

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 30 October 2024 at 11:20:09

Project Information:

Assessed By: John Ashe (STRO031268)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 52.22m²

Site Reference : Victoria Mill, Stockport

Plot Reference: N1 Victoria Mill, Stockport

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

32.94 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

55.71 kg/m²

Fail

Excess emissions = 22.77 kg/m² (69.1 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

64.4 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

81.1 kWh/m²

Fail

Excess energy = 16.65 kg/m² (25.8 %)

2 Fabric U-values

Element

Average

Highest

External wall

0.19 (max. 0.30)

0.19 (max. 0.70)

OK

Floor

0.16 (max. 0.25)

0.16 (max. 0.70)

OK

Roof

(no roof)

Openings

1.60 (max. 2.00)

1.60 (max. 3.30)

OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals

15.00

OK

4 Heating efficiency

Main Heating system:

Electric storage systems - electric
Modern (slimline) storage heaters with Celect-type control

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

No cylinder

6 Controls

Space heating controls

Controls for high heat retention storage heaters

OK

Hot water controls:

No cylinder thermostat
No cylinder

Regulations Compliance Report

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines):	Not assessed	?
-----------------------------------	--------------	---

10 Key features

None

Thermal Bridge Report

Property Details: N1 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

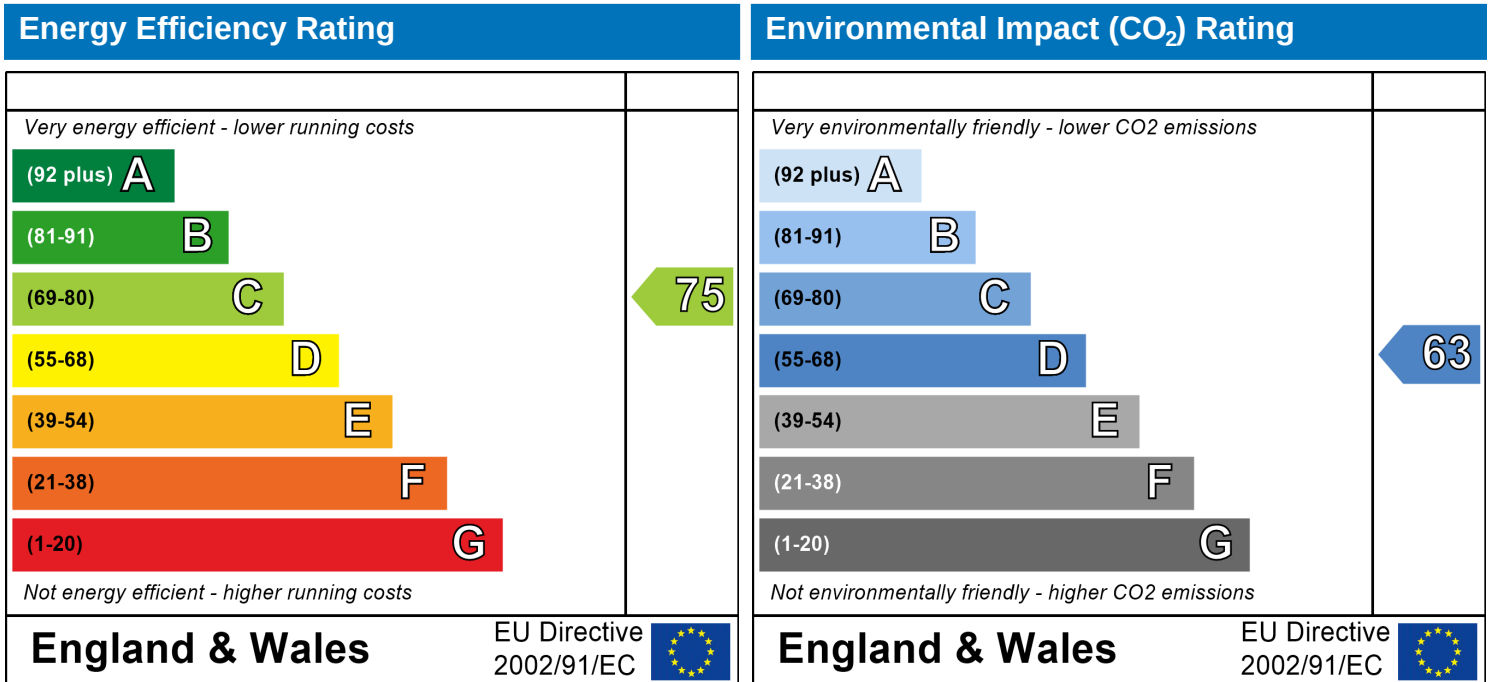
Predicted Energy Assessment

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

Ground floor Flat
30 October 2024
John Ashe
52.22 m²

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

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



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

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

Developer Confirmation Report

Property Details: N1 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines
UPRN:
Date of assessment: 30 October 2024
Date of certificate: 30 October 2024
Assessment type: New dwelling design stage
Transaction type: New dwelling
Thermal Mass Parameter: Indicative Value Low
Comments:

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2023
Front of dwelling faces: North
Comments:

Opening types:

Name:	Type:	Frame Factor:	g-value:	U-Value:	Area:
Windows	Windows	0.7	0.63	1.6	13

Overshading: Average or unknown
Comments:

Opaque Elements:

Type:	U-Value:	Kappa:
<u>External Elements</u>		
Walls	0.19 Please provide the U-Value calculation to justify the U-Value entered into the assessment.	N/A

Materials Used:

Type:	Name:	Thickness:	Conductivity:	R-Value:
Walls	Internal Surface Resistance	0	0	0.13
Walls	Plaster (Lightweight) (0 mm)	3	0.18	0.02
Walls	Plasterboard Standard (0 mm)	12.5	0.21	0.06

Developer Confirmation Report

Walls	Thermawall TW50 (100 mm)	100	0.022	4.55
Walls	Plaster Dabs Cavity (15 mm)	15	0	0.17
Walls	Brickwork Outer Leaf - BRE (102.5 mm)	300	0.77	0.39
