4.63	x	24.49	x	0.63	x	0.7	=	34.65	(80)
West	0.9x	0.77	x	4.63	x	16.15	x	0.63	x	0.7	=	22.85	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	170.24	287.66	386.71	466.46	510.03	500.65	485.07	453.57	414.57	316.14	203.51	145.95	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	559.01	674.29	759.48	816.88	837.74	806.5	776.76	751.34	723.85	647.98	561.25	523.15	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.87	0.71	0.54	0.57	0.81	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.8	20.09	20.48	20.76	20.94	20.99	20.98	20.89	20.51	20.01	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.82	19.83	19.84	19.89	19.9	19.94	19.94	19.95	19.92	19.9	19.88	19.86	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.93	0.83	0.62	0.42	0.45	0.73	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.55	18.77	19.07	19.47	19.74	19.92	19.94	19.95	19.86	19.52	19.02	18.6	(90)

fLA = Living area ÷ (4) = | 0.34 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.12	19.41	19.81	20.08	20.26	20.29	20.29	20.21	19.85	19.35	18.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.75	18.97	19.26	19.66	19.93	20.11	20.14	20.14	20.06	19.7	19.2	18.79	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.93	0.83	0.63	0.44	0.48	0.74	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	555.72	665.1	736.26	755.73	693.64	511.27	342.06	357.25	533.54	607.89	554.22	520.86	(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=	1596.7	1538.46	1381.5	1109.2	840.35	537.81	345.58	362.28	591.83	929.54	1259.72	1548.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	774.49	586.9	480.06	254.5	109.15	0	0	0	0	239.31	507.96	764.37	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3716.74 (98)

Space heating requirement in kWh/m²/year 44.69 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		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)													
	774.49	586.9	480.06	254.5	109.15	0	0	0	0	239.31	507.96	764.37	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	853.91	647.08	529.28	280.59	120.34	0	0	0	0	263.85	560.05	842.75	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4097.83 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	182.58	160.52	167.6	148.88	144.91	128.08	121.67	135.35	135.7	154.45	165.03	177.74	
Efficiency of water heater												87	(216)
(217)m=	89.97	89.88	89.71	89.3	88.55	87	87	87	87	89.21	89.76	89.98	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	202.94	178.59	186.81	166.72	163.65	147.21	139.85	155.58	155.98	173.13	183.84	197.53	

Total = Sum(219a)$_{1...12}$ = 2051.84 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4097.83

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Water heating fuel used			2051.84	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			364.82	(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	=	885.13	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	443.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1328.33	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	189.34	(268)
Total CO2, kg/year		sum of (265)…(271) =		1556.6	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		18.72	(273)
EI rating (section 14)				84	(274)

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User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 4 PL1B

Address : Flat 4, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	65.33	(1a) x	2.8	(2a) =	182.92	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.33	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	182.92	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.11	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			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			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.67	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.85	0.83	0.82	0.73	0.72	0.63	0.63	0.62	0.67	0.72	0.75	0.78

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.86	0.85	0.83	0.77	0.76	0.7	0.7	0.69	0.72	0.76	0.78	0.81	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.86	0.85	0.83	0.77	0.76	0.7	0.7	0.69	0.72	0.76	0.78	0.81	(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			2.12	x	1.6	=	3.392			(26)
Windows			13.88	x1/[1/(1.4)+ 0.04]		=	18.4			(27)
Walls Type1	26.4	13.88	12.52	x	0.3	=	3.76			(29)
Walls Type2	40.77	2.12	38.65	x	0.18	=	7.12			(29)
Walls Type3	11.17	0	11.17	x	0.24	=	2.64			(29)
Total area of elements, m²			78.34							(31)
Party wall			25.54	x	0	=	0			(32)
Party floor			65.33							(32a)
Party ceiling			65.33							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5083.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 47.06 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.94	51.1	50.27	46.38	45.65	42.26	42.26	41.64	43.57	45.65	47.13	48.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	99	98.16	97.33	93.44	92.71	89.32	89.32	88.69	90.63	92.71	94.18	95.72	

Average = Sum(39)$_{1…12}$ /12= 93.43 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.52	1.5	1.49	1.43	1.42	1.37	1.37	1.36	1.39	1.42	1.44	1.47

Average = Sum(40)$_{1…12}$ /12= 1.43 (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 2.13 (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 84.73 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	93.2	89.82	86.43	83.04	79.65	76.26	76.26	79.65	83.04	86.43	89.82	93.2

Total = Sum(44)$_{1…12}$ = 1016.78 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	138.22	120.89	124.75	108.76	104.35	90.05	83.44	95.75	96.9	112.92	123.27	133.86

Total = Sum(45)$_{1…12}$ = 1333.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.73	18.13	18.71	16.31	15.65	13.51	12.52	14.36	14.53	16.94	18.49	20.08

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.12	26.29	29.08	28.13	29.05	28.09	29.02	29.04	28.11	29.07	28.16	29.11	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97	

Output from water heater (annual)$_{1...12}$ 1675.41 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.24	46.77	48.75	43.19	41.96	36.96	35	39.1	39.25	44.81	48.02	51.79	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	16.63	14.77	12.01	9.09	6.8	5.74	6.2	8.06	10.82	13.74	16.03	17.09	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	186.16	188.09	183.23	172.86	159.78	147.49	139.27	137.34	142.21	152.57	165.65	177.95	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	(71)
Water heating gains (Table 5)													
(72)m=	71.56	69.59	65.52	59.99	56.4	51.34	47.04	52.55	54.51	60.23	66.7	69.6	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	332.26	330.37	318.68	299.86	280.89	262.48	250.43	255.86	265.45	284.46	306.3	322.56	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	13.88	x	19.64	x	0.63	x	0.7	=	83.31	(80)
West	0.9x	0.77	x	13.88	x	38.42	x	0.63	x	0.7	=	162.98	(80)
West	0.9x	0.77	x	13.88	x	63.27	x	0.63	x	0.7	=	268.4	(80)
West	0.9x	0.77	x	13.88	x	92.28	x	0.63	x	0.7	=	391.44	(80)
West	0.9x	0.77	x	13.88	x	113.09	x	0.63	x	0.7	=	479.73	(80)

West	0.9x	0.77	x	13.88	x	115.77	x	0.63	x	0.7	=	491.09	(80)
West	0.9x	0.77	x	13.88	x	110.22	x	0.63	x	0.7	=	467.54	(80)
West	0.9x	0.77	x	13.88	x	94.68	x	0.63	x	0.7	=	401.61	(80)
West	0.9x	0.77	x	13.88	x	73.59	x	0.63	x	0.7	=	312.16	(80)
West	0.9x	0.77	x	13.88	x	45.59	x	0.63	x	0.7	=	193.39	(80)
West	0.9x	0.77	x	13.88	x	24.49	x	0.63	x	0.7	=	103.88	(80)
West	0.9x	0.77	x	13.88	x	16.15	x	0.63	x	0.7	=	68.51	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.31	162.98	268.4	391.44	479.73	491.09	467.54	401.61	312.16	193.39	103.88	68.51	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	415.57	493.35	587.07	691.3	760.62	753.57	717.97	657.47	577.61	477.84	410.18	391.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.69	0.53	0.59	0.84	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	19.53	19.87	20.35	20.71	20.93	20.98	20.97	20.81	20.32	19.77	19.34	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.68	19.69	19.7	19.74	19.75	19.79	19.79	19.8	19.77	19.75	19.73	19.71	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.8	0.58	0.39	0.45	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.18	18.39	18.73	19.23	19.56	19.76	19.78	19.79	19.67	19.22	18.66	18.22	(90)

fLA = Living area ÷ (4) = 0.41 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.66	18.86	19.21	19.7	20.04	20.24	20.28	20.28	20.14	19.67	19.12	18.69	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.51	18.71	19.06	19.55	19.89	20.09	20.13	20.13	19.99	19.52	18.97	18.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.81	0.61	0.43	0.49	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	413.48	488.25	571.69	638.29	615.5	461.64	310.53	322.62	450.26	457.23	406.36	389.56	(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=	1406.64	1355.5	1222	994.66	759.19	490.55	315.39	330.76	534.11	827.14	1118.15	1372.57	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	738.91	582.79	483.83	256.59	106.91	0	0	0	0	275.21	512.49	731.36	(98)

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3688.09	(98)
Space heating requirement in kWh/m²/year	56.45	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		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)	738.91	582.79	483.83	256.59	106.91	0	0	0	0	275.21	512.49	731.36		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	814.67	642.55	533.44	282.9	117.87	0	0	0	0	303.43	565.04	806.35		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													4066.25	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97		
Efficiency of water heater													87	(216)
(217)m=	89.99	89.93	89.78	89.38	88.61	87	87	87	87	89.41	89.83	90		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	185.94	163.66	171.34	153.15	150.55	135.8	129.27	143.44	143.69	158.82	168.57	181.07		
Total = Sum(219a)$_{1...12}$ =													1885.29	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4066.25	
Water heating fuel used			1885.29	
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			293.68	(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	=	878.31	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	407.22	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1285.53	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	152.42	(268)
Total CO2, kg/year		sum of (265)…(271) =		1476.88	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		22.61	(273)
EI rating (section 14)				82	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 5 PL1B

Address : Flat 5, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	51.39	(1a)	x	2.8	(2a)	=	143.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.39	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			143.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.89	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.69	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.88	0.86	0.84	0.76	0.74	0.65	0.65	0.64	0.69	0.74	0.78	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows			9.25	x1/[1/(1.4)+ 0.04]		=	12.26			(27)
Walls Type1	16.97	9.25	7.72	x	0.3	=	2.32			(29)
Walls Type2	40.71	2.12	38.59	x	0.18	=	7.11			(29)
Total area of elements, m²			57.68							(31)
Party wall			23.74	x	0	=	0			(32)
Party floor			51.39							(32a)
Party ceiling			51.39							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.08 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4072.1 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 33.73 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.06	41.35	40.65	37.38	36.77	33.91	33.91	33.39	35.01	36.77	38.01	39.3	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	75.79	75.08	74.38	71.11	70.5	67.64	67.64	67.12	68.74	70.5	71.74	73.03	

Average = Sum(39)$_{1…12}$ /12= 71.11 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.47	1.46	1.45	1.38	1.37	1.32	1.32	1.31	1.34	1.37	1.4	1.42

Average = Sum(40)$_{1…12}$ /12= 1.38 (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 1.73 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.84	79.83	76.82	73.81	70.79	67.78	67.78	70.79	73.81	76.82	79.83	82.84

Total = Sum(44)$_{1…12}$ = 903.76 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.86	107.45	110.88	96.67	92.75	80.04	74.17	85.11	86.13	100.37	109.56	118.98

Total = Sum(45)$_{1…12}$ = 1184.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.43	16.12	16.63	14.5	13.91	12.01	11.13	12.77	12.92	15.06	16.43	17.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.08	26.25	29.05	28.1	29.02	28.07	29	29.01	28.09	29.04	28.12	29.07	(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=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	

Output from water heater (annual) $_{1...12}$ 1526.86 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	48.12	42.29	44.13	39.17	38.1	33.63	31.91	35.55	35.66	40.63	43.46	46.83	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.74	12.2	9.92	7.51	5.61	4.74	5.12	6.66	8.94	11.35	13.24	14.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	150.84	152.41	148.46	140.07	129.47	119.5	112.85	111.28	115.23	123.62	134.23	144.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(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=	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	(71)

Water heating gains (Table 5)

(72)m=	64.68	62.93	59.31	54.4	51.2	46.71	42.89	47.79	49.53	54.61	60.36	62.94	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	281.22	279.51	269.67	253.94	238.25	222.92	212.83	217.69	225.65	241.55	259.79	273.21	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.25	x	10.63	x	0.63	x	0.7	=	30.06	(74)
North	0.9x	0.77	x	9.25	x	20.32	x	0.63	x	0.7	=	57.45	(74)
North	0.9x	0.77	x	9.25	x	34.53	x	0.63	x	0.7	=	97.61	(74)
North	0.9x	0.77	x	9.25	x	55.46	x	0.63	x	0.7	=	156.79	(74)
North	0.9x	0.77	x	9.25	x	74.72	x	0.63	x	0.7	=	211.22	(74)

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North	0.9x	0.77	x	9.25	x	79.99	x	0.63	x	0.7	=	226.11	(74)
North	0.9x	0.77	x	9.25	x	74.68	x	0.63	x	0.7	=	211.1	(74)
North	0.9x	0.77	x	9.25	x	59.25	x	0.63	x	0.7	=	167.48	(74)
North	0.9x	0.77	x	9.25	x	41.52	x	0.63	x	0.7	=	117.36	(74)
North	0.9x	0.77	x	9.25	x	24.19	x	0.63	x	0.7	=	68.38	(74)
North	0.9x	0.77	x	9.25	x	13.12	x	0.63	x	0.7	=	37.08	(74)
North	0.9x	0.77	x	9.25	x	8.86	x	0.63	x	0.7	=	25.06	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	30.06	57.45	97.61	156.79	211.22	226.11	211.1	167.48	117.36	68.38	37.08	25.06	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	311.28	336.95	367.28	410.73	449.47	449.03	423.93	385.18	343.02	309.93	296.88	298.27	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.93	0.8	0.65	0.72	0.92	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.35	19.49	19.76	20.2	20.58	20.87	20.96	20.94	20.72	20.25	19.77	19.38	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.71	19.72	19.73	19.78	19.79	19.83	19.83	19.84	19.81	19.79	19.77	19.75	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.9	0.71	0.5	0.57	0.87	0.98	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.23	18.37	18.65	19.12	19.49	19.77	19.82	19.82	19.64	19.18	18.69	18.29	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.77	18.92	19.19	19.64	20.02	20.3	20.37	20.37	20.17	19.7	19.22	18.82	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.62	18.77	19.04	19.49	19.87	20.15	20.22	20.22	20.02	19.55	19.07	18.67	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.9	0.74	0.56	0.63	0.88	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	310.02	334.88	362.8	396.8	404.19	331.89	236.03	241.11	301.53	302.74	294.89	297.29	(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=	1085.65	1041.07	932.9	753.19	576.1	375.67	245.19	256.09	406.74	630.94	858.56	1056.74	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	577.07	474.56	424.15	256.6	127.9	0	0	0	0	244.18	405.84	565.03	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3075.35	(98)
Space heating requirement in kWh/m²/year	59.84	(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)	577.07	474.56	424.15	256.6	127.9	0	0	0	0	244.18	405.84	565.03		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	636.24	523.22	467.64	282.91	141.02	0	0	0	0	269.22	447.46	622.97		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3390.68	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05		
Efficiency of water heater													87	(216)
(217)m=	89.9	89.86	89.75	89.46	88.86	87	87	87	87	89.38	89.73	89.91		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	168.99	148.79	155.91	139.47	137.05	124.27	118.58	131.18	131.28	144.78	153.44	164.67		
Total = Sum(219a)$_{1...12}$ =													1718.4	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3390.68	
Water heating fuel used			1718.4	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			242.56	(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	=	732.39	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	371.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1103.56	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	125.89	(268)
Total CO_2, kg/year		sum of (265)…(271) =		1268.38	(272)
Dwelling CO_2 Emission Rate		(272) ÷ (4) =		24.68	(273)
EI rating (section 14)				82	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 6 PL1B

Address : Flat 6, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	55.75	(1a) x	2.8	(2a) =	156.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.75	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		156.1	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.88	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.68	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.87	0.85	0.83	0.75	0.73	0.65	0.65	0.63	0.68	0.73	0.77	0.8

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(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			2.12	x	1.6	=	3.392			(26)
Windows			9.25	x1/[1/(1.4)+ 0.04]		=	12.26			(27)
Walls Type1	16.91	9.25	7.66	x	0.3	=	2.3			(29)
Walls Type2	19.01	2.12	16.89	x	0.18	=	3.11			(29)
Total area of elements, m²			35.92							(31)
Party wall			49.59	x	0	=	0			(32)
Party floor			55.75							(32a)
Party ceiling			55.75							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.06 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.39 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 26.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.15	44.4	43.66	40.19	39.54	36.52	36.52	35.96	37.69	39.54	40.85	42.23	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.6	70.85	70.11	66.64	65.99	62.97	62.97	62.41	64.14	65.99	67.31	68.68	

Average = Sum(39)$_{1…12}$ /12= 66.64 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.28	1.27	1.26	1.2	1.18	1.13	1.13	1.12	1.15	1.18	1.21	1.23

Average = Sum(40)$_{1...12}$ /12= 1.2 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.86 (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 78.36 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	86.19	83.06	79.93	76.79	73.66	70.52	70.52	73.66	76.79	79.93	83.06	86.19

Total = Sum(44)$_{1...12}$ = 940.3 (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=	127.82	111.8	115.36	100.58	96.51	83.28	77.17	88.55	89.61	104.43	113.99	123.79

Total = Sum(45)$_{1...12}$ = 1232.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.17	16.77	17.3	15.09	14.48	12.49	11.58	13.28	13.44	15.66	17.1	18.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.09	26.26	29.06	28.11	29.03	28.08	29	29.02	28.09	29.05	28.13	29.08	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	

Output from water heater (annual)$_{1\ldots12}$ 1574.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	49.77	43.74	45.62	40.47	39.35	34.71	32.91	36.7	36.82	41.99	44.94	48.43	(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=	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.97	13.3	10.82	8.19	6.12	5.17	5.58	7.26	9.74	12.37	14.44	15.39	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	162.12	163.8	159.56	150.53	139.14	128.44	121.28	119.6	123.84	132.86	144.26	154.96	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	(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=	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	(71)

Water heating gains (Table 5)

(72)m=	66.9	65.09	61.32	56.21	52.88	48.21	44.23	49.33	51.14	56.43	62.41	65.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	297.88	296.07	285.59	268.82	252.04	235.7	224.99	230.07	238.61	255.55	274.99	289.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.25	x	10.63	x	0.63	x	0.7	=	30.06	(74)
North	0.9x	0.77	x	9.25	x	20.32	x	0.63	x	0.7	=	57.45	(74)
North	0.9x	0.77	x	9.25	x	34.53	x	0.63	x	0.7	=	97.61	(74)
North	0.9x	0.77	x	9.25	x	55.46	x	0.63	x	0.7	=	156.79	(74)
North	0.9x	0.77	x	9.25	x	74.72	x	0.63	x	0.7	=	211.22	(74)

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North	0.9x	0.77	x	9.25	x	79.99	x	0.63	x	0.7	=	226.11	(74)
North	0.9x	0.77	x	9.25	x	74.68	x	0.63	x	0.7	=	211.1	(74)
North	0.9x	0.77	x	9.25	x	59.25	x	0.63	x	0.7	=	167.48	(74)
North	0.9x	0.77	x	9.25	x	41.52	x	0.63	x	0.7	=	117.36	(74)
North	0.9x	0.77	x	9.25	x	24.19	x	0.63	x	0.7	=	68.38	(74)
North	0.9x	0.77	x	9.25	x	13.12	x	0.63	x	0.7	=	37.08	(74)
North	0.9x	0.77	x	9.25	x	8.86	x	0.63	x	0.7	=	25.06	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	30.06	57.45	97.61	156.79	211.22	226.11	211.1	167.48	117.36	68.38	37.08	25.06	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	327.94	353.52	383.2	425.61	463.25	461.81	436.09	397.56	355.97	323.94	312.08	314.4	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.92	0.77	0.61	0.68	0.91	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.57	19.7	19.95	20.35	20.69	20.92	20.98	20.97	20.8	20.39	19.96	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.85	19.86	19.87	19.92	19.93	19.98	19.98	19.98	19.96	19.93	19.91	19.89	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.89	0.69	0.48	0.55	0.86	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.56	18.7	18.95	19.39	19.71	19.94	19.97	19.98	19.84	19.43	18.99	18.63	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.03	19.17	19.42	19.84	20.17	20.4	20.45	20.44	20.29	19.88	19.45	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.88	19.02	19.27	19.69	20.02	20.25	20.3	20.29	20.14	19.73	19.3	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.89	0.71	0.52	0.59	0.87	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	326.85	351.69	379.04	411.46	413.68	328.68	228.19	235	308.69	316.64	310.27	313.56	(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=	1044.22	1000.16	895.26	718.85	549.1	355.84	232.7	242.92	387.38	602.49	820.87	1011.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	533.73	435.77	384.07	221.32	100.75	0	0	0	0	212.67	367.63	519.63	(98)

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2775.58	(98)
Space heating requirement in kWh/m²/year	49.79	(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)	533.73	435.77	384.07	221.32	100.75	0	0	0	0	212.67	367.63	519.63		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	588.45	480.46	423.45	244.02	111.09	0	0	0	0	234.48	405.33	572.91		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3060.17	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87		
Efficiency of water heater													87	(216)
(217)m=	89.83	89.78	89.66	89.3	88.61	87	87	87	87	89.24	89.64	89.83		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	174.67	153.77	161.08	144.09	141.67	127.99	122.04	135.14	135.29	149.58	158.56	170.18		
Total = Sum(219a)$_{1...12}$ =													1774.06	(219)

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			3060.17	
Water heating fuel used			1774.06	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			264.43	(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	=	661	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	383.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1044.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	137.24	(268)
Total CO2, kg/year		sum of (265)…(271) =		1220.36	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		21.89	(273)
EI rating (section 14)				84	(274)

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User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 7 PL1B

Address : Flat 7, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	55.75	(1a) x	2.8	(2a) =	156.1	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.75	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	156.1	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.88	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.68	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.87	0.85	0.83	0.75	0.73	0.65	0.65	0.63	0.68	0.73	0.77	0.8

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(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			2.12	x	1.6	=	3.392			(26)
Windows			9.25	x1/[1/(1.4)+ 0.04]		=	12.26			(27)
Walls Type1	16.91	9.25	7.66	x	0.3	=	2.3			(29)
Walls Type2	19.01	2.12	16.89	x	0.18	=	3.11			(29)
Total area of elements, m²			35.92							(31)
Party wall			49.59	x	0	=	0			(32)
Party floor			55.75							(32a)
Party ceiling			55.75							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.06 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.39 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 26.45 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.15	44.4	43.66	40.19	39.54	36.52	36.52	35.96	37.69	39.54	40.85	42.23	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	71.6	70.85	70.11	66.64	65.99	62.97	62.97	62.41	64.14	65.99	67.31	68.68	

Average = Sum(39)$_{1…12}$ /12= 66.64 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.28	1.27	1.26	1.2	1.18	1.13	1.13	1.12	1.15	1.18	1.21	1.23

Average = Sum(40)$_{1…12}$ /12= 1.2 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.86 (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 78.36 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	86.19	83.06	79.93	76.79	73.66	70.52	70.52	73.66	76.79	79.93	83.06	86.19

Total = Sum(44)$_{1…12}$ = 940.3 (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=	127.82	111.8	115.36	100.58	96.51	83.28	77.17	88.55	89.61	104.43	113.99	123.79

Total = Sum(45)$_{1…12}$ = 1232.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.17	16.77	17.3	15.09	14.48	12.49	11.58	13.28	13.44	15.66	17.1	18.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (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)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.09	26.26	29.06	28.11	29.03	28.08	29	29.02	28.09	29.05	28.13	29.08	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	

Output from water heater (annual)1…12 1574.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	49.77	43.74	45.62	40.47	39.35	34.71	32.91	36.7	36.82	41.99	44.94	48.43	(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=	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.97	13.3	10.82	8.19	6.12	5.17	5.58	7.26	9.74	12.37	14.44	15.39	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	162.12	163.8	159.56	150.53	139.14	128.44	121.28	119.6	123.84	132.86	144.26	154.96	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	(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=	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	(71)
Water heating gains (Table 5)													
(72)m=	66.9	65.09	61.32	56.21	52.88	48.21	44.23	49.33	51.14	56.43	62.41	65.1	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	297.88	296.07	285.59	268.82	252.04	235.7	224.99	230.07	238.61	255.55	274.99	289.34	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.25	x	10.63	x	0.63	x	0.7	=	30.06	(74)
North	0.9x	0.77	x	9.25	x	20.32	x	0.63	x	0.7	=	57.45	(74)
North	0.9x	0.77	x	9.25	x	34.53	x	0.63	x	0.7	=	97.61	(74)
North	0.9x	0.77	x	9.25	x	55.46	x	0.63	x	0.7	=	156.79	(74)
North	0.9x	0.77	x	9.25	x	74.72	x	0.63	x	0.7	=	211.22	(74)

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North	0.9x	0.77	x	9.25	x	79.99	x	0.63	x	0.7	=	226.11	(74)
North	0.9x	0.77	x	9.25	x	74.68	x	0.63	x	0.7	=	211.1	(74)
North	0.9x	0.77	x	9.25	x	59.25	x	0.63	x	0.7	=	167.48	(74)
North	0.9x	0.77	x	9.25	x	41.52	x	0.63	x	0.7	=	117.36	(74)
North	0.9x	0.77	x	9.25	x	24.19	x	0.63	x	0.7	=	68.38	(74)
North	0.9x	0.77	x	9.25	x	13.12	x	0.63	x	0.7	=	37.08	(74)
North	0.9x	0.77	x	9.25	x	8.86	x	0.63	x	0.7	=	25.06	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	30.06	57.45	97.61	156.79	211.22	226.11	211.1	167.48	117.36	68.38	37.08	25.06	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	327.94	353.52	383.2	425.61	463.25	461.81	436.09	397.56	355.97	323.94	312.08	314.4	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.92	0.77	0.61	0.68	0.91	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.57	19.7	19.95	20.35	20.69	20.92	20.98	20.97	20.8	20.39	19.96	19.61	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.85	19.86	19.87	19.92	19.93	19.98	19.98	19.98	19.96	19.93	19.91	19.89	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.89	0.69	0.48	0.55	0.86	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.56	18.7	18.95	19.39	19.71	19.94	19.97	19.98	19.84	19.43	18.99	18.63	(90)

fLA = Living area ÷ (4) = | 0.47 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.03	19.17	19.42	19.84	20.17	20.4	20.45	20.44	20.29	19.88	19.45	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.88	19.02	19.27	19.69	20.02	20.25	20.3	20.29	20.14	19.73	19.3	18.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.89	0.71	0.52	0.59	0.87	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	326.85	351.69	379.04	411.46	413.68	328.68	228.19	235	308.69	316.64	310.27	313.56	(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=	1044.22	1000.16	895.26	718.85	549.1	355.84	232.7	242.92	387.38	602.49	820.87	1011.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	533.73	435.77	384.07	221.32	100.75	0	0	0	0	212.67	367.63	519.63	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2775.58	(98)
Space heating requirement in kWh/m²/year	49.79	(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)	533.73	435.77	384.07	221.32	100.75	0	0	0	0	212.67	367.63	519.63		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	588.45	480.46	423.45	244.02	111.09	0	0	0	0	234.48	405.33	572.91		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3060.17	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87		
Efficiency of water heater													87	(216)
(217)m=	89.83	89.78	89.66	89.3	88.61	87	87	87	87	89.24	89.64	89.83		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	174.67	153.77	161.08	144.09	141.67	127.99	122.04	135.14	135.29	149.58	158.56	170.18		
Total = Sum(219a)$_{1...12}$ =													1774.06	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3060.17	
Water heating fuel used			1774.06	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			264.43	(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	=	661	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	383.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1044.2	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	137.24	(268)
Total CO2, kg/year		sum of (265)…(271) =		1220.36	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		21.89	(273)
EI rating (section 14)				84	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 8 PL1B

Address : Flat 8, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	51.39	(1a) x	2.8	(2a) =	143.89	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	143.89	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.89	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.69	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.88	0.86	0.84	0.76	0.74	0.65	0.65	0.64	0.69	0.74	0.78	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows			9.25	x1/[1/(1.4)+ 0.04]		=	12.26			(27)
Walls Type1	16.97	9.25	7.72	x	0.3	=	2.32			(29)
Walls Type2	11.48	2.12	9.36	x	0.18	=	1.72			(29)
Total area of elements, m²			28.45							(31)
Party wall			52.98	x	0	=	0			(32)
Party floor			51.39							(32a)
Party ceiling			51.39							(32b)

** 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) = 19.7 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3597.3 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 23.96 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.06	41.35	40.65	37.38	36.77	33.91	33.91	33.39	35.01	36.77	38.01	39.3	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.03	65.31	64.62	61.34	60.73	57.88	57.88	57.35	58.97	60.73	61.97	63.26	

Average = Sum(39)$_{1…12}$ /12= 61.34 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.28	1.27	1.26	1.19	1.18	1.13	1.13	1.12	1.15	1.18	1.21	1.23

Average = Sum(40)$_{1…12}$ /12= 1.19 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.73 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	82.84	79.83	76.82	73.81	70.79	67.78	67.78	70.79	73.81	76.82	79.83	82.84

Total = Sum(44)$_{1…12}$ = 903.76 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.86	107.45	110.88	96.67	92.75	80.04	74.17	85.11	86.13	100.37	109.56	118.98

Total = Sum(45)$_{1…12}$ = 1184.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.43	16.12	16.63	14.5	13.91	12.01	11.13	12.77	12.92	15.06	16.43	17.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.08	26.25	29.05	28.1	29.02	28.07	29	29.01	28.09	29.04	28.12	29.07	(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=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	

Output from water heater (annual)$_{1...12}$ 1526.86 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	48.12	42.29	44.13	39.17	38.1	33.63	31.91	35.55	35.66	40.63	43.46	46.83	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.74	12.2	9.92	7.51	5.61	4.74	5.12	6.66	8.94	11.35	13.24	14.12	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	150.84	152.41	148.46	140.07	129.47	119.5	112.85	111.28	115.23	123.62	134.23	144.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(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=	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	(71)

Water heating gains (Table 5)

(72)m=	64.68	62.93	59.31	54.4	51.2	46.71	42.89	47.79	49.53	54.61	60.36	62.94	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	281.22	279.51	269.67	253.94	238.25	222.92	212.83	217.69	225.65	241.55	259.79	273.21	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	9.25	x	10.63	x	0.63	x	0.7	=	30.06	(74)
North	0.9x	0.77	x	9.25	x	20.32	x	0.63	x	0.7	=	57.45	(74)
North	0.9x	0.77	x	9.25	x	34.53	x	0.63	x	0.7	=	97.61	(74)
North	0.9x	0.77	x	9.25	x	55.46	x	0.63	x	0.7	=	156.79	(74)
North	0.9x	0.77	x	9.25	x	74.72	x	0.63	x	0.7	=	211.22	(74)

North	0.9x	0.77	x	9.25	x	79.99	x	0.63	x	0.7	=	226.11	(74)
North	0.9x	0.77	x	9.25	x	74.68	x	0.63	x	0.7	=	211.1	(74)
North	0.9x	0.77	x	9.25	x	59.25	x	0.63	x	0.7	=	167.48	(74)
North	0.9x	0.77	x	9.25	x	41.52	x	0.63	x	0.7	=	117.36	(74)
North	0.9x	0.77	x	9.25	x	24.19	x	0.63	x	0.7	=	68.38	(74)
North	0.9x	0.77	x	9.25	x	13.12	x	0.63	x	0.7	=	37.08	(74)
North	0.9x	0.77	x	9.25	x	8.86	x	0.63	x	0.7	=	25.06	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	30.06	57.45	97.61	156.79	211.22	226.11	211.1	167.48	117.36	68.38	37.08	25.06	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	311.28	336.95	367.28	410.73	449.47	449.03	423.93	385.18	343.02	309.93	296.88	298.27	(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	0.91	0.75	0.58	0.65	0.9	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.72	19.97	20.38	20.72	20.94	20.99	20.98	20.82	20.41	19.98	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.85	19.86	19.87	19.93	19.93	19.98	19.98	19.99	19.96	19.93	19.92	19.9	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.87	0.66	0.46	0.52	0.84	0.98	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.57	18.72	18.98	19.42	19.74	19.95	19.98	19.98	19.86	19.45	19.01	18.64	(90)

fLA = Living area ÷ (4) = 0.49 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.07	19.2	19.46	19.88	20.21	20.43	20.47	20.46	20.32	19.92	19.48	19.12	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.92	19.05	19.31	19.73	20.06	20.28	20.32	20.31	20.17	19.77	19.33	18.97	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.96	0.88	0.69	0.5	0.57	0.85	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	310.12	334.97	362.69	394.8	394.42	307.66	211.74	218.45	292.18	301.97	294.93	297.38	(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=	965.09	924.45	827.83	664.62	507.94	328.66	215.1	224.48	358.18	556.72	757.96	934.34	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	487.29	396.13	346.07	194.27	84.46	0	0	0	0	189.53	333.38	473.9	(98)

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2505.03	(98)
Space heating requirement in kWh/m²/year	48.75	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		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)	487.29	396.13	346.07	194.27	84.46	0	0	0	0	189.53	333.38	473.9		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	537.26	436.75	381.55	214.19	93.12	0	0	0	0	208.96	367.56	522.49		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2761.88	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05		
Efficiency of water heater													87	(216)
(217)m=	89.79	89.74	89.6	89.22	88.48	87	87	87	87	89.16	89.59	89.79		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	169.2	148.99	156.17	139.84	137.63	124.27	118.58	131.18	131.28	145.14	153.69	164.88		
Total = Sum(219a)$_{1...12}$ =													1720.86	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2761.88	
Water heating fuel used			1720.86	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			242.56	(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	=	596.57	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	371.71	(264)
Space and water heating	(261) + (262) + (263) + (264) =			968.27	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	125.89	(268)
Total CO2, kg/year		sum of (265)…(271) =		1133.09	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		22.05	(273)
EI rating (section 14)				84	(274)

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User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 9 PL1B

Address : Flat 9, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	58.52	(1a)	x	2.8	(2a)	=	163.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.52	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			163.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.68	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(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

0.86	0.84	0.83	0.74	0.73	0.64	0.64	0.63	0.68	0.73	0.76	0.79

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.87	0.86	0.84	0.78	0.76	0.71	0.71	0.7	0.73	0.76	0.79	0.82	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.87	0.86	0.84	0.78	0.76	0.71	0.71	0.7	0.73	0.76	0.79	0.82	(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			2.12	x	1.6	=	3.392			(26)
Windows Type 1			9.25	x1/[1/(1.4)+ 0.04]		=	12.26			(27)
Windows Type 2			4.63	x1/[1/(1.4)+ 0.04]		=	6.14			(27)
Windows Type 3			4.63	x1/[1/(1.4)+ 0.04]		=	6.14			(27)
Walls Type1	39.81	18.51	21.3	x	0.3	=	6.39			(29)
Walls Type2	3.39	2.12	1.27	x	0.18	=	0.23			(29)
Total area of elements, m²			43.2							(31)
Party wall			54.29	x	0	=	0			(32)
Party floor			58.52							(32a)
Party ceiling			58.52							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.56 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.48 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.04 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	47.11	46.33	45.57	41.98	41.31	38.18	38.18	37.6	39.39	41.31	42.67	44.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.15	87.37	86.6	83.01	82.34	79.22	79.22	78.64	80.42	82.34	83.7	85.12	

Average = $Sum(39)_{1...12}$ /12= 83.01 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.51	1.49	1.48	1.42	1.41	1.35	1.35	1.34	1.37	1.41	1.43	1.45	

Average = $Sum(40)_{1...12}$ /12= 1.42 (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 1.94 (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 80.26 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	88.29	85.08	81.87	78.66	75.45	72.24	72.24	75.45	78.66	81.87	85.08	88.29

Total = $Sum(44)_{1...12}$ = 963.16 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	130.93	114.51	118.17	103.02	98.85	85.3	79.04	90.7	91.79	106.97	116.76	126.8

Total = $Sum(45)_{1...12}$ = 1262.85 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.64	17.18	17.73	15.45	14.83	12.8	11.86	13.61	13.77	16.05	17.51	19.02	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.1	26.27	29.07	28.11	29.03	28.08	29.01	29.03	28.1	29.05	28.14	29.09	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89	(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=	160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89

Output from water heater (annual)$_{1...12}$ | 1604.93 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	50.81	44.64	46.56	41.28	40.13	35.38	33.53	37.42	37.54	42.83	45.86	49.43	(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=	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.08	13.4	10.9	8.25	6.17	5.21	5.62	7.31	9.81	12.46	14.54	15.5	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	169.2	170.96	166.53	157.11	145.22	134.05	126.58	124.83	129.25	138.67	150.56	161.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	(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=	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	(71)

Water heating gains (Table 5)

(72)m=	68.29	66.43	62.58	57.34	53.93	49.14	45.07	50.29	52.14	57.57	63.69	66.44	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	307.67	305.88	295.1	277.79	260.41	243.49	232.37	237.52	246.3	263.79	283.89	298.77	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.63	x	10.63	x	0.63	x	0.7	=	15.05	(74)
North	0.9x	0.77	x	4.63	x	20.32	x	0.63	x	0.7	=	28.75	(74)

North	0.9x	0.77	x	4.63	x	34.53	x	0.63	x	0.7	=	48.86	(74)
North	0.9x	0.77	x	4.63	x	55.46	x	0.63	x	0.7	=	78.48	(74)
North	0.9x	0.77	x	4.63	x	74.72	x	0.63	x	0.7	=	105.72	(74)
North	0.9x	0.77	x	4.63	x	79.99	x	0.63	x	0.7	=	113.18	(74)
North	0.9x	0.77	x	4.63	x	74.68	x	0.63	x	0.7	=	105.67	(74)
North	0.9x	0.77	x	4.63	x	59.25	x	0.63	x	0.7	=	83.83	(74)
North	0.9x	0.77	x	4.63	x	41.52	x	0.63	x	0.7	=	58.75	(74)
North	0.9x	0.77	x	4.63	x	24.19	x	0.63	x	0.7	=	34.23	(74)
North	0.9x	0.77	x	4.63	x	13.12	x	0.63	x	0.7	=	18.56	(74)
North	0.9x	0.77	x	4.63	x	8.86	x	0.63	x	0.7	=	12.54	(74)
Northeast	0.9x	0.77	x	4.63	x	11.28	x	0.63	x	0.7	=	15.97	(75)
Northeast	0.9x	0.77	x	4.63	x	22.97	x	0.63	x	0.7	=	32.5	(75)
Northeast	0.9x	0.77	x	4.63	x	41.38	x	0.63	x	0.7	=	58.55	(75)
Northeast	0.9x	0.77	x	4.63	x	67.96	x	0.63	x	0.7	=	96.16	(75)
Northeast	0.9x	0.77	x	4.63	x	91.35	x	0.63	x	0.7	=	129.25	(75)
Northeast	0.9x	0.77	x	4.63	x	97.38	x	0.63	x	0.7	=	137.8	(75)
Northeast	0.9x	0.77	x	4.63	x	91.1	x	0.63	x	0.7	=	128.91	(75)
Northeast	0.9x	0.77	x	4.63	x	72.63	x	0.63	x	0.7	=	102.77	(75)
Northeast	0.9x	0.77	x	4.63	x	50.42	x	0.63	x	0.7	=	71.34	(75)
Northeast	0.9x	0.77	x	4.63	x	28.07	x	0.63	x	0.7	=	39.71	(75)
Northeast	0.9x	0.77	x	4.63	x	14.2	x	0.63	x	0.7	=	20.09	(75)
Northeast	0.9x	0.77	x	4.63	x	9.21	x	0.63	x	0.7	=	13.04	(75)
East	0.9x	0.77	x	9.25	x	19.64	x	0.63	x	0.7	=	55.52	(76)
East	0.9x	0.77	x	9.25	x	38.42	x	0.63	x	0.7	=	108.61	(76)
East	0.9x	0.77	x	9.25	x	63.27	x	0.63	x	0.7	=	178.87	(76)
East	0.9x	0.77	x	9.25	x	92.28	x	0.63	x	0.7	=	260.87	(76)
East	0.9x	0.77	x	9.25	x	113.09	x	0.63	x	0.7	=	319.7	(76)
East	0.9x	0.77	x	9.25	x	115.77	x	0.63	x	0.7	=	327.27	(76)
East	0.9x	0.77	x	9.25	x	110.22	x	0.63	x	0.7	=	311.58	(76)
East	0.9x	0.77	x	9.25	x	94.68	x	0.63	x	0.7	=	267.64	(76)
East	0.9x	0.77	x	9.25	x	73.59	x	0.63	x	0.7	=	208.03	(76)
East	0.9x	0.77	x	9.25	x	45.59	x	0.63	x	0.7	=	128.88	(76)
East	0.9x	0.77	x	9.25	x	24.49	x	0.63	x	0.7	=	69.23	(76)
East	0.9x	0.77	x	9.25	x	16.15	x	0.63	x	0.7	=	45.66	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	86.53	169.86	286.28	435.51	554.68	578.25	546.15	454.24	338.12	202.82	107.88	71.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	394.2	475.74	581.37	713.3	815.09	821.74	778.52	691.76	584.42	466.61	391.77	370.01	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(86)m=	1	0.99	0.98	0.92	0.78	0.59	0.44	0.51	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.37	19.59	19.96	20.47	20.81	20.96	20.99	20.98	20.86	20.38	19.82	19.39	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.68	19.69	19.7	19.75	19.76	19.8	19.8	19.81	19.78	19.76	19.74	19.72	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.89	0.72	0.49	0.32	0.38	0.7	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.23	18.45	18.82	19.34	19.64	19.78	19.8	19.8	19.71	19.28	18.72	18.27	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.78	19	19.37	19.88	20.2	20.35	20.37	20.37	20.26	19.81	19.25	18.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.63	18.85	19.22	19.73	20.05	20.2	20.22	20.22	20.11	19.66	19.1	18.66	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.89	0.74	0.52	0.37	0.43	0.73	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	391.83	469.56	560.99	635.36	600.26	429.76	284.69	296.28	426.43	441.12	387.3	368.31	(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=	1263.19	1218.64	1101.61	899.36	687.66	443.64	286.89	300.5	483.58	745.83	1004.14	1230.77	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	648.29	503.38	402.23	190.08	65.03	0	0	0	0	226.7	444.12	641.67	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 3121.49 (98)