Walls	External Surface Resistance	0	0	0.04

Comments:

GF 0.16 Please provide the U-Value calculation to justify the U-Value entered into the assessment. N/A

Internal Elements (Area, Kappa)

Party Elements (Area, Kappa)

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Comments:

If specific construction details have been adopted then please provide the associated checklists; signed and dated.

Ventilation:

Pressure test: No (Assumed)
Ventilation: Natural ventilation (extract fans)
Pressure test: 15

Comments:

Please provide the pressure test certificate, or certificates if the result is based on an average; signed and dated.

Main heating system:

Main heating system: Electric storage systems
Off-peak tariffs
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 405
Modern (slimline) storage heaters with Celect-type control
Systems with radiators

Comments:

Main heating Control:

Developer Confirmation Report

Main heating Control:

Controls for high heat retention storage heaters

Comments:

Secondary heating system:

Secondary heating system:

None

Comments:

Water heating:

Water heating:

No hot water cylinder

Comments:

Solar panel: False

Others:

Electricity tariff:

7-Hour Tariff

Low energy lights:

100%

Terrain type:

Low rise urban / suburban

Wind turbine:

No

Photovoltaics:

None

Comments:

Please provide the MCS certificate or data sheet equivalent confirming the size of the array on the roof. This should include any calculations to support a proportioned amount included in the assessment.

Declaration :

I confirm that the property has been built to the above specification.

Signed:

.....

Date:

.....

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N1 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	52.22 (1a) x	4 (2a) =	208.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.22 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.88 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.75 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.58 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

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

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

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

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			13	$\times 1/[1/(1.6) + 0.04] =$	19.55		(27)
Floor			52.22	$\times$ 0.16	8.3552		(28)
Walls	50.03	13	37.03	$\times$ 0.19	7.04		(29)
Total area of elements, m²			102.25				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34.94 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 6077.47 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 15.34 (36)

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

Total fabric heat loss (33) + (36) = 50.28 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	53.39	52.66	51.94	48.55	47.92	44.97	44.97	44.43	46.11	47.92	49.2	50.54

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

(39)m=	103.67	102.94	102.22	98.83	98.2	95.25	95.25	94.71	96.39	98.2	99.48	100.82
	Average = Sum(39) _{1...12} /12= 98.83											(39)