Space heating requirement in kWh/m²/year 53.34 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		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)													
	648.29	503.38	402.23	190.08	65.03	0	0	0	0	226.7	444.12	641.67	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	714.76	554.99	443.47	209.57	71.69	0	0	0	0	249.95	489.66	707.46	

Total (kWh/year) =$Sum(211)_{1...5,10....12}$= 3441.56 (211)

DER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89

Efficiency of water heater 87 (216)

(217)m=	89.94	89.86	89.68	89.15	88.21	87	87	87	87	89.28	89.76	89.95	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	177.92	156.66	164.18	147.09	144.97	130.33	124.2	137.62	137.8	152.36	161.43	173.3

Total = Sum(219a)$_{1...12}$ = 1807.86 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3441.56	
Water heating fuel used		1807.86	
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		266.39	(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	=	743.38	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	390.5	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1133.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	138.26	(268)
Total CO2, kg/year		sum of (265)…(271) =		1311.06	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		22.4	(273)
EI rating (section 14)				83	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 10 PL1B

Address : Flat 10, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.27	(1a) x	2.8	(2a) =	140.76	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.27	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	140.76	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.89	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.69	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.88	0.86	0.85	0.76	0.74	0.66	0.66	0.64	0.69	0.74	0.78	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.89	0.87	0.86	0.79	0.78	0.72	0.72	0.7	0.74	0.78	0.8	0.83	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.89	0.87	0.86	0.79	0.78	0.72	0.72	0.7	0.74	0.78	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows			9.25	x1/[1/(1.4)+ 0.04]		=	12.26			(27)
Walls Type1	16.86	9.25	7.61	x	0.3	=	2.28			(29)
Walls Type2	40.24	2.12	38.12	x	0.18	=	7.02			(29)
Total area of elements, m²			57.1							(31)
Party wall			23.38	x	0	=	0			(32)
Party floor			50.27							(32a)
Party ceiling			50.27							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 24.96 (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 8.57 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 33.52 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.27	40.57	39.88	36.66	36.05	33.24	33.24	32.72	34.33	36.05	37.27	38.55	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.79	74.09	73.41	70.18	69.58	66.77	66.77	66.25	67.85	69.58	70.8	72.07	

Average = Sum(39)$_{1…12}$ /12= 70.18 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.49	1.47	1.46	1.4	1.38	1.33	1.33	1.32	1.35	1.38	1.41	1.43

Average = Sum(40)$_{1…12}$ /12= 1.4 (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 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.53 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	81.98	79	76.02	73.04	70.06	67.08	67.08	70.06	73.04	76.02	79	81.98

Total = Sum(44)$_{1…12}$ = 894.34 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.58	106.33	109.72	95.66	91.79	79.21	73.4	84.22	85.23	99.33	108.42	117.74

Total = Sum(45)$_{1…12}$ = 1172.63 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.24	15.95	16.46	14.35	13.77	11.88	11.01	12.63	12.78	14.9	16.26	17.66	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (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)

DER WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.07	26.25	29.05	28.09	29.02	28.07	29	29.01	28.08	29.04	28.12	29.07	(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=	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81	(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=	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81	

Output from water heater (annual)$_{1...12}$ 1514.49 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	47.69	41.92	43.75	38.83	37.77	33.35	31.65	35.26	35.36	40.29	43.08	46.42	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.42	11.92	9.7	7.34	5.49	4.63	5.01	6.51	8.73	11.09	12.94	13.8	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.94	149.47	145.6	137.37	126.97	117.2	110.67	109.14	113.01	121.24	131.64	141.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	(71)

Water heating gains (Table 5)

(72)m=	64.1	62.38	58.8	53.93	50.77	46.32	42.54	47.39	49.11	54.15	59.83	62.39	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	276.93	275.24	265.57	250.11	234.7	219.63	209.69	214.5	222.32	237.95	255.88	269.06	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	9.25	x	19.64	x	0.63	x	0.7	=	55.52	(76)
East	0.9x	0.77	x	9.25	x	38.42	x	0.63	x	0.7	=	108.61	(76)
East	0.9x	0.77	x	9.25	x	63.27	x	0.63	x	0.7	=	178.87	(76)
East	0.9x	0.77	x	9.25	x	92.28	x	0.63	x	0.7	=	260.87	(76)
East	0.9x	0.77	x	9.25	x	113.09	x	0.63	x	0.7	=	319.7	(76)

East	0.9x	0.77	x	9.25	x	115.77	x	0.63	x	0.7	=	327.27	(76)
East	0.9x	0.77	x	9.25	x	110.22	x	0.63	x	0.7	=	311.58	(76)
East	0.9x	0.77	x	9.25	x	94.68	x	0.63	x	0.7	=	267.64	(76)
East	0.9x	0.77	x	9.25	x	73.59	x	0.63	x	0.7	=	208.03	(76)
East	0.9x	0.77	x	9.25	x	45.59	x	0.63	x	0.7	=	128.88	(76)
East	0.9x	0.77	x	9.25	x	24.49	x	0.63	x	0.7	=	69.23	(76)
East	0.9x	0.77	x	9.25	x	16.15	x	0.63	x	0.7	=	45.66	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	55.52	108.61	178.87	260.87	319.7	327.27	311.58	267.64	208.03	128.88	69.23	45.66	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	332.45	383.85	444.44	510.98	554.41	546.9	521.27	482.15	430.35	366.83	325.11	314.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.87	0.71	0.54	0.6	0.85	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.38	19.57	19.89	20.35	20.7	20.92	20.98	20.97	20.81	20.34	19.82	19.41	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.7	19.71	19.72	19.77	19.78	19.82	19.82	19.83	19.8	19.78	19.76	19.74	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.82	0.6	0.41	0.46	0.77	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.25	18.44	18.77	19.26	19.58	19.79	19.81	19.82	19.7	19.26	18.73	18.31	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.77	18.96	19.28	19.76	20.09	20.3	20.35	20.34	20.21	19.76	19.23	18.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.62	18.81	19.13	19.61	19.94	20.15	20.2	20.19	20.06	19.61	19.08	18.66	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.93	0.83	0.63	0.45	0.51	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	330.58	379.79	433.41	475.44	458.19	347.16	236.06	244.85	339.77	351.07	321.81	313.33	(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=	1070.96	1030.35	927.25	751.3	573.56	370.88	240.12	251.39	404.31	626.54	848.09	1042.01	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	550.84	437.17	367.42	198.62	85.84	0	0	0	0	204.95	378.92	542.14	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2765.9	(98)
Space heating requirement in kWh/m²/year	55.02	(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)	550.84	437.17	367.42	198.62	85.84	0	0	0	0	204.95	378.92	542.14		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	607.32	482	405.09	218.98	94.64	0	0	0	0	225.97	417.78	597.73		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3049.5	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81		
Efficiency of water heater													87	(216)
(217)m=	89.88	89.81	89.65	89.24	88.5	87	87	87	87	89.24	89.69	89.89		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	167.61	147.62	154.79	138.67	136.51	123.31	117.69	130.15	130.24	143.84	152.24	163.33		
Total = Sum(219a)$_{1...12}$ =													1706	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3049.5	
Water heating fuel used			1706	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			237.08	(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	=	658.69	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	368.5	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1027.19	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	123.04	(268)
Total CO2, kg/year		sum of (265)…(271) =		1189.16	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		23.66	(273)
EI rating (section 14)				83	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 11 PL1B

Address : Flat 11, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	62.02	(1a) x	2.6	(2a) =	161.25	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	62.02	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	161.25	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.68	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.86	0.85	0.83	0.75	0.73	0.64	0.64	0.63	0.68	0.73	0.76	0.8

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.87	0.86	0.84	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.87	0.86	0.84	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.79	0.82	(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			2.12	x	1.6	=	3.392			(26)
Windows			8.74	x1/[1/(1.4)+ 0.04]		=	11.59			(27)
Walls Type1	24.26	8.74	15.52	x	0.3	=	4.66			(29)
Walls Type2	25.82	2.12	23.7	x	0.18	=	4.36			(29)
Walls Type3	16.22	0	16.22	x	0.27	=	4.31			(29)
Roof	62.02	0	62.02	x	0.11	=	6.82			(30)
Total area of elements, m²			128.32							(31)
Party wall			17.78	x	0	=	0			(32)
Party floor			62.02							(32a)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	35.13	(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		19.25	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	54.38	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	46.45	45.68	44.93	41.38	40.71	37.62	37.62	37.05	38.81	40.71	42.06	43.46	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	100.83	100.06	99.31	95.76	95.09	92	92	91.43	93.19	95.09	96.44	97.84	

Average = Sum(39)$_{1…12}$ /12= 95.76 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.63	1.61	1.6	1.54	1.53	1.48	1.48	1.47	1.5	1.53	1.55	1.58

Average = Sum(40)$_{1…12}$ /12= 1.54 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.04 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 82.61 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	90.87	87.56	84.26	80.95	77.65	74.35	74.35	77.65	80.95	84.26	87.56	90.87

Total = Sum(44)$_{1…12}$ = 991.27 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	134.75	117.85	121.62	106.03	101.74	87.79	81.35	93.35	94.47	110.09	120.17	130.5

Total = Sum(45)$_{1…12}$ = 1299.71 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.21	17.68	18.24	15.9	15.26	13.17	12.2	14	14.17	16.51	18.03	19.58	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (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)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.11	26.28	29.08	28.12	29.04	28.09	29.01	29.03	28.1	29.06	28.15	29.1	(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=	163.86	144.13	150.69	134.15	130.78	115.88	110.36	122.38	122.57	139.15	148.32	159.6	(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=	163.86	144.13	150.69	134.15	130.78	115.88	110.36	122.38	122.57	139.15	148.32	159.6	

Output from water heater (annual)$_{1...12}$ 1641.88 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	52.08	45.76	47.71	42.28	41.09	36.21	34.3	38.3	38.44	43.87	46.99	50.67	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	101.91	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17	15.1	12.28	9.3	6.95	5.87	6.34	8.24	11.06	14.04	16.39	17.47	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	178.01	179.86	175.2	165.29	152.78	141.03	133.17	131.33	135.98	145.89	158.4	170.16	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	33.19	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	-81.53	(71)

Water heating gains (Table 5)

(72)m=	70	68.09	64.12	58.73	55.23	50.29	46.11	51.47	53.38	58.97	65.27	68.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	321.59	319.62	308.18	289.89	271.53	253.76	242.19	247.61	257	275.47	296.63	312.3	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	8.74	x	46.75	x	0.63	x	0.7	=	124.88	(78)
South	0.9x	0.77	x	8.74	x	76.57	x	0.63	x	0.7	=	204.52	(78)
South	0.9x	0.77	x	8.74	x	97.53	x	0.63	x	0.7	=	260.52	(78)
South	0.9x	0.77	x	8.74	x	110.23	x	0.63	x	0.7	=	294.44	(78)
South	0.9x	0.77	x	8.74	x	114.87	x	0.63	x	0.7	=	306.83	(78)

South	0.9x	0.77	x	8.74	x	110.55	x	0.63	x	0.7	=	295.28	(78)
South	0.9x	0.77	x	8.74	x	108.01	x	0.63	x	0.7	=	288.51	(78)
South	0.9x	0.77	x	8.74	x	104.89	x	0.63	x	0.7	=	280.18	(78)
South	0.9x	0.77	x	8.74	x	101.89	x	0.63	x	0.7	=	272.14	(78)
South	0.9x	0.77	x	8.74	x	82.59	x	0.63	x	0.7	=	220.59	(78)
South	0.9x	0.77	x	8.74	x	55.42	x	0.63	x	0.7	=	148.02	(78)
South	0.9x	0.77	x	8.74	x	40.4	x	0.63	x	0.7	=	107.91	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	124.88	204.52	260.52	294.44	306.83	295.28	288.51	280.18	272.14	220.59	148.02	107.91	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	446.46	524.14	568.7	584.33	578.36	549.04	530.7	527.79	529.14	496.06	444.66	420.21	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.97	0.93	0.83	0.68	0.71	0.87	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.27	19.48	19.77	20.16	20.51	20.81	20.94	20.93	20.74	20.28	19.73	19.28	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.59	19.6	19.61	19.65	19.66	19.7	19.7	19.71	19.69	19.66	19.65	19.63	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.95	0.89	0.74	0.52	0.55	0.8	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.06	18.27	18.57	18.99	19.32	19.61	19.68	19.69	19.54	19.11	18.56	18.1	(90)

fLA = Living area ÷ (4) = 0.41 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.56	18.77	19.07	19.47	19.81	20.11	20.2	20.2	20.04	19.59	19.05	18.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.41	18.62	18.92	19.32	19.66	19.96	20.05	20.05	19.89	19.44	18.9	18.44	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.97	0.95	0.89	0.76	0.57	0.59	0.81	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	442.91	516.26	553.26	553.75	515.98	416.72	301.24	313.59	429.14	469.84	438.13	417.57	(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=	1423.23	1372.94	1232.9	998.07	757.26	492.82	317.87	333.96	539.67	841.11	1137.51	1392.92	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	729.36	575.69	505.65	319.92	179.51	0	0	0	0	276.22	503.55	725.66	

DER WorkSheet: New dwelling design stage

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3815.55	(98)
Space heating requirement in kWh/m²/year		61.52	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.7	(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)	729.36	575.69	505.65	319.92	179.51	0	0	0	0	276.22	503.55	725.66		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	804.14	634.72	557.5	352.72	197.91	0	0	0	0	304.54	555.18	800.06		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													4206.78	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	163.86	144.13	150.69	134.15	130.78	115.88	110.36	122.38	122.57	139.15	148.32	159.6		
Efficiency of water heater													87	(216)
(217)m=	90	89.93	89.82	89.57	89.1	87	87	87	87	89.43	89.83	90.01		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	182.07	160.27	167.77	149.76	146.77	133.19	126.86	140.67	140.89	155.61	165.11	177.31		
Total = Sum(219a)$_{1...12}$ =													1846.27	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4206.78	
Water heating fuel used			1846.27	
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			300.25	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	908.66	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	398.79	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1307.46	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	155.83	(268)
Total CO2, kg/year		sum of (265)…(271) =		1502.21	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		24.22	(273)
EI rating (section 14)				81	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 12 PL1B

Address : Flat 12, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	65.8	(1a) x	2.6	(2a) =	171.08	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.8	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.08	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.67	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.86	0.84	0.82	0.74	0.72	0.64	0.64	0.62	0.67	0.72	0.76	0.79

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.87	0.85	0.84	0.77	0.76	0.7	0.7	0.69	0.73	0.76	0.79	0.81	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.87	0.85	0.84	0.77	0.76	0.7	0.7	0.69	0.73	0.76	0.79	0.81	(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			2.12	x	1.6	=	3.392			(26)
Windows			8.74	x1/[1/(1.4)+ 0.04]		=	11.59			(27)
Walls Type1	25.01	8.74	16.27	x	0.3	=	4.88			(29)
Walls Type2	25.01	2.12	22.89	x	0.18	=	4.22			(29)
Roof	50.14	0	50.14	x	0.11	=	5.52			(30)
Total area of elements, m²			100.16							(31)
Party wall			35.57	x	0	=	0			(32)
Party floor			65.8							(32a)
Party ceiling			15.66							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.59 (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 15.02 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 44.61 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	48.94	48.14	47.35	43.65	42.95	39.73	39.73	39.13	40.97	42.95	44.35	45.82	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	93.56	92.75	91.96	88.26	87.57	84.34	84.34	83.75	85.58	87.57	88.97	90.43	

Average = $Sum(39)_{1…12}$ /12= 88.26 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.42	1.41	1.4	1.34	1.33	1.28	1.28	1.27	1.3	1.33	1.35	1.37

Average = Sum(40)$_{1\ldots12}$ /12= 1.34 (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 — 2.14 (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 — 85.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	93.53	90.13	86.73	83.32	79.92	76.52	76.52	79.92	83.32	86.73	90.13	93.53

Total = Sum(44)$_{1\ldots12}$ = 1020.3 (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=	138.7	121.31	125.18	109.13	104.72	90.36	83.73	96.09	97.23	113.32	123.69	134.32

Total = Sum(45)$_{1\ldots12}$ = 1337.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.8	18.2	18.78	16.37	15.71	13.55	12.56	14.41	14.58	17	18.55	20.15	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 0 (54)

Enter (50) or (54) in (55) — 0 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.12	26.29	29.09	28.13	29.05	28.09	29.02	29.04	28.11	29.07	28.16	29.11	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43	(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=	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43	

Output from water heater (annual)$_{1...12}$ 1680.04 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.4	46.91	48.89	43.32	42.08	37.07	35.1	39.21	39.36	44.95	48.17	51.94	(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=	107	107	107	107	107	107	107	107	107	107	107	107	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.12	16.1	13.09	9.91	7.41	6.25	6.76	8.78	11.79	14.97	17.47	18.63	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	187.3	189.25	184.35	173.92	160.76	148.39	140.13	138.18	143.08	153.51	166.67	179.04	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	33.7	(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=	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	-85.6	(71)
Water heating gains (Table 5)													
(72)m=	71.77	69.8	65.72	60.16	56.56	51.48	47.17	52.7	54.66	60.41	66.9	69.81	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	335.3	333.24	321.26	302.1	282.83	264.23	252.16	257.76	267.63	286.99	309.14	325.58	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	8.74	x	46.75	x	0.63	x	0.7	=	124.88	(78)
South	0.9x	0.77	x	8.74	x	76.57	x	0.63	x	0.7	=	204.52	(78)
South	0.9x	0.77	x	8.74	x	97.53	x	0.63	x	0.7	=	260.52	(78)
South	0.9x	0.77	x	8.74	x	110.23	x	0.63	x	0.7	=	294.44	(78)
South	0.9x	0.77	x	8.74	x	114.87	x	0.63	x	0.7	=	306.83	(78)