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

(40)m=	1.99	1.97	1.96	1.89	1.88	1.82	1.82	1.81	1.85	1.88	1.91	1.93
	Average = Sum(40) _{1...12} /12= 1.89											(40)

SAP WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.76 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.89 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	83.48	80.45	77.41	74.38	71.34	68.31	68.31	71.34	74.38	77.41	80.45	83.48	
Total = Sum(44) _{1...12} =												910.73	(44)

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

(45)m=	123.8	108.28	111.74	97.41	93.47	80.66	74.74	85.77	86.79	101.15	110.41	119.9	
Total = Sum(45) _{1...12} =												1194.12	(45)

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

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

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

SAP WorkSheet: New dwelling design stage

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

(62)m=	105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91	(62)
--------	--------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	--------	------

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

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

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

Output from water heater

(64)m=	105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91	
Output from water heater (annual) _{1...12}												1015	(64)

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

(65)m=	26.31	23.01	23.74	20.7	19.86	17.14	15.88	18.23	18.44	21.49	23.46	25.48	(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=	105.33	105.33	105.33	105.33	105.33	105.33	105.33	105.33	105.33	105.33	105.33	105.33	(66)

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

(67)m=	34.1	30.29	24.63	18.65	13.94	11.77	12.72	16.53	22.18	28.17	32.88	35.05	(67)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(68)m=	228.35	230.72	224.75	212.04	195.99	180.91	170.83	168.47	174.44	187.15	203.2	218.28	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(69)m=	47.29	47.29	47.29	47.29	47.29	47.29	47.29	47.29	47.29	47.29	47.29	47.29	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.36	34.24	31.91	28.75	26.7	23.81	21.35	24.5	25.62	28.89	32.59	34.25	(72)
--------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	------

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

(73)m=	380.21	377.65	363.7	341.84	319.03	298.88	287.3	291.89	304.64	326.61	351.06	369.97	(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	13	x	19.64	x	0.63	x	0.7	=	78.03	(76)		
East	0.9x	0.77	x	13	x	38.42	x	0.63	x	0.7	=	152.64	(76)		
East	0.9x	0.77	x	13	x	63.27	x	0.63	x	0.7	=	251.38	(76)		
East	0.9x	0.77	x	13	x	92.28	x	0.63	x	0.7	=	366.63	(76)		
East	0.9x	0.77	x	13	x	113.09	x	0.63	x	0.7	=	449.31	(76)		
East	0.9x	0.77	x	13	x	115.77	x	0.63	x	0.7	=	459.95	(76)		
East	0.9x	0.77	x	13	x	110.22	x	0.63	x	0.7	=	437.89	(76)		
East	0.9x	0.77	x	13	x	94.68	x	0.63	x	0.7	=	376.14	(76)		

SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	13	x	73.59	x	0.63	x	0.7	=	292.37	(76)
East	0.9x	0.77	x	13	x	45.59	x	0.63	x	0.7	=	181.12	(76)
East	0.9x	0.77	x	13	x	24.49	x	0.63	x	0.7	=	97.29	(76)
East	0.9x	0.77	x	13	x	16.15	x	0.63	x	0.7	=	64.17	(76)

Solar gains in watts, calculated for each month

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

(83)m=	78.03	152.64	251.38	366.63	449.31	459.95	437.89	376.14	292.37	181.12	97.29	64.17	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	458.24	530.29	615.08	708.46	768.34	758.84	725.19	668.03	597	507.73	448.35	434.14	(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=	0.94	0.92	0.89	0.82	0.72	0.59	0.48	0.52	0.7	0.86	0.92	0.95	(86)

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

(87)m=	19.3	19.43	19.67	20.01	20.29	20.51	20.6	20.59	20.41	20.04	19.63	19.3	(87)
--------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	------

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

(88)m=	19.34	19.35	19.36	19.41	19.41	19.45	19.45	19.46	19.44	19.41	19.4	19.38	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(89)m=	0.93	0.91	0.86	0.78	0.66	0.5	0.34	0.38	0.62	0.82	0.91	0.94	(89)
--------	------	------	------	------	------	-----	------	------	------	------	------	------	------

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

(90)m=	17.14	17.34	17.68	18.18	18.55	18.86	18.95	18.95	18.74	18.24	17.65	17.16	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.41

(91)

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

(92)m=	18.02	18.19	18.49	18.92	19.26	19.53	19.62	19.61	19.42	18.97	18.45	18.03	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.02	18.19	18.49	18.92	19.26	19.53	19.62	19.61	19.42	18.97	18.45	18.03	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.92	0.9	0.85	0.77	0.65	0.5	0.36	0.4	0.62	0.81	0.9	0.93	(94)
--------	------	-----	------	------	------	-----	------	-----	------	------	-----	------	------

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

(95)m=	422.13	475.2	522.9	543.8	502.02	380.43	259.26	267.1	367.31	409.9	401.64	402.75	(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=	1421.86	1367.71	1225.71	990.3	742.18	469.27	288.05	304.42	512.82	822.01	1129.5	1394.37	(97)
--------	---------	---------	---------	-------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	743.8	599.77	522.89	321.49	178.68	0	0	0	0	306.61	524.06	737.76	(98)
--------	-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

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

3935.05

Space heating requirement in kWh/m²/year

75.36

(99)

SAP WorkSheet: New dwelling design stage

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		100	(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)

743.8	599.77	522.89	321.49	178.68	0	0	0	0	306.61	524.06	737.76
-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

743.8	599.77	522.89	321.49	178.68	0	0	0	0	306.61	524.06	737.76
-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

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

3935.05 (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
---------	---	---	---	---	---	---	---	---	---	---	---

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

0 (215)

Water heating

Output from water heater (calculated above)

105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91
--------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	--------

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91
---------	--------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	--------

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

1015 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3935.05
Water heating fuel used		1015

Electricity for pumps, fans and electric keep-hot

Total electricity for the above, kWh/year sum of (230a)...(230g) = 0 (231)

Electricity for lighting 240.88 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 5190.93 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	5.5	x 0.01 = 216.43 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	15.29	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	14.31	x 0.01 = 145.26 (247)
Pumps, fans and electric keep-hot	(231)	0	x 0.01 = 0 (249)

SAP WorkSheet: New dwelling design stage

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting (232) 14.31 x 0.01 = 34.47 (250)

Additional standing charges (Table 12) 24 (251)

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

Total energy cost (245)...(247) + (250)...(254) = 420.16 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12) 0.42 (256)

Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] = 1.82 (257)

SAP rating (Section 12) 74.68 (258)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1) (211) x	0.519	=	2042.29 (261)
Space heating (secondary) (215) x	0.519	=	0 (263)
Water heating (219) x	0.519	=	526.78 (264)
Space and water heating (261) + (262) + (263) + (264) =			2569.08 (265)
Electricity for pumps, fans and electric keep-hot (231) x	0.519	=	0 (267)
Electricity for lighting (232) x	0.519	=	125.02 (268)
Total CO2, kg/year		sum of (265)...(271) =	2694.09 (272)
CO2 emissions per m²		(272) ÷ (4) =	51.59 (273)
El rating (section 14)			63 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1) (211) x	3.07	=	12080.61 (261)
Space heating (secondary) (215) x	3.07	=	0 (263)
Energy for water heating (219) x	3.07	=	3116.05 (264)
Space and water heating (261) + (262) + (263) + (264) =			15196.66 (265)
Electricity for pumps, fans and electric keep-hot (231) x	3.07	=	0 (267)
Electricity for lighting (232) x	0	=	739.51 (268)
'Total Primary Energy		sum of (265)...(271) =	15936.17 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	305.17 (273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N1 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	<input type="text" value="52.22"/> (1a) x	<input type="text" value="4"/> (2a) =	<input type="text" value="208.88"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="52.22"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="208.88"/> (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="20"/> ÷ (5) =	<input type="text" value="0.1"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		<input type="text" value="0"/> (9)
Additional infiltration	[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0		<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped		<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		<input type="text" value="5"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		<input type="text" value="0.35"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		<input type="text" value="3"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	<input type="text" value="0.78"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	<input type="text" value="0.27"/> (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TFEE WorkSheet: New dwelling design stage