South	0.9x	0.77	x	8.74	x	110.55	x	0.63	x	0.7	=	295.28	(78)
South	0.9x	0.77	x	8.74	x	108.01	x	0.63	x	0.7	=	288.51	(78)
South	0.9x	0.77	x	8.74	x	104.89	x	0.63	x	0.7	=	280.18	(78)
South	0.9x	0.77	x	8.74	x	101.89	x	0.63	x	0.7	=	272.14	(78)
South	0.9x	0.77	x	8.74	x	82.59	x	0.63	x	0.7	=	220.59	(78)
South	0.9x	0.77	x	8.74	x	55.42	x	0.63	x	0.7	=	148.02	(78)
South	0.9x	0.77	x	8.74	x	40.4	x	0.63	x	0.7	=	107.91	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	124.88	204.52	260.52	294.44	306.83	295.28	288.51	280.18	272.14	220.59	148.02	107.91	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	460.17	537.76	581.77	596.54	589.65	559.51	540.66	537.94	539.78	507.58	457.16	433.48	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.97	0.92	0.81	0.64	0.67	0.85	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.5	19.69	19.96	20.32	20.63	20.88	20.97	20.96	20.82	20.42	19.92	19.51	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.75	19.76	19.77	19.81	19.82	19.86	19.86	19.86	19.84	19.82	19.8	19.78	(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	0.72	0.5	0.52	0.78	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.6	18.88	19.26	19.56	19.8	19.85	19.85	19.74	19.37	18.87	18.44	(90)

fLA = Living area ÷ (4) = 0.37 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.81	19.01	19.28	19.66	19.96	20.2	20.27	20.27	20.15	19.76	19.26	18.84	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.66	18.86	19.13	19.51	19.81	20.05	20.12	20.12	20	19.61	19.11	18.69	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.95	0.88	0.73	0.53	0.56	0.79	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	457	530.41	566.68	564.73	521.49	410.1	287.91	300.44	427.22	480.03	450.99	431.17	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1343.86	1294.92	1161.75	936.44	709.88	459.7	296.61	311.32	504.65	789.14	1068.75	1310.61	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	659.82	513.75	442.73	267.63	140.16	0	0	0	0	229.98	444.79	654.31	

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	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3353.16	(98)
Space heating requirement in kWh/m²/year		50.96	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		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)	659.82	513.75	442.73	267.63	140.16	0	0	0	0	229.98	444.79	654.31		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	727.48	566.43	488.13	295.07	154.53	0	0	0	0	253.56	490.39	721.4		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3696.98	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	167.82	147.59	154.26	137.26	133.76	118.46	112.75	125.12	125.34	142.39	151.85	163.43		
Efficiency of water heater													87	(216)
(217)m=	89.92	89.85	89.71	89.41	88.85	87	87	87	87	89.25	89.73	89.94		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	186.62	164.27	171.95	153.52	150.54	136.16	129.6	143.82	144.07	159.54	169.23	181.72		
Total = Sum(219a)$_{1...12}$ =													1891.04	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3696.98	
Water heating fuel used			1891.04	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			320.04	(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	=	798.55	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	408.47	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1207.01	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	166.1	(268)
Total CO2, kg/year		sum of (265)…(271) =		1412.04	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		21.46	(273)
EI rating (section 14)				83	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 13 PL1B

Address : Flat 13, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	83.17	(1a)	x	2.6	(2a)	=	216.24	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	83.17	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	216.24	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.89	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.69	(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

0.88	0.86	0.84	0.76	0.74	0.65	0.65	0.64	0.69	0.74	0.77	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.89	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows Type 1			2.91	x1/[1/(1.4)+ 0.04]		=	3.86			(27)
Windows Type 2			8	x1/[1/(1.4)+ 0.04]		=	10.61			(27)
Walls Type1	47.42	10.91	36.51	x	0.3	=	10.95			(29)
Walls Type2	5.93	2.12	3.81	x	0.18	=	0.7			(29)
Roof	18.21	0	18.21	x	0.11	=	2			(30)
Total area of elements, m²			71.56							(31)
Party wall			41.5	x	0	=	0			(32)
Party floor			83.17							(32a)
Party ceiling			64.96							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.51 (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 10.73 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 42.25 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	63.2	62.13	61.08	56.16	55.24	50.96	50.96	50.16	52.61	55.24	57.1	59.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	105.44	104.38	103.33	98.41	97.49	93.2	93.2	92.41	94.85	97.49	99.35	101.3	

Average = Sum(39)$_{1…12}$ /12= 98.4 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.27	1.25	1.24	1.18	1.17	1.12	1.12	1.11	1.14	1.17	1.19	1.22	

Average = Sum(40)$_{1…12}$ /12= 1.18 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.52 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 94.06 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	103.46	99.7	95.94	92.18	88.41	84.65	84.65	88.41	92.18	95.94	99.7	103.46

Total = Sum(44)$_{1…12}$ = 1128.67 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	153.43	134.19	138.47	120.72	115.84	99.96	92.63	106.29	107.56	125.35	136.83	148.59

Total = Sum(45)$_{1…12}$ = 1479.87 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.01	20.13	20.77	18.11	17.38	14.99	13.89	15.94	16.13	18.8	20.52	22.29	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.15	26.32	29.12	28.16	29.08	28.12	29.04	29.06	28.14	29.1	28.19	29.15	(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=	182.58	160.52	167.6	148.88	144.91	128.08	121.67	135.35	135.7	154.45	165.03	177.74	(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=	182.58	160.52	167.6	148.88	144.91	128.08	121.67	135.35	135.7	154.45	165.03	177.74

Output from water heater (annual)$_{1...12}$ | 1822.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	58.3	51.2	53.32	47.18	45.79	40.27	38.06	42.61	42.8	48.96	52.54	56.69	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	126.01	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.92	19.47	15.83	11.99	8.96	7.56	8.17	10.62	14.26	18.11	21.13	22.53	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	225.94	228.28	222.37	209.8	193.92	179	169.03	166.68	172.59	185.17	201.05	215.97	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	35.6	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	-100.81	(71)

Water heating gains (Table 5)

(72)m=	78.37	76.19	71.67	65.53	61.54	55.92	51.15	57.27	59.44	65.8	72.98	76.2	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	390.03	387.75	373.68	351.12	328.22	306.29	292.16	298.38	310.1	332.88	358.96	378.5	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	8	x	46.75	x	0.63	x	0.7	=	114.3	(78)
South	0.9x	0.77	x	8	x	76.57	x	0.63	x	0.7	=	187.2	(78)

South	0.9x	0.77	x	8	x	97.53	x	0.63	x	0.7	=	238.46	(78)
South	0.9x	0.77	x	8	x	110.23	x	0.63	x	0.7	=	269.51	(78)
South	0.9x	0.77	x	8	x	114.87	x	0.63	x	0.7	=	280.85	(78)
South	0.9x	0.77	x	8	x	110.55	x	0.63	x	0.7	=	270.28	(78)
South	0.9x	0.77	x	8	x	108.01	x	0.63	x	0.7	=	264.08	(78)
South	0.9x	0.77	x	8	x	104.89	x	0.63	x	0.7	=	256.46	(78)
South	0.9x	0.77	x	8	x	101.89	x	0.63	x	0.7	=	249.1	(78)
South	0.9x	0.77	x	8	x	82.59	x	0.63	x	0.7	=	201.91	(78)
South	0.9x	0.77	x	8	x	55.42	x	0.63	x	0.7	=	135.49	(78)
South	0.9x	0.77	x	8	x	40.4	x	0.63	x	0.7	=	98.77	(78)
West	0.9x	0.77	x	2.91	x	19.64	x	0.63	x	0.7	=	17.47	(80)
West	0.9x	0.77	x	2.91	x	38.42	x	0.63	x	0.7	=	34.17	(80)
West	0.9x	0.77	x	2.91	x	63.27	x	0.63	x	0.7	=	56.27	(80)
West	0.9x	0.77	x	2.91	x	92.28	x	0.63	x	0.7	=	82.07	(80)
West	0.9x	0.77	x	2.91	x	113.09	x	0.63	x	0.7	=	100.58	(80)
West	0.9x	0.77	x	2.91	x	115.77	x	0.63	x	0.7	=	102.96	(80)
West	0.9x	0.77	x	2.91	x	110.22	x	0.63	x	0.7	=	98.02	(80)
West	0.9x	0.77	x	2.91	x	94.68	x	0.63	x	0.7	=	84.2	(80)
West	0.9x	0.77	x	2.91	x	73.59	x	0.63	x	0.7	=	65.45	(80)
West	0.9x	0.77	x	2.91	x	45.59	x	0.63	x	0.7	=	40.54	(80)
West	0.9x	0.77	x	2.91	x	24.49	x	0.63	x	0.7	=	21.78	(80)
West	0.9x	0.77	x	2.91	x	16.15	x	0.63	x	0.7	=	14.36	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	131.77	221.37	294.73	351.58	381.43	373.24	362.1	340.66	314.55	242.46	157.27	113.13	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.8	609.12	668.41	702.7	709.65	679.53	654.26	639.04	624.65	575.34	516.23	491.64	(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	0.99	0.99	0.97	0.92	0.78	0.6	0.64	0.85	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.63	19.81	20.07	20.43	20.71	20.92	20.98	20.98	20.86	20.49	20.03	19.65	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.87	19.88	19.89	19.93	19.94	19.98	19.98	19.99	19.97	19.94	19.92	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.95	0.88	0.69	0.48	0.51	0.78	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.63	18.81	19.08	19.47	19.74	19.95	19.98	19.99	19.89	19.54	19.07	18.68	(90)

fLA = Living area ÷ (4) = | 0.31 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.94	19.12	19.39	19.77	20.04	20.25	20.29	20.29	20.19	19.83	19.37	18.98	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.79	18.97	19.24	19.62	19.89	20.1	20.14	20.14	20.04	19.68	19.22	18.83	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.95	0.88	0.7	0.5	0.53	0.79	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	519.47	603.33	654.76	667.6	622.37	476.59	325.13	339.19	493.11	549.52	511.45	489.99	(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=	1527.69	1468.94	1316.15	1054.56	798.64	512.65	330.09	346.01	563.79	885.62	1204.01	1481.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	750.12	581.69	492.08	278.61	131.15	0	0	0	0	250.06	498.64	738.04	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3720.39 (98)

Space heating requirement in kWh/m²/year 44.73 (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)													
	750.12	581.69	492.08	278.61	131.15	0	0	0	0	250.06	498.64	738.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	827.03	641.33	542.53	307.18	144.59	0	0	0	0	275.7	549.77	813.72	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4101.86 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	182.58	160.52	167.6	148.88	144.91	128.08	121.67	135.35	135.7	154.45	165.03	177.74	
Efficiency of water heater												87	(216)
(217)m=	89.95	89.87	89.73	89.38	88.72	87	87	87	87	89.25	89.75	89.96	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	202.98	178.6	186.78	166.58	163.34	147.21	139.85	155.58	155.98	173.06	183.87	197.58

Total = Sum(219a)$_{1...12}$ = 2051.4 (219)

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Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			4101.86	
Water heating fuel used			2051.4	
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			387.12	(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	=	886	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	443.1	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1329.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	200.92	(268)
Total CO2, kg/year		sum of (265)…(271) =		1568.95	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		18.86	(273)
EI rating (section 14)				84	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 14 PL1B

Address : Flat 14, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	65.33	(1a) x	2.6	(2a) =	169.86	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.33	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	169.86	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		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		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.67	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.86	0.84	0.82	0.74	0.72	0.64	0.64	0.62	0.67	0.72	0.76	0.79

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.87	0.85	0.84	0.77	0.76	0.7	0.7	0.69	0.73	0.76	0.79	0.81	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.87	0.85	0.84	0.77	0.76	0.7	0.7	0.69	0.73	0.76	0.79	0.81	(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			2.12	x	1.6	=	3.392			(26)
Windows			8.74	x1/[1/(1.4)+ 0.04]		=	11.59			(27)
Walls Type1	24.52	8.74	15.78	x	0.3	=	4.73			(29)
Walls Type2	37.86	2.12	35.74	x	0.18	=	6.58			(29)
Walls Type3	10.37	0	10.37	x	0.24	=	2.45			(29)
Roof	36.23	0	36.23	x	0.11	=	3.99			(30)
Total area of elements, m²			108.98							(31)
Party wall			23.71	x	0	=	0			(32)
Party floor			65.33							(32a)
Party ceiling			29.1							(32b)

** 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) = 32.73 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.35 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 49.08 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m=	48.63	47.83	47.05	43.36	42.67	39.47	39.47	38.87	40.7	42.67	44.07	45.53	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	97.71	96.91	96.12	92.44	91.75	88.54	88.54	87.95	89.78	91.75	93.15	94.6

Average = $Sum(39)_{1...12}$ /12= 92.44 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.5	1.48	1.47	1.41	1.4	1.36	1.36	1.35	1.37	1.4	1.43	1.45

Average = $Sum(40)_{1...12}$ /12= 1.41 (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 2.13 (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 84.73 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	93.2	89.82	86.43	83.04	79.65	76.26	76.26	79.65	83.04	86.43	89.82	93.2

Total = $Sum(44)_{1...12}$ = 1016.78 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	138.22	120.89	124.75	108.76	104.35	90.05	83.44	95.75	96.9	112.92	123.27	133.86

Total = $Sum(45)_{1...12}$ = 1333.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.73	18.13	18.71	16.31	15.65	13.51	12.52	14.36	14.53	16.94	18.49	20.08	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.12	26.29	29.08	28.13	29.05	28.09	29.02	29.04	28.11	29.07	28.16	29.11	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97

Output from water heater (annual)$_{1...12}$ | 1675.41 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.24	46.77	48.75	43.19	41.96	36.96	35	39.1	39.25	44.81	48.02	51.79	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	106.38	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.98	15.97	12.99	9.83	7.35	6.21	6.71	8.72	11.7	14.85	17.34	18.48	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	186.16	188.09	183.23	172.86	159.78	147.49	139.27	137.34	142.21	152.57	165.65	177.95	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	33.64	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	-85.11	(71)

Water heating gains (Table 5)

(72)m=	71.56	69.59	65.52	59.99	56.4	51.34	47.04	52.55	54.51	60.23	66.7	69.6	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	333.62	331.58	319.65	300.6	281.44	262.95	250.93	256.52	266.33	285.58	307.61	323.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	8.74	x	19.64	x	0.63	x	0.7	=	52.46	(80)
West	0.9x	0.77	x	8.74	x	38.42	x	0.63	x	0.7	=	102.62	(80)

West	0.9x	0.77	x	8.74	x	63.27	x	0.63	x	0.7	=	169.01	(80)
West	0.9x	0.77	x	8.74	x	92.28	x	0.63	x	0.7	=	246.49	(80)
West	0.9x	0.77	x	8.74	x	113.09	x	0.63	x	0.7	=	302.08	(80)
West	0.9x	0.77	x	8.74	x	115.77	x	0.63	x	0.7	=	309.23	(80)
West	0.9x	0.77	x	8.74	x	110.22	x	0.63	x	0.7	=	294.4	(80)
West	0.9x	0.77	x	8.74	x	94.68	x	0.63	x	0.7	=	252.88	(80)
West	0.9x	0.77	x	8.74	x	73.59	x	0.63	x	0.7	=	196.56	(80)
West	0.9x	0.77	x	8.74	x	45.59	x	0.63	x	0.7	=	121.77	(80)
West	0.9x	0.77	x	8.74	x	24.49	x	0.63	x	0.7	=	65.41	(80)
West	0.9x	0.77	x	8.74	x	16.15	x	0.63	x	0.7	=	43.14	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	52.46	102.62	169.01	246.49	302.08	309.23	294.4	252.88	196.56	121.77	65.41	43.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	386.08	434.2	488.66	547.09	583.52	572.18	545.33	509.41	462.89	407.35	373.02	367.09	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.93	0.81	0.66	0.71	0.91	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.31	19.47	19.77	20.2	20.57	20.86	20.96	20.94	20.73	20.24	19.74	19.33	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.69	19.7	19.71	19.75	19.76	19.8	19.8	19.8	19.78	19.76	19.74	19.73	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.96	0.89	0.72	0.5	0.56	0.85	0.98	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.18	18.34	18.64	19.1	19.46	19.73	19.79	19.79	19.62	19.15	18.64	18.22	(90)

fLA = Living area ÷ (4) = 0.44 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.68	18.84	19.14	19.59	19.95	20.23	20.31	20.3	20.11	19.63	19.13	18.71	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.53	18.69	18.99	19.44	19.8	20.08	20.16	20.15	19.96	19.48	18.98	18.56	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.96	0.89	0.74	0.55	0.61	0.86	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	384.61	431.34	481.62	525.66	522.18	424.87	302.46	311.12	398.97	396.73	370.57	365.99	(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=	1390.52	1336.61	1200.48	973.99	743.46	485.15	314.86	329.73	526.26	815.13	1106.17	1358.96	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	748.4	608.34	534.84	322.8	164.63	0	0	0	0	311.29	529.63	738.77

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3958.7 (98)

Space heating requirement in kWh/m²/year 60.6 (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)	748.4	608.34	534.84	322.8	164.63	0	0	0	0	311.29	529.63	738.77	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	825.14	670.72	589.68	355.9	181.51	0	0	0	0	343.21	583.94	814.52	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4364.61 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	167.34	147.17	153.83	136.88	133.4	118.14	112.46	124.79	125.01	141.99	151.42	162.97

Efficiency of water heater 87 (216)

(217)m=	90	89.95	89.85	89.57	89.01	87	87	87	87	89.51	89.85	90.01	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	185.93	163.61	171.21	152.83	149.88	135.8	129.27	143.44	143.69	158.64	168.53	181.06

Total = Sum(219a)$_{1...12}$ = 1883.87 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		4364.61	
Water heating fuel used		1883.87	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		317.59	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

DER WorkSheet: New dwelling design stage

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	942.76	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	406.92	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1349.67	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	164.83	(268)
Total CO2, kg/year			sum of (265)…(271) =		1553.43	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		23.78	(273)
EI rating (section 14)					81	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 15 PL1B

Address : Flat 15, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	51.39	(1a)	x	2.6	(2a)	=	133.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.39	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			133.61	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.9	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.7	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.89	0.87	0.85	0.77	0.75	0.66	0.66	0.64	0.7	0.75	0.78	0.82

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.9	0.88	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.9	0.88	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(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			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(1.4)+ 0.04]		=	7.72			(27)
Walls Type1	15.76	5.82	9.94	x	0.3	=	2.98			(29)
Walls Type2	37.8	2.12	35.68	x	0.18	=	6.57			(29)
Roof	6.3	0	6.3	x	0.11	=	0.69			(30)
Total area of elements, m²			59.86							(31)
Party wall			22.05	x	0	=	0			(32)
Party floor			51.39							(32a)
Party ceiling			45.09							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.35 (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 8.98 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 30.33 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.47	38.79	38.13	35.02	34.43	31.72	31.72	31.22	32.76	34.43	35.61	36.84	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	69.8	69.13	68.46	65.35	64.77	62.05	62.05	61.55	63.1	64.77	65.94	67.18

Average = Sum(39)$_{1…12}$ /12= 65.35 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.36	1.35	1.33	1.27	1.26	1.21	1.21	1.2	1.23	1.26	1.28	1.31

Average = Sum(40)$_{1…12}$ /12= 1.27 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.73 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 75.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	82.84	79.83	76.82	73.81	70.79	67.78	67.78	70.79	73.81	76.82	79.83	82.84

Total = Sum(44)$_{1…12}$ = 903.76 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(45)m=	122.86	107.45	110.88	96.67	92.75	80.04	74.17	85.11	86.13	100.37	109.56	118.98

Total = Sum(45)$_{1…12}$ = 1184.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	18.43	16.12	16.63	14.5	13.91	12.01	11.13	12.77	12.92	15.06	16.43	17.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) — 0 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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=	29.08	26.25	29.05	28.1	29.02	28.07	29	29.01	28.09	29.04	28.12	29.07	(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=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05

Output from water heater (annual)$_{1...12}$ 1526.86 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	48.12	42.29	44.13	39.17	38.1	33.63	31.91	35.55	35.66	40.63	43.46	46.83	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.12	13.43	10.92	8.27	6.18	5.22	5.64	7.33	9.84	12.49	14.58	15.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	150.84	152.41	148.46	140.07	129.47	119.5	112.85	111.28	115.23	123.62	134.23	144.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(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=	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	(71)

Water heating gains (Table 5)

(72)m=	64.68	62.93	59.31	54.4	51.2	46.71	42.89	47.79	49.53	54.61	60.36	62.94	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	282.6	280.73	270.66	254.7	238.82	223.4	213.34	218.36	226.55	242.69	261.13	274.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)