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

0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31
------	------	------	------	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.56 0.56 0.55 0.54 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 0.55 0.54 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
Windows			13	$\times 1/[1/(1.4) + 0.04] =$	17.23		(27)
Floor			52.22	$\times$ 0.13	6.7886		(28)
Walls	50.03	13	37.03	$\times$ 0.18	6.67		(29)
Total area of elements, m²			102.25				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 30.69 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 6077.47 (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 5.11 (36)

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

Total fabric heat loss (33) + (36) = 35.8 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	38.49	38.33	38.18	37.46	37.32	36.7	36.7	36.58	36.94	37.32	37.6	37.88

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

(39)m=	74.29	74.13	73.98	73.26	73.13	72.5	72.5	72.38	72.74	73.13	73.4	73.68
	Average = Sum(39) _{1...12} /12= 73.26											(39)

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

(40)m=	1.42	1.42	1.42	1.4	1.4	1.39	1.39	1.39	1.39	1.4	1.41	1.41
	Average = Sum(40) _{1...12} /12= 1.4											(40)

TFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.76 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.89 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	83.48	80.45	77.41	74.38	71.34	68.31	68.31	71.34	74.38	77.41	80.45	83.48	
Total = Sum(44) _{1...12} =												910.73	(44)

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

(45)m=	123.8	108.28	111.74	97.41	93.47	80.66	74.74	85.77	86.79	101.15	110.41	119.9	
Total = Sum(45) _{1...12} =												1194.12	(45)

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

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

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

TFEE WorkSheet: New dwelling design stage

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

(62)m=	105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91	(62)
--------	--------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	--------	------

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

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

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

Output from water heater

(64)m=	105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91	
Output from water heater (annual) _{1...12}												1015	(64)

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

(65)m=	26.31	23.01	23.74	20.7	19.86	17.14	15.88	18.23	18.44	21.49	23.46	25.48	(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=	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	(66)

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

(67)m=	13.64	12.11	9.85	7.46	5.58	4.71	5.09	6.61	8.87	11.27	13.15	14.02	(67)
--------	-------	-------	------	------	------	------	------	------	------	-------	-------	-------	------

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

(68)m=	153	154.58	150.58	142.07	131.31	121.21	114.46	112.87	116.87	125.39	136.14	146.25	(68)
--------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.36	34.24	31.91	28.75	26.7	23.81	21.35	24.5	25.62	28.89	32.59	34.25	(72)
--------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	------

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

(73)m=	251.33	250.27	241.68	227.61	212.92	199.06	190.23	193.31	200.7	214.88	231.21	243.84	(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	13	x	19.64	x	0.63	x	0.7	=	78.03	(76)		
East	0.9x	0.77	x	13	x	38.42	x	0.63	x	0.7	=	152.64	(76)		
East	0.9x	0.77	x	13	x	63.27	x	0.63	x	0.7	=	251.38	(76)		
East	0.9x	0.77	x	13	x	92.28	x	0.63	x	0.7	=	366.63	(76)		
East	0.9x	0.77	x	13	x	113.09	x	0.63	x	0.7	=	449.31	(76)		
East	0.9x	0.77	x	13	x	115.77	x	0.63	x	0.7	=	459.95	(76)		
East	0.9x	0.77	x	13	x	110.22	x	0.63	x	0.7	=	437.89	(76)		
East	0.9x	0.77	x	13	x	94.68	x	0.63	x	0.7	=	376.14	(76)		

TFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	13	x	73.59	x	0.63	x	0.7	=	292.37	(76)
East	0.9x	0.77	x	13	x	45.59	x	0.63	x	0.7	=	181.12	(76)
East	0.9x	0.77	x	13	x	24.49	x	0.63	x	0.7	=	97.29	(76)
East	0.9x	0.77	x	13	x	16.15	x	0.63	x	0.7	=	64.17	(76)

Solar gains in watts, calculated for each month

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

(83)m=	78.03	152.64	251.38	366.63	449.31	459.95	437.89	376.14	292.37	181.12	97.29	64.17	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	329.36	402.92	493.06	594.23	662.23	659.01	628.12	569.46	493.06	396	328.51	308.01	(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	0.93	0.82	0.65	0.49	0.56	0.82	0.97	0.99	1	(86)