North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.91	36.14	61.42	98.65	132.89	142.27	132.82	105.38	73.84	43.02	23.33	15.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	301.52	316.88	332.08	353.35	371.71	365.66	346.17	323.74	300.4	285.72	284.46	290.4	(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	1	0.99	0.96	0.86	0.72	0.77	0.94	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.48	19.59	19.83	20.21	20.56	20.85	20.96	20.94	20.72	20.3	19.87	19.51	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.8	19.81	19.82	19.86	19.87	19.91	19.91	19.92	19.9	19.87	19.85	19.84	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.93	0.78	0.57	0.63	0.9	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.42	18.54	18.79	19.2	19.55	19.84	19.9	19.9	19.72	19.3	18.86	18.48	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.92	19.04	19.28	19.68	20.03	20.32	20.4	20.39	20.2	19.78	19.34	18.97	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.77	18.89	19.13	19.53	19.88	20.17	20.25	20.24	20.05	19.63	19.19	18.82	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.93	0.8	0.62	0.68	0.9	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	300.49	315.38	329.25	345.64	347.24	294.11	215.62	220.15	271.76	280.48	282.87	289.59	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1010.25	967.3	864.82	694.71	529.6	345.53	226.65	236.62	375.41	584.51	797.24	982.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	528.06	438.09	398.46	251.32	135.67	0	0	0	0	226.2	370.35	515.33	(98)

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2863.5	(98)
Space heating requirement in kWh/m²/year	55.72	(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)	528.06	438.09	398.46	251.32	135.67	0	0	0	0	226.2	370.35	515.33		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	582.21	483.01	439.32	277.09	149.59	0	0	0	0	249.39	408.32	568.17		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3157.11	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05		
Efficiency of water heater													87	(216)
(217)m=	89.85	89.81	89.71	89.44	88.91	87	87	87	87	89.32	89.67	89.85		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	169.1	148.88	155.98	139.5	136.96	124.27	118.58	131.18	131.28	144.89	153.55	164.78		
Total = Sum(219a)$_{1...12}$ =													1718.94	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3157.11	
Water heating fuel used			1718.94	
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			266.99	(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	=	681.94	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	371.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1053.23	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	138.57	(268)
Total CO2, kg/year		sum of (265)…(271) =		1230.72	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		23.95	(273)
EI rating (section 14)				83	(274)

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User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 16 PL1B

Address :	Flat 16, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	55.75	(1a)	x	2.6	(2a)	=	144.95	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.75	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	144.95	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.89	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.69	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.88	0.86	0.84	0.76	0.74	0.65	0.65	0.64	0.69	0.74	0.77	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.88	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.88	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(1.4)+ 0.04]		=	7.72			(27)
Walls Type1	15.7	5.82	9.88	x	0.3	=	2.96			(29)
Walls Type2	17.65	2.12	15.53	x	0.18	=	2.86			(29)
Roof	6.28	0	6.28	x	0.11	=	0.69			(30)
Total area of elements, m²			39.63							(31)
Party wall			46.05	x	0	=	0			(32)
Party floor			55.75							(32a)
Party ceiling			49.47							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	17.62	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		5.94	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	23.57	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.33	41.62	40.91	37.62	37.01	34.14	34.14	33.61	35.24	37.01	38.25	39.55	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	65.9	65.18	64.48	61.19	60.57	57.71	57.71	57.18	58.81	60.57	61.82	63.12	

Average = Sum(39)$_{1…12}$ /12= 61.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.18	1.17	1.16	1.1	1.09	1.04	1.04	1.03	1.05	1.09	1.11	1.13	

Average = Sum(40)$_{1…12}$ /12= 1.1 (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 1.86 (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 78.36 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	86.19	83.06	79.93	76.79	73.66	70.52	70.52	73.66	76.79	79.93	83.06	86.19	

Total = Sum(44)$_{1…12}$ = 940.3 (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=	127.82	111.8	115.36	100.58	96.51	83.28	77.17	88.55	89.61	104.43	113.99	123.79	

Total = Sum(45)$_{1…12}$ = 1232.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.17	16.77	17.3	15.09	14.48	12.49	11.58	13.28	13.44	15.66	17.1	18.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.09	26.26	29.06	28.11	29.03	28.08	29	29.02	28.09	29.05	28.13	29.08	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	

Output from water heater (annual)$_{1...12}$ 1574.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	49.77	43.74	45.62	40.47	39.35	34.71	32.91	36.7	36.82	41.99	44.94	48.43	(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=	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.54	14.69	11.95	9.04	6.76	5.71	6.17	8.02	10.76	13.66	15.94	17	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	162.12	163.8	159.56	150.53	139.14	128.44	121.28	119.6	123.84	132.86	144.26	154.96	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	(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=	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	(71)

Water heating gains (Table 5)

(72)m=	66.9	65.09	61.32	56.21	52.88	48.21	44.23	49.33	51.14	56.43	62.41	65.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	299.44	297.46	286.72	269.67	252.68	236.24	225.57	230.83	239.62	256.85	276.5	290.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)

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North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.91	36.14	61.42	98.65	132.89	142.27	132.82	105.38	73.84	43.02	23.33	15.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	318.36	333.61	348.13	368.33	385.57	378.51	358.4	336.21	313.47	299.87	299.83	306.71	(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	1	0.99	0.95	0.83	0.67	0.73	0.93	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.69	19.8	20.01	20.36	20.67	20.91	20.98	20.97	20.8	20.43	20.05	19.73	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.94	19.95	20	20.01	20.05	20.05	20.06	20.04	20.01	19.99	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.93	0.76	0.55	0.6	0.89	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.74	18.86	19.08	19.46	19.76	20.01	20.05	20.05	19.91	19.54	19.15	18.81	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.2	19.31	19.53	19.89	20.2	20.44	20.5	20.49	20.34	19.97	19.58	19.25	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.05	19.16	19.38	19.74	20.05	20.29	20.35	20.34	20.19	19.82	19.43	19.1	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.93	0.78	0.59	0.64	0.89	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	317.47	332.28	345.51	360.53	358.66	295.17	210.59	216.61	280.26	294.5	298.37	306.02	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	971.86	929.51	830.32	663.56	505.73	328.43	216.2	225.47	358.37	558.58	762.37	940.58	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	486.87	401.34	360.7	218.18	109.42	0	0	0	0	196.48	334.08	472.11	

	Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2579.18	(98)
Space heating requirement in kWh/m²/year		46.26	(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)	486.87	401.34	360.7	218.18	109.42	0	0	0	0	196.48	334.08	472.11		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	536.79	442.49	397.69	240.55	120.64	0	0	0	0	216.63	368.33	520.52		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2843.64	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87		
Efficiency of water heater													87	(216)
(217)m=	89.77	89.72	89.61	89.29	88.68	87	87	87	87	89.17	89.56	89.77		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	174.79	153.87	161.17	144.11	141.55	127.99	122.04	135.14	135.29	149.7	158.69	170.3		
Total = Sum(219a)$_{1...12}$ =													1774.64	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2843.64	
Water heating fuel used			1774.64	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			292.06	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	614.23	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	383.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =			997.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	151.58	(268)
Total CO2, kg/year		sum of (265)…(271) =		1188.05	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		21.31	(273)
EI rating (section 14)				84	(274)

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User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 17 PL1B

Address : Flat 17, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	55.75	(1a)	x	2.6	(2a)	=	144.95	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.75	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	144.95	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.89	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.69	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.88	0.86	0.84	0.76	0.74	0.65	0.65	0.64	0.69	0.74	0.77	0.81

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.88	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.88	0.87	0.86	0.79	0.77	0.71	0.71	0.7	0.74	0.77	0.8	0.83	(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			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(1.4)+ 0.04]		=	7.72			(27)
Walls Type1	15.7	5.82	9.88	x	0.3	=	2.96			(29)
Walls Type2	17.65	2.12	15.53	x	0.18	=	2.87			(29)
Roof	6.28	0	6.28	x	0.11	=	0.69			(30)
Total area of elements, m²			39.63							(31)
Party wall			46.05	x	0	=	0			(32)
Party floor			55.75							(32a)
Party ceiling			49.47							(32b)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 17.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.94 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 23.57 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	42.33	41.62	40.91	37.62	37.01	34.14	34.14	33.61	35.24	37.01	38.25	39.55	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	65.9	65.19	64.49	61.19	60.58	57.71	57.71	57.18	58.82	60.58	61.82	63.13	

Average = Sum(39)$_{1…12}$ /12= 61.19 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.18	1.17	1.16	1.1	1.09	1.04	1.04	1.03	1.05	1.09	1.11	1.13

Average = Sum(40)$_{1…12}$ /12= 1.1 (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 1.86 (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 78.36 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	86.19	83.06	79.93	76.79	73.66	70.52	70.52	73.66	76.79	79.93	83.06	86.19

Total = Sum(44)$_{1…12}$ = 940.3 (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=	127.82	111.8	115.36	100.58	96.51	83.28	77.17	88.55	89.61	104.43	113.99	123.79

Total = Sum(45)$_{1…12}$ = 1232.88 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.17	16.77	17.3	15.09	14.48	12.49	11.58	13.28	13.44	15.66	17.1	18.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.09	26.26	29.06	28.11	29.03	28.08	29	29.02	28.09	29.05	28.13	29.08	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87	

Output from water heater (annual)$_{1...12}$ 1574.89 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	49.77	43.74	45.62	40.47	39.35	34.71	32.91	36.7	36.82	41.99	44.94	48.43	(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=	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	92.96	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.54	14.69	11.95	9.04	6.76	5.71	6.17	8.02	10.76	13.66	15.94	17	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	162.12	163.8	159.56	150.53	139.14	128.44	121.28	119.6	123.84	132.86	144.26	154.96	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	(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=	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	-74.37	(71)

Water heating gains (Table 5)

(72)m=	66.9	65.09	61.32	56.21	52.88	48.21	44.23	49.33	51.14	56.43	62.41	65.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	299.44	297.46	286.72	269.67	252.68	236.24	225.57	230.83	239.62	256.85	276.5	290.95	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)

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North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.91	36.14	61.42	98.65	132.89	142.27	132.82	105.38	73.84	43.02	23.33	15.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	318.36	333.61	348.13	368.33	385.57	378.51	358.4	336.21	313.47	299.87	299.83	306.71	(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	1	0.99	0.95	0.83	0.67	0.73	0.93	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.69	19.8	20.01	20.36	20.67	20.91	20.98	20.97	20.8	20.43	20.05	19.73	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.94	19.95	20	20.01	20.05	20.05	20.06	20.04	20.01	19.99	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.93	0.76	0.55	0.6	0.89	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.74	18.86	19.08	19.46	19.76	20.01	20.05	20.05	19.91	19.54	19.15	18.81	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.2	19.31	19.53	19.89	20.2	20.44	20.5	20.49	20.34	19.97	19.58	19.25	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.05	19.16	19.38	19.74	20.05	20.29	20.35	20.34	20.19	19.82	19.43	19.1	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.93	0.78	0.59	0.64	0.89	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	317.47	332.28	345.51	360.53	358.67	295.18	210.6	216.62	280.26	294.5	298.37	306.02	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	971.93	929.57	830.38	663.61	505.77	328.45	216.22	225.49	358.4	558.63	762.43	940.65	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	486.92	401.38	360.75	218.21	109.45	0	0	0	0	196.51	334.12	472.16	

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Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ =	2579.5	(98)
Space heating requirement in kWh/m²/year	46.27	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		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)	486.92	401.38	360.75	218.21	109.45	0	0	0	0	196.51	334.12	472.16		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	536.85	442.54	397.74	240.59	120.67	0	0	0	0	216.66	368.38	520.58		(211)
Total (kWh/year) = $Sum(211)_{1...5,10...12}$ =													2844	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) = $Sum(215)_{1...5,10...12}$ =													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	156.91	138.06	144.42	128.68	125.53	111.35	106.17	117.57	117.7	133.48	142.13	152.87		
Efficiency of water heater													87	(216)
(217)m=	89.77	89.72	89.61	89.29	88.69	87	87	87	87	89.17	89.56	89.77		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	174.79	153.87	161.17	144.11	141.55	127.99	122.04	135.14	135.29	149.7	158.69	170.3		
Total = $Sum(219a)_{1...12}$ =													1774.64	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2844	
Water heating fuel used			1774.64	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			292.06	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	614.3	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	383.32	(264)
Space and water heating	(261) + (262) + (263) + (264) =			997.63	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	151.58	(268)
Total CO2, kg/year		sum of (265)…(271) =		1188.13	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		21.31	(273)
EI rating (section 14)				84	(274)

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User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 18 PL1B

Address : Flat 18, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	51.39	(1a)	x	2.6	(2a)	=	133.61	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.39	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			133.61	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.9	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.7	(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

0.89	0.87	0.85	0.77	0.75	0.66	0.66	0.64	0.7	0.75	0.78	0.82

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.9	0.88	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.9	0.88	0.86	0.79	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(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			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(1.4)+ 0.04]		=	7.72			(27)
Walls Type1	15.76	5.82	9.94	x	0.3	=	2.98			(29)
Walls Type2	10.66	2.12	8.54	x	0.18	=	1.57			(29)
Roof	6.3	0	6.3	x	0.11	=	0.69			(30)
Total area of elements, m²			32.72							(31)
Party wall			49.19	x	0	=	0			(32)
Party floor			51.39							(32a)
Party ceiling			45.09							(32b)

** 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) = 16.36 (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 4.91 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.26 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.47	38.79	38.13	35.02	34.43	31.72	31.72	31.22	32.76	34.43	35.61	36.84	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	60.73	60.06	59.39	56.28	55.7	52.98	52.98	52.48	54.03	55.7	56.88	58.11	

Average = Sum(39)$_{1…12}$ /12= 56.28 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.18	1.17	1.16	1.1	1.08	1.03	1.03	1.02	1.05	1.08	1.11	1.13	

Average = Sum(40)$_{1…12}$ /12= 1.1 (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 1.73 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.31 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.84	79.83	76.82	73.81	70.79	67.78	67.78	70.79	73.81	76.82	79.83	82.84	

Total = Sum(44)$_{1…12}$ = 903.76 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	122.86	107.45	110.88	96.67	92.75	80.04	74.17	85.11	86.13	100.37	109.56	118.98	

Total = Sum(45)$_{1…12}$ = 1184.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	18.43	16.12	16.63	14.5	13.91	12.01	11.13	12.77	12.92	15.06	16.43	17.85	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.08	26.25	29.05	28.1	29.02	28.07	29	29.01	28.09	29.04	28.12	29.07	(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=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05	

Output from water heater (annual) 1…12 | 1526.86 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	48.12	42.29	44.13	39.17	38.1	33.63	31.91	35.55	35.66	40.63	43.46	46.83	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	86.55	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.12	13.43	10.92	8.27	6.18	5.22	5.64	7.33	9.84	12.49	14.58	15.54	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	150.84	152.41	148.46	140.07	129.47	119.5	112.85	111.28	115.23	123.62	134.23	144.19	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	31.66	(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=	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	-69.24	(71)

Water heating gains (Table 5)

(72)m=	64.68	62.93	59.31	54.4	51.2	46.71	42.89	47.79	49.53	54.61	60.36	62.94	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	282.6	280.73	270.66	254.7	238.82	223.4	213.34	218.36	226.55	242.69	261.13	274.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)

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North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.91	36.14	61.42	98.65	132.89	142.27	132.82	105.38	73.84	43.02	23.33	15.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	301.52	316.88	332.08	353.35	371.71	365.66	346.17	323.74	300.4	285.72	284.46	290.4	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.94	0.81	0.65	0.7	0.92	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.7	19.81	20.03	20.38	20.69	20.92	20.98	20.97	20.82	20.45	20.07	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.95	19.96	20	20.01	20.06	20.06	20.07	20.04	20.01	20	19.98	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.92	0.73	0.52	0.58	0.87	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.76	18.87	19.1	19.49	19.79	20.02	20.05	20.06	19.93	19.56	19.17	18.83	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.21	19.32	19.54	19.91	20.22	20.45	20.49	20.49	20.35	19.98	19.59	19.26	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.06	19.17	19.39	19.76	20.07	20.3	20.34	20.34	20.2	19.83	19.44	19.11	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.92	0.75	0.56	0.62	0.88	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	300.57	315.44	329.19	344.58	341.58	276.04	194.31	200.29	264.45	279.85	282.89	289.66	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	896.22	857.1	765.69	611.45	466.03	301.86	198.4	206.92	329.74	514.34	702.06	866.46	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	443.16	363.99	324.75	192.15	92.59	0	0	0	0	174.46	301.8	429.14	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2322.05 (98)

Space heating requirement in kWh/m²/year 45.18 (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)	443.16	363.99	324.75	192.15	92.59	0	0	0	0	174.46	301.8	429.14		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	488.6	401.32	358.05	211.85	102.09	0	0	0	0	192.35	332.75	473.14		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2560.15	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	151.93	133.7	139.93	124.76	121.78	108.11	103.17	114.12	114.21	129.41	137.68	148.05		
Efficiency of water heater													87	(216)
(217)m=	89.73	89.68	89.55	89.21	88.56	87	87	87	87	89.09	89.51	89.72		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	169.33	149.1	156.25	139.86	137.51	124.27	118.58	131.18	131.28	145.26	153.82	165.01		
Total = Sum(219a)$_{1...12}$ =													1721.44	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2560.15	
Water heating fuel used			1721.44	
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			266.99	(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	=	552.99	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	371.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =			924.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	138.57	(268)
Total CO2, kg/year		sum of (265)…(271) =		1102.32	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		21.45	(273)
EI rating (section 14)				85	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 19 PL1B

Address : Flat 19, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m^2)		Av. Height(m)		Volume(m^3)	
Ground floor	58.52	(1a) x	2.6	(2a) =	152.15	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.52	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		152.15	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.88	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.68	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.87	0.85	0.84	0.75	0.73	0.65	0.65	0.63	0.68	0.73	0.77	0.8

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.8	0.82	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.88	0.86	0.85	0.78	0.77	0.71	0.71	0.7	0.73	0.77	0.8	0.82	(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			2.12	x	1.6	=	3.392			(26)
Windows Type 1			5.82	x1/[1/(1.4)+ 0.04]		=	7.72			(27)
Windows Type 2			2.91	x1/[1/(1.4)+ 0.04]		=	3.86			(27)
Windows Type 3			2.91	x1/[1/(1.4)+ 0.04]		=	3.86			(27)
Walls Type1	36.97	11.64	25.33	x	0.3	=	7.6			(29)
Walls Type2	3.15	2.12	1.03	x	0.18	=	0.19			(29)
Roof	8.8	0	8.8	x	0.11	=	0.97			(30)
Total area of elements, m²			48.92							(31)
Party wall			50.41	x	0	=	0			(32)
Party floor			58.52							(32a)
Party ceiling			49.72							(32b)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.58 (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 7.34 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 34.92 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.15	43.41	42.69	39.28	38.64	35.68	35.68	35.13	36.82	38.64	39.93	41.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	79.07	78.33	77.6	74.2	73.56	70.6	70.6	70.05	71.74	73.56	74.85	76.2	

Average = $Sum(39)_{1...12}$ /12= 74.2 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.35	1.34	1.33	1.27	1.26	1.21	1.21	1.2	1.23	1.26	1.28	1.3	

Average = $Sum(40)_{1...12}$ /12= 1.27 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.94 (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 80.26 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	88.29	85.08	81.87	78.66	75.45	72.24	72.24	75.45	78.66	81.87	85.08	88.29	

Total = $Sum(44)_{1...12}$ = 963.16 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	130.93	114.51	118.17	103.02	98.85	85.3	79.04	90.7	91.79	106.97	116.76	126.8	

Total = $Sum(45)_{1...12}$ = 1262.85 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.64	17.18	17.73	15.45	14.83	12.8	11.86	13.61	13.77	16.05	17.51	19.02	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.1	26.27	29.07	28.11	29.03	28.08	29.01	29.03	28.1	29.05	28.14	29.09	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89	(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=	160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89

Output from water heater (annual)$_{1...12}$ — 1604.93 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	50.81	44.64	46.56	41.28	40.13	35.38	33.53	37.42	37.54	42.83	45.86	49.43	(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=	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	96.97	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.2	13.5	10.98	8.31	6.21	5.25	5.67	7.37	9.89	12.56	14.65	15.62	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	169.2	170.96	166.53	157.11	145.22	134.05	126.58	124.83	129.25	138.67	150.56	161.73	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	(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=	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	-77.58	(71)

Water heating gains (Table 5)

(72)m=	68.29	66.43	62.58	57.34	53.93	49.14	45.07	50.29	52.14	57.57	63.69	66.44	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	307.78	305.98	295.18	277.85	260.46	243.53	232.41	237.57	246.37	263.89	284	298.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

North	0.9x	0.77	x	2.91	x	10.63	x	0.63	x	0.7	=	9.46	(74)
North	0.9x	0.77	x	2.91	x	20.32	x	0.63	x	0.7	=	18.07	(74)
North	0.9x	0.77	x	2.91	x	34.53	x	0.63	x	0.7	=	30.71	(74)
North	0.9x	0.77	x	2.91	x	55.46	x	0.63	x	0.7	=	49.33	(74)
North	0.9x	0.77	x	2.91	x	74.72	x	0.63	x	0.7	=	66.45	(74)
North	0.9x	0.77	x	2.91	x	79.99	x	0.63	x	0.7	=	71.13	(74)
North	0.9x	0.77	x	2.91	x	74.68	x	0.63	x	0.7	=	66.41	(74)
North	0.9x	0.77	x	2.91	x	59.25	x	0.63	x	0.7	=	52.69	(74)
North	0.9x	0.77	x	2.91	x	41.52	x	0.63	x	0.7	=	36.92	(74)
North	0.9x	0.77	x	2.91	x	24.19	x	0.63	x	0.7	=	21.51	(74)
North	0.9x	0.77	x	2.91	x	13.12	x	0.63	x	0.7	=	11.67	(74)
North	0.9x	0.77	x	2.91	x	8.86	x	0.63	x	0.7	=	7.88	(74)
Northeast	0.9x	0.77	x	2.91	x	11.28	x	0.63	x	0.7	=	10.03	(75)
Northeast	0.9x	0.77	x	2.91	x	22.97	x	0.63	x	0.7	=	20.43	(75)
Northeast	0.9x	0.77	x	2.91	x	41.38	x	0.63	x	0.7	=	36.8	(75)
Northeast	0.9x	0.77	x	2.91	x	67.96	x	0.63	x	0.7	=	60.44	(75)
Northeast	0.9x	0.77	x	2.91	x	91.35	x	0.63	x	0.7	=	81.24	(75)
Northeast	0.9x	0.77	x	2.91	x	97.38	x	0.63	x	0.7	=	86.61	(75)
Northeast	0.9x	0.77	x	2.91	x	91.1	x	0.63	x	0.7	=	81.02	(75)
Northeast	0.9x	0.77	x	2.91	x	72.63	x	0.63	x	0.7	=	64.59	(75)
Northeast	0.9x	0.77	x	2.91	x	50.42	x	0.63	x	0.7	=	44.84	(75)
Northeast	0.9x	0.77	x	2.91	x	28.07	x	0.63	x	0.7	=	24.96	(75)
Northeast	0.9x	0.77	x	2.91	x	14.2	x	0.63	x	0.7	=	12.63	(75)
Northeast	0.9x	0.77	x	2.91	x	9.21	x	0.63	x	0.7	=	8.19	(75)
East	0.9x	0.77	x	5.82	x	19.64	x	0.63	x	0.7	=	34.93	(76)
East	0.9x	0.77	x	5.82	x	38.42	x	0.63	x	0.7	=	68.34	(76)
East	0.9x	0.77	x	5.82	x	63.27	x	0.63	x	0.7	=	112.54	(76)
East	0.9x	0.77	x	5.82	x	92.28	x	0.63	x	0.7	=	164.14	(76)
East	0.9x	0.77	x	5.82	x	113.09	x	0.63	x	0.7	=	201.15	(76)
East	0.9x	0.77	x	5.82	x	115.77	x	0.63	x	0.7	=	205.92	(76)
East	0.9x	0.77	x	5.82	x	110.22	x	0.63	x	0.7	=	196.04	(76)
East	0.9x	0.77	x	5.82	x	94.68	x	0.63	x	0.7	=	168.4	(76)
East	0.9x	0.77	x	5.82	x	73.59	x	0.63	x	0.7	=	130.89	(76)
East	0.9x	0.77	x	5.82	x	45.59	x	0.63	x	0.7	=	81.09	(76)
East	0.9x	0.77	x	5.82	x	24.49	x	0.63	x	0.7	=	43.56	(76)
East	0.9x	0.77	x	5.82	x	16.15	x	0.63	x	0.7	=	28.73	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	54.42	106.83	180.05	273.9	348.84	363.66	343.47	285.68	212.65	127.56	67.85	44.81	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	362.21	412.82	475.23	551.75	609.3	607.19	575.89	523.25	459.03	391.45	351.85	343.7	(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	0.87	0.69	0.53	0.59	0.86	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.52	19.68	19.98	20.42	20.76	20.95	20.99	20.98	20.84	20.4	19.92	19.54	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.8	19.81	19.82	19.87	19.87	19.91	19.91	19.92	19.9	19.87	19.86	19.84	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.82	0.59	0.4	0.47	0.78	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.46	18.64	18.94	19.4	19.71	19.89	19.91	19.92	19.81	19.4	18.91	18.51	(90)

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.13	19.43	19.89	20.21	20.39	20.42	20.42	20.3	19.87	19.39	19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.81	18.98	19.28	19.74	20.06	20.24	20.27	20.27	20.15	19.72	19.24	18.85	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.83	0.62	0.45	0.51	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	360.7	409.57	465.99	517.65	504.36	378.86	256.3	265.79	368.54	377.74	349.14	342.58	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1147.5	1103.03	992.1	804.02	614.88	398.36	259.34	271.24	433.96	671.09	908.54	1116.29	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	585.38	466.01	391.43	206.19	82.23	0	0	0	0	218.25	402.77	575.64	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2927.89 (98)

Space heating requirement in kWh/m²/year 50.03 (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)													
	585.38	466.01	391.43	206.19	82.23	0	0	0	0	218.25	402.77	575.64	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	645.4	513.79	431.57	227.33	90.66	0	0	0	0	240.63	444.07	634.66	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3228.1 (211)

DER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

160.03	140.78	147.23	131.13	127.89	113.38	108.05	119.73	119.89	136.02	144.9	155.89

Efficiency of water heater 87 (216)

(217)m=	89.88	89.81	89.66	89.22	88.41	87	87	87	87	89.24	89.69	89.89

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	178.05	156.75	164.22	146.97	144.65	130.33	124.2	137.62	137.8	152.42	161.56	173.43

Total = Sum(219a)$_{1...12}$ = 1807.98 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3228.1	
Water heating fuel used		1807.98	
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		268.43	(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	=	697.27	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	390.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1087.79	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	139.31	(268)
Total CO2, kg/year			sum of (265)…(271) =		1266.03	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		21.63	(273)
EI rating (section 14)					84	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 20 PL1B

Address : Flat 20, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.27	(1a) x	2.6	(2a) =	130.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.27	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		130.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.9	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.7	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.89	0.87	0.86	0.77	0.75	0.66	0.66	0.65	0.7	0.75	0.79	0.82

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.9	0.88	0.87	0.8	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.9	0.88	0.87	0.8	0.78	0.72	0.72	0.71	0.74	0.78	0.81	0.84	(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			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(1.4)+ 0.04]		=	7.72			(27)
Walls Type1	15.65	5.82	9.83	x	0.3	=	2.95			(29)
Walls Type2	37.36	2.12	35.24	x	0.18	=	6.49			(29)
Roof	2.84	0	2.84	x	0.11	=	0.31			(30)
Total area of elements, m²			55.85							(31)
Party wall			21.71	x	0	=	0			(32)
Party floor			50.27							(32a)
Party ceiling			47.43							(32b)

** 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) = 20.86 (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 8.38 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 29.24 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.74	38.07	37.42	34.35	33.77	31.1	31.1	30.6	32.13	33.77	34.93	36.15	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.97	67.31	66.65	63.58	63.01	60.34	60.34	59.84	61.36	63.01	64.17	65.39	

Average = Sum(39)$_{1…12}$ /12= 63.58 (39)

DER WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.35	1.34	1.33	1.26	1.25	1.2	1.2	1.19	1.22	1.25	1.28	1.3

Average = Sum(40)$_{1…12}$ /12= 1.26 (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 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.53 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.98	79	76.02	73.04	70.06	67.08	67.08	70.06	73.04	76.02	79	81.98	
											Total = Sum(44)$_{1…12}$ =	894.34	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	121.58	106.33	109.72	95.66	91.79	79.21	73.4	84.22	85.23	99.33	108.42	117.74	
											Total = Sum(45)$_{1…12}$ =	1172.63	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.24	15.95	16.46	14.35	13.77	11.88	11.01	12.63	12.78	14.9	16.26	17.66	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.07	26.25	29.05	28.09	29.02	28.07	29	29.01	28.08	29.04	28.12	29.07	(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=	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81	(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=	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81	

Output from water heater (annual)$_{1...12}$ 1514.49 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	47.69	41.92	43.75	38.83	37.77	33.35	31.65	35.26	35.36	40.29	43.08	46.42	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.76	13.11	10.66	8.07	6.03	5.09	5.5	7.15	9.6	12.19	14.23	15.17	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	147.94	149.47	145.6	137.37	126.97	117.2	110.67	109.14	113.01	121.24	131.64	141.41	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	31.49	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	-67.92	(71)

Water heating gains (Table 5)

(72)m=	64.1	62.38	58.8	53.93	50.77	46.32	42.54	47.39	49.11	54.15	59.83	62.39	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	278.26	276.42	266.53	250.84	235.25	220.09	210.19	215.15	223.19	239.05	257.17	270.43	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	5.82	x	19.64	x	0.63	x	0.7	=	34.93	(76)
East	0.9x	0.77	x	5.82	x	38.42	x	0.63	x	0.7	=	68.34	(76)
East	0.9x	0.77	x	5.82	x	63.27	x	0.63	x	0.7	=	112.54	(76)
East	0.9x	0.77	x	5.82	x	92.28	x	0.63	x	0.7	=	164.14	(76)
East	0.9x	0.77	x	5.82	x	113.09	x	0.63	x	0.7	=	201.15	(76)

East	0.9x	0.77	x	5.82	x	115.77	x	0.63	x	0.7	=	205.92	(76)
East	0.9x	0.77	x	5.82	x	110.22	x	0.63	x	0.7	=	196.04	(76)
East	0.9x	0.77	x	5.82	x	94.68	x	0.63	x	0.7	=	168.4	(76)
East	0.9x	0.77	x	5.82	x	73.59	x	0.63	x	0.7	=	130.89	(76)
East	0.9x	0.77	x	5.82	x	45.59	x	0.63	x	0.7	=	81.09	(76)
East	0.9x	0.77	x	5.82	x	24.49	x	0.63	x	0.7	=	43.56	(76)
East	0.9x	0.77	x	5.82	x	16.15	x	0.63	x	0.7	=	28.73	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	34.93	68.34	112.54	164.14	201.15	205.92	196.04	168.4	130.89	81.09	43.56	28.73	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	313.2	344.76	379.07	414.97	436.4	426	406.23	383.55	354.08	320.14	300.73	299.16	(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	0.92	0.79	0.62	0.67	0.89	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.52	19.66	19.93	20.33	20.66	20.91	20.98	20.97	20.8	20.37	19.92	19.55	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.8	19.81	19.82	19.87	19.88	19.92	19.92	19.93	19.9	19.88	19.86	19.84	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.96	0.89	0.7	0.48	0.54	0.83	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=	18.46	18.62	18.89	19.32	19.64	19.87	19.91	19.92	19.79	19.38	18.91	18.52	(90)

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.95	19.1	19.37	19.79	20.11	20.35	20.41	20.4	20.26	19.84	19.38	19	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.8	18.95	19.22	19.64	19.96	20.2	20.26	20.25	20.11	19.69	19.23	18.85	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.96	0.89	0.72	0.53	0.58	0.84	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	311.86	342.31	373.37	397.98	387.78	307.41	215.25	222.57	298.71	310.58	298.45	298.13	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	985.76	945.76	847.99	682.88	520.73	337.98	220.59	230.62	368.68	572.68	778.19	957.69	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	501.39	405.52	353.12	205.13	98.92	0	0	0	0	195.01	345.41	490.71	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 2595.2 | (98)

Space heating requirement in kWh/m²/year | 51.63 | (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)	501.39	405.52	353.12	205.13	98.92	0	0	0	0	195.01	345.41	490.71		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	552.8	447.1	389.33	226.16	109.06	0	0	0	0	215	380.83	541.03		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2861.3	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208) (215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	150.65	132.58	138.77	123.76	120.81	107.28	102.39	113.23	113.31	128.36	136.54	146.81		
Efficiency of water heater													87	(216)
(217)m=	89.82	89.76	89.62	89.27	88.63	87	87	87	87	89.19	89.62	89.82		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m=	167.73	147.71	154.84	138.63	136.31	123.31	117.69	130.15	130.24	143.91	152.36	163.45		
Total = Sum(219a)$_{1...12}$ =													1706.32	(219)

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			2861.3	
Water heating fuel used			1706.32	
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			260.58	(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	=	618.04	(261)

DER WorkSheet: New dwelling design stage

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	368.57	(264)
Space and water heating	(261) + (262) + (263) + (264) =			986.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	135.24	(268)
Total CO2, kg/year		sum of (265)…(271) =		1160.77	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		23.09	(273)
EI rating (section 14)				84	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 21 PL1A

Address : Flat 21, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	63.52	(1a)	x	2.37	(2a)	=	150.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.52	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	150.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.37	0.36	0.33	0.32	0.28	0.28	0.27	0.3	0.32	0.33	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.4	=	2.968			(26)
Windows			10.8	x1/[1/(1.4)+ 0.04]		=	14.32			(27)
Floor			6.6	x	0.12	=	0.792			(28)
Walls Type1	20.19	0	20.19	x	0.18	=	3.63			(29)
Walls Type2	24.64	10.8	13.84	x	0.18	=	2.49			(29)
Walls Type3	4.47	2.12	2.35	x	0.18	=	0.43			(29)
Roof Type1	24.18	0	24.18	x	0.11	=	2.66			(30)
Roof Type2	45.56	0	45.56	x	0.11	=	5.01			(30)
Roof Type3	7.73	0	7.73	x	0.11	=	0.85			(30)
Total area of elements, m²			133.37							(31)
Party wall			31.63	x	0	=	0			(32)
Party floor			56.91							(32a)
Internal wall **			95.36							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.16 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5468.79 (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 12.1 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 45.26 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.39	28.26	28.12	27.49	27.37	26.81	26.81	26.71	27.03	27.37	27.61	27.86	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.65	73.52	73.38	72.75	72.63	72.07	72.07	71.97	72.29	72.63	72.87	73.12

Average = Sum(39)$_{1…12}$ /12= 72.75 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.16	1.16	1.16	1.15	1.14	1.13	1.13	1.13	1.14	1.14	1.15	1.15

Average = Sum(40)$_{1…12}$ /12= 1.15 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.08 (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 83.58 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	91.94	88.6	85.25	81.91	78.57	75.22	75.22	78.57	81.91	85.25	88.6	91.94

Total = Sum(44)$_{1…12}$ = 1002.98 (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=	136.34	119.25	123.05	107.28	102.94	88.83	82.31	94.45	95.58	111.39	121.59	132.04

Total = Sum(45)$_{1…12}$ = 1315.06 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.45	17.89	18.46	16.09	15.44	13.32	12.35	14.17	14.34	16.71	18.24	19.81	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.11	26.28	29.08	28.12	29.04	28.09	29.02	29.03	28.11	29.07	28.15	29.1	(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=	165.45	145.53	152.13	135.4	131.98	116.92	111.33	123.49	123.69	140.46	149.74	161.15	(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=	165.45	145.53	152.13	135.4	131.98	116.92	111.33	123.49	123.69	140.46	149.74	161.15

Output from water heater (annual)1…12 — 1657.26 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	52.61	46.22	48.18	42.7	41.49	36.56	34.62	38.66	38.81	44.3	47.47	51.18	(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=	103.96	103.96	103.96	103.96	103.96	103.96	103.96	103.96	103.96	103.96	103.96	103.96	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.71	14.84	12.07	9.14	6.83	5.77	6.23	8.1	10.87	13.8	16.11	17.17	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	181.73	183.62	178.86	168.75	155.98	143.97	135.95	134.07	138.82	148.94	161.71	173.71	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.4	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-83.17	-83.17	-83.17	-83.17	-83.17	-83.17	-83.17	-83.17	-83.17	-83.17	-83.17	-83.17	(71)

Water heating gains (Table 5)

(72)m=	70.71	68.78	64.76	59.31	55.76	50.77	46.54	51.97	53.9	59.55	65.93	68.79	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	326.34	324.42	312.88	294.38	275.76	257.7	245.91	251.32	260.78	279.48	300.93	316.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.77	x	10.8	x	46.75	x	0.63	x	0.7	=	154.31	(78)
South	0.9x	0.77	x	10.8	x	76.57	x	0.63	x	0.7	=	252.72	(78)
South	0.9x	0.77	x	10.8	x	97.53	x	0.63	x	0.7	=	321.92	(78)
South	0.9x	0.77	x	10.8	x	110.23	x	0.63	x	0.7	=	363.84	(78)
South	0.9x	0.77	x	10.8	x	114.87	x	0.63	x	0.7	=	379.15	(78)
South	0.9x	0.77	x	10.8	x	110.55	x	0.63	x	0.7	=	364.88	(78)
South	0.9x	0.77	x	10.8	x	108.01	x	0.63	x	0.7	=	356.51	(78)
South	0.9x	0.77	x	10.8	x	104.89	x	0.63	x	0.7	=	346.22	(78)
South	0.9x	0.77	x	10.8	x	101.89	x	0.63	x	0.7	=	336.29	(78)
South	0.9x	0.77	x	10.8	x	82.59	x	0.63	x	0.7	=	272.58	(78)
South	0.9x	0.77	x	10.8	x	55.42	x	0.63	x	0.7	=	182.91	(78)
South	0.9x	0.77	x	10.8	x	40.4	x	0.63	x	0.7	=	133.34	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	154.31	252.72	321.92	363.84	379.15	364.88	356.51	346.22	336.29	272.58	182.91	133.34	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	480.65	577.15	634.81	658.22	654.9	622.58	602.42	597.54	597.07	552.06	483.84	450.2	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.93	0.85	0.69	0.52	0.54	0.75	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.89	20.09	20.34	20.6	20.82	20.95	20.99	20.99	20.93	20.65	20.21	19.85	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.97	19.97	19.96	19.96	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.91	0.8	0.6	0.4	0.43	0.67	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.96	19.16	19.4	19.66	19.85	19.95	19.97	19.97	19.93	19.7	19.28	18.92	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.33	19.53	19.77	20.04	20.24	20.36	20.38	20.38	20.33	20.08	19.65	19.29	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.18	19.38	19.62	19.89	20.09	20.21	20.23	20.23	20.18	19.93	19.5	19.14	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.98	0.95	0.9	0.8	0.62	0.43	0.46	0.69	0.91	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	476.22	564.46	605.58	595.04	526.05	387.03	259.59	272.79	410.59	500.93	473.95	447.1	(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=	1096.11	1064.77	963.1	799.27	609.4	404.02	261.75	275.72	439.74	677.73	903.81	1092.55	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	461.2	336.21	265.99	147.05	62.01	0	0	0	0	131.54	309.5	480.21

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2193.72 (98)

Space heating requirement in kWh/m²/year 34.54 (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)	461.2	336.21	265.99	147.05	62.01	0	0	0	0	131.54	309.5	480.21	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	508.49	370.68	293.27	162.13	68.37	0	0	0	0	145.03	341.23	529.45	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2418.65 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	165.45	145.53	152.13	135.4	131.98	116.92	111.33	123.49	123.69	140.46	149.74	161.15

Efficiency of water heater 87 (216)

(217)m=	89.69	89.55	89.32	88.89	88.15	87	87	87	87	88.75	89.46	89.74	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	184.47	162.51	170.33	152.33	149.72	134.39	127.96	141.94	142.17	158.26	167.39	179.57