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

(87)m=	19.44	19.64	19.99	20.43	20.77	20.94	20.99	20.98	20.83	20.35	19.81	19.4	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(88)m=	19.75	19.75	19.75	19.76	19.76	19.77	19.77	19.77	19.77	19.76	19.76	19.75	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	1	0.99	0.97	0.91	0.76	0.55	0.36	0.42	0.73	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=	18.34	18.55	18.89	19.32	19.62	19.75	19.77	19.77	19.68	19.26	18.72	18.31	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.41

(91)

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

(92)m=	18.79	18.99	19.34	19.77	20.08	20.23	20.26	20.26	20.15	19.7	19.16	18.76	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(93)m=	18.79	18.99	19.34	19.77	20.08	20.23	20.26	20.26	20.15	19.7	19.16	18.76	(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	0.97	0.91	0.78	0.59	0.42	0.48	0.76	0.95	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

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

(95)m=	327.87	398.62	478.14	539.91	515.88	387.14	261.89	272.7	376.33	377.71	325.57	306.96	(95)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1076.26	1044.59	949.75	796.46	613.1	408.28	265.6	279.31	440	665.8	885.48	1072.6	(97)
--------	---------	---------	--------	--------	-------	--------	-------	--------	-----	-------	--------	--------	------

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

(98)m=	556.8	434.1	350.87	184.71	72.33	0	0	0	0	214.33	403.14	569.63	(98)
--------	-------	-------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

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

2785.92

Space heating requirement in kWh/m²/year

53.35

(99)

TFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

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

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

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

(100)m=	0	0	0	0	0	681.5	536.5	550.12	0	0	0	0	(100)
---------	---	---	---	---	---	-------	-------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.89	0.93	0.91	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

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

(102)m=	0	0	0	0	0	603.37	500.9	499.46	0	0	0	0	(102)
---------	---	---	---	---	---	--------	-------	--------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	836.49	799.12	731.54	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

(104)m=	0	0	0	0	0	167.85	221.88	172.67	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = Sum(104) = 562.39 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

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

Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	41.96	55.47	43.17	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 140.6 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 2.69 (108)

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

Fabric Energy Efficiency (99) + (108) = 56.04 (109)

Target Fabric Energy Efficiency (TFEE) 64.45 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N1 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	52.22 (1a)	4 (2a)	208.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.22 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.88 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.85 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.66 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DFEE WorkSheet: New dwelling design stage

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

0.84	0.82	0.8	0.72	0.7	0.62	0.62	0.61	0.66	0.7	0.74	0.77
------	------	-----	------	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.85 0.84 0.82 0.76 0.75 0.69 0.69 0.68 0.71 0.75 0.77 0.8 (24d)

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

(25)m= 0.85 0.84 0.82 0.76 0.75 0.69 0.69 0.68 0.71 0.75 0.77 0.8 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			13	$\times 1/[1/(1.6) + 0.04] =$	19.55		(27)
Floor			52.22	$\times$ 0.16	8.3552		(28)
Walls	50.03	13	37.03	$\times$ 0.19	7.04		(29)
Total area of elements, m²			102.25				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34.94 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 6077.47 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 15.34 (36)

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

Total fabric heat loss (33) + (36) = 50.28 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	58.54	57.6	56.68	52.38	51.58	47.83	47.83	47.13	49.27	51.58	53.21	54.91

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

(39)m=	108.81	107.88	106.96	102.66	101.85	98.11	98.11	97.41	99.55	101.85	103.48	105.19
	Average = Sum(39) _{1...12} /12= 102.66											(39)

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

(40)m=	2.08	2.07	2.05	1.97	1.95	1.88	1.88	1.87	1.91	1.95	1.98	2.01
	Average = Sum(40) _{1...12} /12= 1.97											(40)

DFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.76 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.89 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	83.48	80.45	77.41	74.38	71.34	68.31	68.31	71.34	74.38	77.41	80.45	83.48	
Total = Sum(44) _{1...12} =												910.73	(44)

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

(45)m=	123.8	108.28	111.74	97.41	93.47	80.66	74.74	85.77	86.79	101.15	110.41	119.9	
Total = Sum(45) _{1...12} =												1194.12	(45)

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

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

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

DFEE WorkSheet: New dwelling design stage

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

(62)m=	105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91	(62)
--------	--------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	--------	------

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

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

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

Output from water heater

(64)m=	105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91	
Output from water heater (annual) _{1...12}												1015	(64)

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

(65)m=	26.31	23.01	23.74	20.7	19.86	17.14	15.88	18.23	18.44	21.49	23.46	25.48	(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=	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	(66)

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

(67)m=	13.64	12.11	9.85	7.46	5.58	4.71	5.09	6.61	8.87	11.27	13.15	14.02	(67)
--------	-------	-------	------	------	------	------	------	------	------	-------	-------	-------	------

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

(68)m=	153	154.58	150.58	142.07	131.31	121.21	114.46	112.87	116.87	125.39	136.14	146.25	(68)
--------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.36	34.24	31.91	28.75	26.7	23.81	21.35	24.5	25.62	28.89	32.59	34.25	(72)
--------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	------

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

(73)m=	251.33	250.27	241.68	227.61	212.92	199.06	190.23	193.31	200.7	214.88	231.21	243.84	(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	13	x	19.64	x	0.63	x	0.7	=	78.03	(76)		
East	0.9x	0.77	x	13	x	38.42	x	0.63	x	0.7	=	152.64	(76)		
East	0.9x	0.77	x	13	x	63.27	x	0.63	x	0.7	=	251.38	(76)		
East	0.9x	0.77	x	13	x	92.28	x	0.63	x	0.7	=	366.63	(76)		
East	0.9x	0.77	x	13	x	113.09	x	0.63	x	0.7	=	449.31	(76)		
East	0.9x	0.77	x	13	x	115.77	x	0.63	x	0.7	=	459.95	(76)		
East	0.9x	0.77	x	13	x	110.22	x	0.63	x	0.7	=	437.89	(76)		
East	0.9x	0.77	x	13	x	94.68	x	0.63	x	0.7	=	376.14	(76)		

DFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	13	x	73.59	x	0.63	x	0.7	=	292.37	(76)
East	0.9x	0.77	x	13	x	45.59	x	0.63	x	0.7	=	181.12	(76)
East	0.9x	0.77	x	13	x	24.49	x	0.63	x	0.7	=	97.29	(76)
East	0.9x	0.77	x	13	x	16.15	x	0.63	x	0.7	=	64.17	(76)

Solar gains in watts, calculated for each month

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

(83)m=	78.03	152.64	251.38	366.63	449.31	459.95	437.89	376.14	292.37	181.12	97.29	64.17	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	329.36	402.92	493.06	594.23	662.23	659.01	628.12	569.46	493.06	396	328.51	308.01	(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=	0.97	0.95	0.92	0.86	0.77	0.65	0.54	0.58	0.77	0.9	0.96	0.97	(86)

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

(87)m=	17.14	17.5	18.15	19.05	19.83	20.45	20.74	20.68	20.16	19.12	18.02	17.15	(87)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.28	19.29	19.3	19.36	19.37	19.42	19.42	19.42	19.4	19.37	19.35	19.32	(88)
--------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.96	0.94	0.9	0.83	0.71	0.55	0.39	0.44	0.69	0.87	0.94	0.97	(89)
--------	------	------	-----	------	------	------	------	------	------	------	------	------	------

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

(90)m=	15.9	16.26	16.9	17.81	18.54	19.12	19.33	19.3	18.88	17.91	16.81	15.93	(90)
--------	------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.41

(91)

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

(92)m=	16.4	16.76	17.41	18.31	19.07	19.66	19.9	19.86	19.4	18.4	17.3	16.42	(92)
--------	------	-------	-------	-------	-------	-------	------	-------	------	------	------	-------	------

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

(93)m=	16.4	16.76	17.41	18.31	19.07	19.66	19.9	19.86	19.4	18.4	17.3	16.42	(93)
--------	------	-------	-------	-------	-------	-------	------	-------	------	------	------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.94	0.92	0.88	0.8	0.7	0.57	0.44	0.48	0.69	0.85	0.93	0.95	(94)
--------	------	------	------	-----	-----	------	------	------	------	------	------	------	------