Total = Sum(219a)$_{1...12}$ = 1871.03 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2418.65	
Water heating fuel used		1871.03	
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			295.09	(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	=	522.43	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	404.14	(264)
Space and water heating	(261) + (262) + (263) + (264) =			926.57	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	153.15	(268)
Total CO2, kg/year		sum of (265)…(271) =		1118.65	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		17.61	(273)
EI rating (section 14)				86	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 22 PL1A

Address : Flat 22, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	58.97	(1a)	x	2.51	(2a)	=	148.01	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	58.97	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	148.01	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.39	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.37	0.37	0.33	0.32	0.28	0.28	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.56	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(1.4)+ 0.04]		=	7.72			(27)
Floor			3.73	x	0.2	=	0.746			(28)
Walls Type1	14.88	5.82	9.06	x	0.18	=	1.63			(29)
Walls Type2	31.31	2.12	29.19	x	0.18	=	5.38			(29)
Roof Type1	8.79	0	8.79	x	0.11	=	0.97			(30)
Roof Type2	50.82	0	50.82	x	0.11	=	5.59			(30)
Roof Type3	4.43	0	4.43	x	0.11	=	0.49			(30)
Total area of elements, m²			113.96							(31)
Party wall			31.63	x	0	=	0			(32)
Party floor			55.24							(32a)
Internal wall **			96.48							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.9 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 5102.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.6 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = **35.5** (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.96	27.82	27.69	27.05	26.94	26.39	26.39	26.28	26.6	26.94	27.18	27.43	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	63.46	63.33	63.19	62.56	62.44	61.89	61.89	61.79	62.1	62.44	62.68	62.93	

Average = Sum(39)$_{1…12}$ /12= **62.56** (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.07	1.07	1.06	1.06	1.05	1.05	1.05	1.05	1.06	1.06	1.07

Average = Sum(40)$_{1…12}$ /12= **1.06** (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 **1.95** (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 **80.57** (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	88.63	85.4	82.18	78.96	75.73	72.51	72.51	75.73	78.96	82.18	85.4	88.63

Total = Sum(44)$_{1…12}$ = **966.82** (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	131.43	114.95	118.62	103.41	99.23	85.63	79.34	91.05	92.14	107.38	117.21	127.28

Total = Sum(45)$_{1…12}$ = **1267.66** (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	19.71	17.24	17.79	15.51	14.88	12.84	11.9	13.66	13.82	16.11	17.58	19.09	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel **0** (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): **0** (48)

Temperature factor from Table 2b **0** (49)

Energy lost from water storage, kWh/year (48) x (49) = **0** (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) **0** (51)

If community heating see section 4.3

Volume factor from Table 2a **0** (52)

Temperature factor from Table 2b **0** (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = **0** (54)

Enter (50) or (54) in (55) **0** (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.1	26.27	29.07	28.11	29.04	28.08	29.01	29.03	28.1	29.06	28.14	29.09	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	160.53	141.22	147.69	131.53	128.26	113.71	108.35	120.08	120.24	136.43	145.35	156.37	(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=	160.53	141.22	147.69	131.53	128.26	113.71	108.35	120.08	120.24	136.43	145.35	156.37

Output from water heater (annual)1…12 — 1609.75 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	50.97	44.79	46.71	41.41	40.25	35.49	33.63	37.53	37.66	42.97	46.01	49.59	(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=	97.62	97.62	97.62	97.62	97.62	97.62	97.62	97.62	97.62	97.62	97.62	97.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.58	15.62	12.7	9.62	7.19	6.07	6.56	8.52	11.44	14.53	16.95	18.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	170.34	172.11	167.66	158.17	146.2	134.95	127.44	125.67	130.12	139.61	151.58	162.83	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.76	32.76	32.76	32.76	32.76	32.76	32.76	32.76	32.76	32.76	32.76	32.76	(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=	-78.09	-78.09	-78.09	-78.09	-78.09	-78.09	-78.09	-78.09	-78.09	-78.09	-78.09	-78.09	(71)

Water heating gains (Table 5)

(72)m=	68.51	66.65	62.78	57.52	54.1	49.29	45.21	50.44	52.31	57.75	63.9	66.66	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	311.73	309.66	298.42	280.59	262.78	245.6	234.49	239.92	249.15	267.17	287.71	302.84	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
West	0.9x	0.77	x	5.82	x	19.64	x	0.63	x	0.7	=	34.93	(80)
West	0.9x	0.77	x	5.82	x	38.42	x	0.63	x	0.7	=	68.34	(80)
West	0.9x	0.77	x	5.82	x	63.27	x	0.63	x	0.7	=	112.54	(80)
West	0.9x	0.77	x	5.82	x	92.28	x	0.63	x	0.7	=	164.14	(80)
West	0.9x	0.77	x	5.82	x	113.09	x	0.63	x	0.7	=	201.15	(80)
West	0.9x	0.77	x	5.82	x	115.77	x	0.63	x	0.7	=	205.92	(80)
West	0.9x	0.77	x	5.82	x	110.22	x	0.63	x	0.7	=	196.04	(80)
West	0.9x	0.77	x	5.82	x	94.68	x	0.63	x	0.7	=	168.4	(80)
West	0.9x	0.77	x	5.82	x	73.59	x	0.63	x	0.7	=	130.89	(80)
West	0.9x	0.77	x	5.82	x	45.59	x	0.63	x	0.7	=	81.09	(80)
West	0.9x	0.77	x	5.82	x	24.49	x	0.63	x	0.7	=	43.56	(80)
West	0.9x	0.77	x	5.82	x	16.15	x	0.63	x	0.7	=	28.73	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	34.93	68.34	112.54	164.14	201.15	205.92	196.04	168.4	130.89	81.09	43.56	28.73	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	346.66	378	410.96	444.73	463.93	451.52	430.53	408.32	380.04	348.25	331.27	331.57	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.92	0.78	0.61	0.66	0.89	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.85	19.96	20.18	20.48	20.75	20.93	20.99	20.98	20.85	20.5	20.12	19.83	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.03	20.03	20.04	20.04	20.04	20.04	20.03	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.89	0.7	0.49	0.54	0.83	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.97	19.08	19.3	19.6	19.86	20.01	20.04	20.04	19.95	19.63	19.25	18.95	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.38	19.49	19.71	20.01	20.27	20.44	20.48	20.48	20.37	20.04	19.66	19.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.23	19.34	19.56	19.86	20.12	20.29	20.33	20.33	20.22	19.89	19.51	19.21	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	1	0.99	0.99	0.96	0.89	0.72	0.53	0.58	0.84	0.97	0.99	1	(94)

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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	345.59	375.96	405.85	428.36	413.31	326.76	227.1	236.49	320.71	338.9	329.3	330.77	(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=	947.39	914.61	825.25	685.58	526.04	352.08	230.84	242.56	380.24	579.89	777.81	944.55	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	447.74	361.98	312.04	185.2	83.87	0	0	0	0	179.29	322.93	456.66

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2349.7 (98)

Space heating requirement in kWh/m²/year 39.85 (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)	447.74	361.98	312.04	185.2	83.87	0	0	0	0	179.29	322.93	456.66		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	493.64	399.09	344.03	204.19	92.47	0	0	0	0	197.68	356.04	503.48		(211)
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2590.63	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)	160.53	141.22	147.69	131.53	128.26	113.71	108.35	120.08	120.24	136.43	145.35	156.37		
Efficiency of water heater													87	(216)
(217)m=	89.69	89.63	89.48	89.13	88.43	87	87	87	87	89.06	89.52	89.73		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	178.97	157.56	165.05	147.57	145.05	130.7	124.54	138.02	138.2	153.18	162.37	174.28		
Total = Sum(219a)$_{1...12}$ =													1815.5	(219)

Annual totals	kWh/year	kWh/year	
Space heating fuel used, main system 1		2590.63	
Water heating fuel used		1815.5	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)

boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			310.54	(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	=	559.58	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	392.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =			951.73	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	161.17	(268)
Total CO2, kg/year		sum of (265)…(271) =		1151.82	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		19.53	(273)
EI rating (section 14)				85	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 23 PL1A

Address : Flat 23, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	54	(1a)	x	2.52	(2a)	=	136.08	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	136.08	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(1.4)+ 0.04]		=	7.72			(27)
Floor			9.02	x	0.2	=	1.804			(28)
Walls Type1	15.22	5.82	9.4	x	0.18	=	1.69			(29)
Walls Type2	37.3	2.12	35.18	x	0.18	=	6.48			(29)
Roof Type1	6.79	0	6.79	x	0.11	=	0.75			(30)
Roof Type2	46.34	0	46.34	x	0.11	=	5.1			(30)
Roof Type3	4.68	0	4.68	x	0.11	=	0.51			(30)
Total area of elements, m²			119.35							(31)
Party wall			21.6	x	0	=	0			(32)
Party floor			44.98							(32a)
Internal wall **			92.97							(32c)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.44 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4888.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 38.6 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.91	25.77	25.64	25.02	24.91	24.37	24.37	24.27	24.58	24.91	25.14	25.39	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.51	64.38	64.25	63.63	63.51	62.98	62.98	62.88	63.18	63.51	63.75	63.99	

Average = Sum(39)$_{1...12}$ /12= 63.63 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.19	1.18	1.18	1.17	1.17	1.16	1.17	1.18	1.18	1.19	

Average = Sum(40)$_{1...12}$ /12= 1.18 (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 1.81 (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 77.14 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.85	81.77	78.68	75.6	72.51	69.43	69.43	72.51	75.6	78.68	81.77	84.85	

Total = Sum(44)$_{1...12}$ = 925.68 (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=	125.84	110.06	113.57	99.01	95	81.98	75.97	87.17	88.22	102.81	112.22	121.87	

Total = Sum(45)$_{1...12}$ = 1213.71 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.88	16.51	17.04	14.85	14.25	12.3	11.4	13.08	13.23	15.42	16.83	18.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.08	26.26	29.06	28.1	29.03	28.08	29	29.02	28.09	29.04	28.13	29.08	(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=	154.92	136.32	142.63	127.11	124.03	110.06	104.97	116.19	116.31	131.85	140.35	150.94	(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=	154.92	136.32	142.63	127.11	124.03	110.06	104.97	116.19	116.31	131.85	140.35	150.94	

Output from water heater (annual)$_{1...12}$ | 1555.67 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	49.11	43.16	45.03	39.95	38.85	34.28	32.51	36.24	36.35	41.44	44.35	47.79	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	15.97	14.18	11.53	8.73	6.53	5.51	5.95	7.74	10.39	13.19	15.39	16.41	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	157.6	159.24	155.12	146.35	135.27	124.86	117.91	116.27	120.39	129.17	140.24	150.65	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	(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=	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	(71)
Water heating gains (Table 5)													
(72)m=	66.01	64.22	60.52	55.48	52.21	47.61	43.7	48.71	50.49	55.7	61.59	64.23	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	292.7	290.77	280.29	263.68	247.13	231.1	220.68	225.84	234.39	251.18	270.35	284.42	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)
North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.91	36.14	61.42	98.65	132.89	142.27	132.82	105.38	73.84	43.02	23.33	15.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	311.62	326.91	341.71	362.33	380.02	373.37	353.5	331.22	308.24	294.21	293.68	300.18	(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	1	0.99	0.96	0.86	0.72	0.77	0.94	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.68	19.77	19.98	20.29	20.61	20.86	20.96	20.94	20.75	20.36	19.97	19.66	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.93	19.93	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.94	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.93	0.79	0.58	0.64	0.9	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.72	18.82	19.02	19.34	19.65	19.87	19.94	19.93	19.78	19.41	19.03	18.71	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.17	19.27	19.48	19.79	20.1	20.34	20.42	20.41	20.24	19.86	19.47	19.16	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.02	19.12	19.33	19.64	19.95	20.19	20.27	20.26	20.09	19.71	19.32	19.01	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.93	0.81	0.62	0.68	0.9	0.98	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	310.7	325.53	338.99	354.68	354.91	301.29	220.55	226.22	278.9	288.98	292.17	299.45	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	949.83	915.44	823.97	683.08	524	351.94	231.04	242.52	378.35	578.64	779.22	947.62	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	475.51	396.42	360.82	236.45	125.8	0	0	0	0	215.51	350.67	482.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2643.43 (98)

Space heating requirement in kWh/m²/year 48.95 (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)														
	475.51	396.42	360.82	236.45	125.8	0	0	0	0	215.51	350.67	482.24		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	524.27	437.07	397.82	260.7	138.7	0	0	0	0	237.61	386.63	531.69		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													2914.48	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	154.92	136.32	142.63	127.11	124.03	110.06	104.97	116.19	116.31	131.85	140.35	150.94		
Efficiency of water heater													87	(216)
(217)m=	89.76	89.72	89.62	89.37	88.82	87	87	87	87	89.26	89.61	89.79		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	172.59	151.93	159.14	142.23	139.64	126.5	120.66	133.55	133.68	147.72	156.62	168.11		
Total = Sum(219a)$_{1...12}$ =													1752.37	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2914.48	
Water heating fuel used		1752.37	
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				281.99	(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	=	629.53	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	378.51	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1008.04	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	146.35	(268)
Total CO2, kg/year		sum of (265)…(271) =		1193.32	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		22.1	(273)
EI rating (section 14)				84	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 24 PL1A

Address : Flat 24, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	54	(1a)	x	2.51	(2a)	=	135.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	135.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(1.4)+ 0.04]		=	7.72			(27)
Floor			4.53	x	0.2	=	0.9060001			(28)
Walls Type1	15.22	5.82	9.4	x	0.18	=	1.69			(29)
Walls Type2	15.7	2.12	13.58	x	0.18	=	2.5			(29)
Roof Type1	6.79	0	6.79	x	0.11	=	0.75			(30)
Roof Type2	46.34	0	46.34	x	0.11	=	5.1			(30)
Roof Type3	4.68	0	4.68	x	0.11	=	0.51			(30)
Total area of elements, m²			93.26							(31)
Party wall			43.19	x	0	=	0			(32)
Party floor			49.47							(32a)
Internal wall **			92.97							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.57 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4861.09 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.39 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss	(33) + (36) =	32.95	(37)
Ventilation heat loss calculated monthly	(38)m = 0.33 × (25)m x (5)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.82	25.68	25.55	24.93	24.82	24.28	24.28	24.18	24.49	24.82	25.05	25.3	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	58.77	58.63	58.5	57.89	57.77	57.23	57.23	57.13	57.44	57.77	58	58.25	

Average = $Sum(39)_{1...12}$ /12= 57.89 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.08	1.07	1.07	1.06	1.06	1.06	1.06	1.07	1.07	1.08	

Average = $Sum(40)_{1...12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.81 (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 77.14 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	84.85	81.77	78.68	75.6	72.51	69.43	69.43	72.51	75.6	78.68	81.77	84.85	
										Total = $Sum(44)_{1...12}$ =		925.68	(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=	125.84	110.06	113.57	99.01	95	81.98	75.97	87.17	88.22	102.81	112.22	121.87	
										Total = $Sum(45)_{1...12}$ =		1213.71	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.88	16.51	17.04	14.85	14.25	12.3	11.4	13.08	13.23	15.42	16.83	18.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)			
Water storage loss:			
a) If manufacturer’s declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.08	26.26	29.06	28.1	29.03	28.08	29	29.02	28.09	29.04	28.13	29.08	(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=	154.92	136.32	142.63	127.11	124.03	110.06	104.97	116.19	116.31	131.85	140.35	150.94	(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=	154.92	136.32	142.63	127.11	124.03	110.06	104.97	116.19	116.31	131.85	140.35	150.94

Output from water heater (annual)$_{1...12}$ 1555.67 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	49.11	43.16	45.03	39.95	38.85	34.28	32.51	36.24	36.35	41.44	44.35	47.79	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.97	14.18	11.53	8.73	6.53	5.51	5.95	7.74	10.39	13.19	15.39	16.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.6	159.24	155.12	146.35	135.27	124.86	117.91	116.27	120.39	129.17	140.24	150.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	(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=	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	(71)

Water heating gains (Table 5)

(72)m=	66.01	64.22	60.52	55.48	52.21	47.61	43.7	48.71	50.49	55.7	61.59	64.23	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	292.7	290.77	280.29	263.68	247.13	231.1	220.68	225.84	234.39	251.18	270.35	284.42	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)
North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.91	36.14	61.42	98.65	132.89	142.27	132.82	105.38	73.84	43.02	23.33	15.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	311.62	326.91	341.71	362.33	380.02	373.37	353.5	331.22	308.24	294.21	293.68	300.18	(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	1	0.99	0.95	0.83	0.67	0.73	0.93	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	19.91	20.11	20.39	20.69	20.9	20.98	20.96	20.8	20.45	20.09	19.8	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.02	20.03	20.03	20.03	20.04	20.03	20.03	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.92	0.76	0.55	0.61	0.88	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.93	19.03	19.22	19.51	19.8	19.98	20.03	20.02	19.91	19.57	19.22	18.92	(90)

fLA = Living area ÷ (4) = 0.47 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.35	19.44	19.64	19.93	20.22	20.42	20.48	20.47	20.33	19.99	19.63	19.34	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.2	19.29	19.49	19.78	20.07	20.27	20.33	20.32	20.18	19.84	19.48	19.19	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	1	1	0.99	0.98	0.92	0.78	0.59	0.65	0.89	0.98	0.99	1	(94)

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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	310.73	325.55	338.91	353.94	351.16	290.58	207.37	214.2	274.4	288.55	292.17	299.49	(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=	875.78	844.03	759.82	629.75	483.34	324.39	213.21	223.82	349.33	533.75	718.13	873.06	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	420.4	348.42	313.16	198.58	98.34	0	0	0	0	182.43	306.69	426.74

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2294.76 (98)

Space heating requirement in kWh/m²/year 42.5 (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)													
	420.4	348.42	313.16	198.58	98.34	0	0	0	0	182.43	306.69	426.74	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	463.5	384.14	345.27	218.94	108.43	0	0	0	0	201.14	338.14	470.5	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2530.05 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

154.92	136.32	142.63	127.11	124.03	110.06	104.97	116.19	116.31	131.85	140.35	150.94

Efficiency of water heater 87 (216)

(217)m=	89.67	89.63	89.51	89.22	88.6	87	87	87	87	89.11	89.5	89.7	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	172.76	152.09	159.34	142.47	139.99	126.5	120.66	133.55	133.68	147.96	156.81	168.27

Total = Sum(219a)$_{1...12}$ = 1754.1 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2530.05	
Water heating fuel used		1754.1	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)

boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			281.99	(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	=	546.49	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	378.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =			925.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	146.35	(268)
Total CO2, kg/year		sum of (265)…(271) =		1110.65	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		20.57	(273)
EI rating (section 14)				85	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 25 PL1A

Address : Flat 25, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	54	(1a) x	2.51	(2a) =	135.54	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	54	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	135.54	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.6	=	3.392			(26)
Windows			5.82	x1/[1/(1.4)+ 0.04]		=	7.72			(27)
Floor			4.86	x	0.2	=	0.9720001			(28)
Walls Type1	15.22	5.82	9.4	x	0.18	=	1.69			(29)
Walls Type2	15.7	2.12	13.58	x	0.18	=	2.5			(29)
Roof Type1	6.79	0	6.79	x	0.11	=	0.75			(30)
Roof Type2	46.34	0	46.34	x	0.11	=	5.1			(30)
Roof Type3	4.68	0	4.68	x	0.11	=	0.51			(30)
Total area of elements, m²			93.59							(31)
Party wall			43.19	x	0	=	0			(32)
Party floor			49.14							(32a)
Internal wall **			92.97							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 4872.64 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

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Total fabric heat loss (33) + (36) = | 33.38 | (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	25.82	25.68	25.55	24.93	24.82	24.28	24.28	24.18	24.49	24.82	25.05	25.3	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	59.19	59.06	58.93	58.31	58.2	57.66	57.66	57.56	57.87	58.2	58.43	58.67	

Average = $\text{Sum}(39)_{1\ldots12}$ /12= | 58.31 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.09	1.09	1.08	1.08	1.07	1.07	1.07	1.07	1.08	1.08	1.09	

Average = $\text{Sum}(40)_{1\ldots12}$ /12= | 1.08 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 1.81 | (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 | 77.14 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	84.85	81.77	78.68	75.6	72.51	69.43	69.43	72.51	75.6	78.68	81.77	84.85

Total = $\text{Sum}(44)_{1\ldots12}$ = | 925.68 | (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=	125.84	110.06	113.57	99.01	95	81.98	75.97	87.17	88.22	102.81	112.22	121.87

Total = $\text{Sum}(45)_{1\ldots12}$ = | 1213.71 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.88	16.51	17.04	14.85	14.25	12.3	11.4	13.08	13.23	15.42	16.83	18.28	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = | 0 | (54)

Enter (50) or (54) in (55) | 0 | (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.08	26.26	29.06	28.1	29.03	28.08	29	29.02	28.09	29.04	28.13	29.08	(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=	154.92	136.32	142.63	127.11	124.03	110.06	104.97	116.19	116.31	131.85	140.35	150.94	(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=	154.92	136.32	142.63	127.11	124.03	110.06	104.97	116.19	116.31	131.85	140.35	150.94

Output from water heater (annual)$_{1...12}$ | 1555.67 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	49.11	43.16	45.03	39.95	38.85	34.28	32.51	36.24	36.35	41.44	44.35	47.79	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	90.4	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15.97	14.18	11.53	8.73	6.53	5.51	5.95	7.74	10.39	13.19	15.39	16.41	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.6	159.24	155.12	146.35	135.27	124.86	117.91	116.27	120.39	129.17	140.24	150.65	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	32.04	(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=	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	-72.32	(71)

Water heating gains (Table 5)

(72)m=	66.01	64.22	60.52	55.48	52.21	47.61	43.7	48.71	50.49	55.7	61.59	64.23	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	292.7	290.77	280.29	263.68	247.13	231.1	220.68	225.84	234.39	251.18	270.35	284.42	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)
North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	18.91	36.14	61.42	98.65	132.89	142.27	132.82	105.38	73.84	43.02	23.33	15.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	311.62	326.91	341.71	362.33	380.02	373.37	353.5	331.22	308.24	294.21	293.68	300.18	(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	1	0.99	0.95	0.84	0.68	0.74	0.93	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	19.9	20.1	20.39	20.68	20.9	20.98	20.96	20.8	20.45	20.09	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20.01	20.01	20.02	20.02	20.03	20.03	20.03	20.02	20.02	20.02	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.92	0.76	0.55	0.61	0.88	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.92	19.01	19.21	19.5	19.78	19.98	20.02	20.02	19.9	19.56	19.2	18.91	(90)

fLA = Living area ÷ (4) = | 0.47 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.43	19.63	19.92	20.21	20.41	20.47	20.46	20.32	19.98	19.62	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.19	19.28	19.48	19.77	20.06	20.26	20.32	20.31	20.17	19.83	19.47	19.18	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	1	1	0.99	0.98	0.92	0.78	0.59	0.65	0.89	0.98	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	310.73	325.55	338.92	354.01	351.5	291.49	208.42	215.19	274.8	288.59	292.17	299.49	(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=	881.33	849.38	764.63	633.75	486.4	326.47	214.56	225.24	351.52	537.12	722.71	878.65	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	424.53	352.01	316.73	201.41	100.37	0	0	0	0	184.91	309.99	430.9

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2320.85 (98)

Space heating requirement in kWh/m²/year 42.98 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		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)	424.53	352.01	316.73	201.41	100.37	0	0	0	0	184.91	309.99	430.9	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	468.05	388.11	349.21	222.07	110.66	0	0	0	0	203.87	341.77	475.08	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2558.82 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

154.92	136.32	142.63	127.11	124.03	110.06	104.97	116.19	116.31	131.85	140.35	150.94

Efficiency of water heater 87 (216)

(217)m=	89.68	89.64	89.52	89.23	88.62	87	87	87	87	89.12	89.51	89.71	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	172.75	152.08	159.33	142.45	139.96	126.5	120.66	133.55	133.68	147.94	156.79	168.26

Total = Sum(219a)$_{1...12}$ = 1753.95 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2558.82	
Water heating fuel used		1753.95	
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		281.99	(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	=	552.7	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	378.85	(264)
Space and water heating	(261) + (262) + (263) + (264) =			931.56	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	146.35	(268)
Total CO2, kg/year		sum of (265)…(271) =		1116.83	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		20.68	(273)
EI rating (section 14)				85	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 26 PL1A

Address : Flat 26, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	79.55	(1a) x	2.4	(2a) =	190.92	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.55	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	190.92	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.1	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.27	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.35	0.34	0.34	0.3	0.3	0.26	0.26	0.25	0.27	0.3	0.31	0.32

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55	(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			2.12	x	1.6	=	3.392			(26)
Windows Type 1			5.82	x1/[1/(1.4)+ 0.04]		=	7.72			(27)
Windows Type 2			2.91	x1/[1/(1.4)+ 0.04]		=	3.86			(27)
Floor			5.49	x	0.2	=	1.098			(28)
Walls Type1	22.78	8.73	14.05	x	0.18	=	2.53			(29)
Walls Type2	6.94	2.12	4.82	x	0.18	=	0.89			(29)
Roof Type1	26.21	0	26.21	x	0.11	=	2.88			(30)
Roof Type2	61.06	0	61.06	x	0.11	=	6.72			(30)
Roof Type3	7	0	7	x	0.11	=	0.77			(30)
Total area of elements, m²			129.48							(31)
Party wall			51.71	x	0	=	0			(32)
Party floor			74.06							(32a)
Internal wall **			96							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.85 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6384.96 (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 12.1 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.95 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.37	35.22	35.08	34.38	34.25	33.65	33.65	33.54	33.88	34.25	34.52	34.79	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.33	77.18	77.03	76.34	76.21	75.6	75.6	75.49	75.84	76.21	76.47	76.74	

Average = Sum(39)$_{1…12}$ /12= 76.34 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.97	0.96	0.96	0.95	0.95	0.95	0.95	0.96	0.96	0.96	

Average = Sum(40)$_{1…12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.45 (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 92.49 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	101.74	98.04	94.34	90.64	86.94	83.24	83.24	86.94	90.64	94.34	98.04	101.74	

Total = Sum(44)$_{1…12}$ = 1109.87 (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=	150.87	131.96	136.17	118.71	113.91	98.29	91.08	104.52	105.77	123.26	134.55	146.11	

Total = Sum(45)$_{1…12}$ = 1455.21 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.63	19.79	20.42	17.81	17.09	14.74	13.66	15.68	15.87	18.49	20.18	21.92	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.15	26.32	29.12	28.15	29.07	28.11	29.04	29.06	28.13	29.1	28.19	29.14	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	180.02	158.27	165.28	146.86	142.98	126.41	120.12	133.58	133.9	152.36	162.74	175.26	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	180.02	158.27	165.28	146.86	142.98	126.41	120.12	133.58	133.9	152.36	162.74	175.26

Output from water heater (annual)$_{1...12}$ | 1797.78 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	57.45	50.45	52.55	46.51	45.14	39.71	37.54	42.02	42.2	48.26	51.79	55.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	122.71	122.71	122.71	122.71	122.71	122.71	122.71	122.71	122.71	122.71	122.71	122.71	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.05	19.58	15.93	12.06	9.01	7.61	8.22	10.69	14.35	18.21	21.26	22.66	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	218.5	220.76	215.05	202.89	187.53	173.1	163.46	161.19	166.91	179.07	194.43	208.86	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.27	35.27	35.27	35.27	35.27	35.27	35.27	35.27	35.27	35.27	35.27	35.27	(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=	-98.17	-98.17	-98.17	-98.17	-98.17	-98.17	-98.17	-98.17	-98.17	-98.17	-98.17	-98.17	(71)

Water heating gains (Table 5)

(72)m=	77.22	75.08	70.64	64.6	60.68	55.15	50.46	56.48	58.61	64.86	71.92	75.09	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	380.58	378.24	364.43	342.36	320.04	298.68	284.96	291.17	302.68	324.96	350.42	369.43	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.82	x	10.63	x	0.63	x	0.7	=	18.91	(74)
North	0.9x	0.77	x	5.82	x	20.32	x	0.63	x	0.7	=	36.14	(74)
North	0.9x	0.77	x	5.82	x	34.53	x	0.63	x	0.7	=	61.42	(74)
North	0.9x	0.77	x	5.82	x	55.46	x	0.63	x	0.7	=	98.65	(74)
North	0.9x	0.77	x	5.82	x	74.72	x	0.63	x	0.7	=	132.89	(74)
North	0.9x	0.77	x	5.82	x	79.99	x	0.63	x	0.7	=	142.27	(74)
North	0.9x	0.77	x	5.82	x	74.68	x	0.63	x	0.7	=	132.82	(74)
North	0.9x	0.77	x	5.82	x	59.25	x	0.63	x	0.7	=	105.38	(74)
North	0.9x	0.77	x	5.82	x	41.52	x	0.63	x	0.7	=	73.84	(74)
North	0.9x	0.77	x	5.82	x	24.19	x	0.63	x	0.7	=	43.02	(74)
North	0.9x	0.77	x	5.82	x	13.12	x	0.63	x	0.7	=	23.33	(74)
North	0.9x	0.77	x	5.82	x	8.86	x	0.63	x	0.7	=	15.77	(74)
Northeast	0.9x	0.77	x	2.91	x	11.28	x	0.63	x	0.7	=	10.03	(75)
Northeast	0.9x	0.77	x	2.91	x	22.97	x	0.63	x	0.7	=	20.43	(75)
Northeast	0.9x	0.77	x	2.91	x	41.38	x	0.63	x	0.7	=	36.8	(75)
Northeast	0.9x	0.77	x	2.91	x	67.96	x	0.63	x	0.7	=	60.44	(75)
Northeast	0.9x	0.77	x	2.91	x	91.35	x	0.63	x	0.7	=	81.24	(75)
Northeast	0.9x	0.77	x	2.91	x	97.38	x	0.63	x	0.7	=	86.61	(75)
Northeast	0.9x	0.77	x	2.91	x	91.1	x	0.63	x	0.7	=	81.02	(75)
Northeast	0.9x	0.77	x	2.91	x	72.63	x	0.63	x	0.7	=	64.59	(75)
Northeast	0.9x	0.77	x	2.91	x	50.42	x	0.63	x	0.7	=	44.84	(75)
Northeast	0.9x	0.77	x	2.91	x	28.07	x	0.63	x	0.7	=	24.96	(75)
Northeast	0.9x	0.77	x	2.91	x	14.2	x	0.63	x	0.7	=	12.63	(75)
Northeast	0.9x	0.77	x	2.91	x	9.21	x	0.63	x	0.7	=	8.19	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	28.95	56.57	98.22	159.09	214.13	228.87	213.84	169.97	118.68	67.99	35.96	23.96	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	409.53	434.81	462.65	501.44	534.17	527.55	498.81	461.14	421.37	392.95	386.38	393.39	(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	1	0.99	0.94	0.82	0.64	0.71	0.93	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.01	20.2	20.48	20.75	20.93	20.99	20.98	20.84	20.51	20.17	19.91	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.12	20.12	20.12	20.13	20.12	20.12	20.12	20.11	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.98	0.92	0.74	0.53	0.6	0.89	0.99	1	1	(89)

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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.11	19.21	19.39	19.67	19.93	20.09	20.12	20.12	20.02	19.71	19.37	19.1	(90)

fLA = Living area ÷ (4) = 0.59 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.59	19.68	19.87	20.15	20.42	20.59	20.63	20.63	20.5	20.18	19.84	19.58	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.44	19.53	19.72	20	20.27	20.44	20.48	20.48	20.35	20.03	19.69	19.43	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.92	0.77	0.58	0.65	0.9	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	408.9	433.73	459.99	491.51	493.77	405.58	287.97	297.53	379.03	387.59	385.24	392.91	(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=	1170.87	1129.25	1018.18	847.03	652.78	441.42	293.48	307.64	474.23	718.52	963	1168.44	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	566.9	467.39	415.29	255.97	118.31	0	0	0	0	246.21	415.99	576.99	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3063.05 (98)

Space heating requirement in kWh/m²/year 38.5 (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)													
	566.9	467.39	415.29	255.97	118.31	0	0	0	0	246.21	415.99	576.99	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	625.03	515.31	457.87	282.22	130.44	0	0	0	0	271.45	458.64	636.16	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3377.12 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

180.02	158.27	165.28	146.86	142.98	126.41	120.12	133.58	133.9	152.36	162.74	175.26

Efficiency of water heater 87 (216)

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(217)m=	89.78	89.73	89.61	89.32	88.64	87	87	87	87	89.25	89.63	89.81	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	200.52	176.38	184.44	164.43	161.31	145.29	138.07	153.54	153.91	170.71	181.57	195.14

Total = Sum(219a)$_{1...12}$ = 2025.31 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3377.12	
Water heating fuel used			2025.31	
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			389.41	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	729.46	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	437.47	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1166.92	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	202.1	(268)
Total CO2, kg/year		sum of (265)…(271) =		1407.95	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		17.7	(273)
EI rating (section 14)				85	(274)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Andrew Mitchell	**Stroma Number:**	STRO001070
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.17

Property Address: 03-19-74836 Flat 27 PL1A

Address : Flat 27, 26 Stonehills

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.66	(1a) x	2.5	(2a) =	179.15	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.66	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	179.15	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.11	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.36	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.28	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.36	0.35	0.34	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.32	0.33

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.55	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.55	(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			2.12	x	1.6	=	3.392			(26)
Windows			8.74	x1/[1/(1.4)+ 0.04]		=	11.59			(27)
Floor			5.85	x	0.2	=	1.17			(28)
Walls Type1	22.68	8.74	13.94	x	0.18	=	2.51			(29)
Walls Type2	36.75	2.12	34.63	x	0.18	=	6.38			(29)
Roof Type1	10.9	0	10.9	x	0.11	=	1.2			(30)
Roof Type2	59.93	0	59.93	x	0.11	=	6.59			(30)
Roof Type3	6.95	0	6.95	x	0.11	=	0.76			(30)
Total area of elements, m²			143.06							(31)
Party wall			30.12	x	0	=	0			(32)
Party floor			65.81							(32a)
Internal wall **			127.2							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.59 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 6198.35 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.93 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 46.52 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.33	33.19	33.04	32.37	32.24	31.66	31.66	31.55	31.88	32.24	32.5	32.77	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	79.85	79.71	79.56	78.89	78.76	78.17	78.17	78.07	78.4	78.76	79.02	79.28	

Average = $Sum(39)_{1...12}$ /12= 78.89 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.11	1.11	1.1	1.1	1.09	1.09	1.09	1.09	1.1	1.1	1.11	

Average = $Sum(40)_{1...12}$ /12= 1.1 (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 2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.49 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	97.34	93.8	90.26	86.72	83.18	79.64	79.64	83.18	86.72	90.26	93.8	97.34	

Total = $Sum(44)_{1...12}$ = 1061.84 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.34	126.25	130.27	113.58	108.98	94.04	87.14	100	101.19	117.93	128.73	139.79	

Total = $Sum(45)_{1...12}$ = 1392.24 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.65	18.94	19.54	17.04	16.35	14.11	13.07	15	15.18	17.69	19.31	20.97	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	29.13	26.3	29.1	28.14	29.06	28.1	29.03	29.05	28.12	29.08	28.17	29.13	(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=	173.48	152.55	159.37	141.71	138.04	122.14	116.17	129.04	129.31	147.01	156.9	168.92	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	173.48	152.55	159.37	141.71	138.04	122.14	116.17	129.04	129.31	147.01	156.9	168.92

Output from water heater (annual)$_{1...12}$ 1734.64 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	55.28	48.55	50.59	44.8	43.5	38.29	36.23	40.51	40.68	46.48	49.84	53.76	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.29	114.29	114.29	114.29	114.29	114.29	114.29	114.29	114.29	114.29	114.29	114.29	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.83	17.61	14.33	10.85	8.11	6.84	7.4	9.61	12.9	16.38	19.12	20.38	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.14	203.23	197.97	186.77	172.64	159.35	150.48	148.39	153.65	164.85	178.98	192.27	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	34.43	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.43	-91.43	-91.43	-91.43	-91.43	-91.43	-91.43	-91.43	-91.43	-91.43	-91.43	-91.43	(71)

Water heating gains (Table 5)

(72)m=	74.3	72.25	68	62.22	58.47	53.19	48.7	54.45	56.49	62.48	69.23	72.26	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	355.56	353.38	340.58	320.12	299.5	279.67	266.86	272.74	283.33	303.99	327.62	345.2	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x 0.77	x	8.74	x	19.64	x	0.63	x	0.7	=	52.46	(76)
East	0.9x 0.77	x	8.74	x	38.42	x	0.63	x	0.7	=	102.62	(76)
East	0.9x 0.77	x	8.74	x	63.27	x	0.63	x	0.7	=	169.01	(76)
East	0.9x 0.77	x	8.74	x	92.28	x	0.63	x	0.7	=	246.49	(76)
East	0.9x 0.77	x	8.74	x	113.09	x	0.63	x	0.7	=	302.08	(76)
East	0.9x 0.77	x	8.74	x	115.77	x	0.63	x	0.7	=	309.23	(76)
East	0.9x 0.77	x	8.74	x	110.22	x	0.63	x	0.7	=	294.4	(76)
East	0.9x 0.77	x	8.74	x	94.68	x	0.63	x	0.7	=	252.88	(76)
East	0.9x 0.77	x	8.74	x	73.59	x	0.63	x	0.7	=	196.56	(76)
East	0.9x 0.77	x	8.74	x	45.59	x	0.63	x	0.7	=	121.77	(76)
East	0.9x 0.77	x	8.74	x	24.49	x	0.63	x	0.7	=	65.41	(76)
East	0.9x 0.77	x	8.74	x	16.15	x	0.63	x	0.7	=	43.14	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	52.46	102.62	169.01	246.49	302.08	309.23	294.4	252.88	196.56	121.77	65.41	43.14	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	408.02	456	509.58	566.61	601.57	588.9	561.26	525.62	479.89	425.76	393.03	388.34	(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	0.91	0.76	0.59	0.65	0.89	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.91	20.14	20.47	20.75	20.93	20.99	20.98	20.85	20.47	20.07	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	19.99	20	20	20.01	20.01	20.01	20.01	20	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.87	0.68	0.47	0.53	0.82	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.87	19	19.24	19.56	19.83	19.98	20	20	19.92	19.57	19.17	18.85	(90)

fLA = Living area ÷ (4) = 0.35 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.19	19.32	19.56	19.88	20.15	20.31	20.35	20.34	20.24	19.89	19.48	19.17	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.04	19.17	19.41	19.73	20	20.16	20.2	20.19	20.09	19.74	19.33	19.02	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	1	0.99	0.99	0.96	0.87	0.69	0.49	0.55	0.83	0.97	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	406.88	453.55	502.63	542.18	524.54	407.48	277.46	289.62	398.52	414.03	390.85	387.5	(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, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1177.04	1137.33	1026.89	854.22	654.02	434.75	281.26	296.17	469.75	719.57	966.58	1174.84	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	573	459.5	390.05	224.67	96.34	0	0	0	0	227.32	414.53	585.78

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2971.18 (98)

Space heating requirement in kWh/m²/year 41.46 (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)	573	459.5	390.05	224.67	96.34	0	0	0	0	227.32	414.53	585.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	631.75	506.61	430.04	247.71	106.21	0	0	0	0	250.63	457.03	645.84	(211)

Total (kWh/year) =$Sum(211)_{1...5,10...12}$= 3275.83 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =$Sum(215)_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

173.48	152.55	159.37	141.71	138.04	122.14	116.17	129.04	129.31	147.01	156.9	168.92

Efficiency of water heater 87 (216)

(217)m=	89.81	89.75	89.59	89.23	88.48	87	87	87	87	89.21	89.65	89.84	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	193.16	169.97	177.88	158.81	156	140.39	133.53	148.33	148.63	164.79	175.01	188.01

Total = $Sum(219a)_{1...12}$ = 1954.52 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3275.83	
Water heating fuel used		1954.52	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)

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boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		350.24	(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	=	707.58	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	422.18	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1129.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	181.78	(268)
Total CO2, kg/year		sum of (265)…(271) =		1350.46	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		18.85	(273)
EI rating (section 14)				84	(274)