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

(95)m=	311.01	370.94	432.91	477.28	464.43	374.17	274.95	276.18	338.19	337.37	304.06	292.69	(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=	1317.14	1279.58	1166.68	966.53	750.33	496.4	323.79	337.43	527.99	794.54	1055.76	1285.78	(97)
--------	---------	---------	---------	--------	--------	-------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	748.56	610.6	545.93	352.26	212.71	0	0	0	0	340.13	541.23	738.86	(98)
--------	--------	-------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

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

4090.28

Space heating requirement in kWh/m²/year

78.33

(99)

DFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

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

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

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

(100)m=	0	0	0	0	0	922.19	725.98	740.33	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.63	0.7	0.66	0	0	0	0	(101)
---------	---	---	---	---	---	------	-----	------	---	---	---	---	-------

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

(102)m=	0	0	0	0	0	582.98	505.6	490	0	0	0	0	(102)
---------	---	---	---	---	---	--------	-------	-----	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	836.49	799.12	731.54	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

(104)m=	0	0	0	0	0	182.53	218.38	179.7	0	0	0	0	
---------	---	---	---	---	---	--------	--------	-------	---	---	---	---	--

Total = Sum(104) = 580.61 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

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

Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	45.63	54.59	44.93	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 145.15 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 2.78 (108)

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

Fabric Energy Efficiency (99) + (108) = 81.11 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N1 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	52.22 (1a)	4 (2a)	208.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.22 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.88 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.75 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.58 (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

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

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

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			13	$\times 1/[1/(1.6) + 0.04] =$	19.55		(27)
Floor			52.22	$\times$ 0.16	8.3552		(28)
Walls	50.03	13	37.03	$\times$ 0.19	7.04		(29)
Total area of elements, m²			102.25				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34.94 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 6077.47 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 15.34 (36)

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

Total fabric heat loss (33) + (36) = 50.28 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	53.39	52.66	51.94	48.55	47.92	44.97	44.97	44.43	46.11	47.92	49.2	50.54

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

(39)m=	103.67	102.94	102.22	98.83	98.2	95.25	95.25	94.71	96.39	98.2	99.48	100.82
	Average = Sum(39) _{1...12} /12= 98.83											(39)

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

(40)m=	1.99	1.97	1.96	1.89	1.88	1.82	1.82	1.81	1.85	1.88	1.91	1.93
	Average = Sum(40) _{1...12} /12= 1.89											(40)

DER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.76 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.89 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	83.48	80.45	77.41	74.38	71.34	68.31	68.31	71.34	74.38	77.41	80.45	83.48	
Total = Sum(44) _{1...12} =												910.73	(44)

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

(45)m=	123.8	108.28	111.74	97.41	93.47	80.66	74.74	85.77	86.79	101.15	110.41	119.9	
Total = Sum(45) _{1...12} =												1194.12	(45)

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

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

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

DER WorkSheet: New dwelling design stage

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

(62)m=	105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91	(62)
--------	--------	-------	-------	------	-------	-------	-------	------	-------	-------	-------	--------	------

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

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

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

Output from water heater

(64)m=	105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91	
Output from water heater (annual) _{1...12}												1015	(64)

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

(65)m=	26.31	23.01	23.74	20.7	19.86	17.14	15.88	18.23	18.44	21.49	23.46	25.48	(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=	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	(66)

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

(67)m=	13.64	12.11	9.85	7.46	5.58	4.71	5.09	6.61	8.87	11.27	13.15	14.02	(67)
--------	-------	-------	------	------	------	------	------	------	------	-------	-------	-------	------

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

(68)m=	153	154.58	150.58	142.07	131.31	121.21	114.46	112.87	116.87	125.39	136.14	146.25	(68)
--------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.36	34.24	31.91	28.75	26.7	23.81	21.35	24.5	25.62	28.89	32.59	34.25	(72)
--------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	------

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

(73)m=	251.33	250.27	241.68	227.61	212.92	199.06	190.23	193.31	200.7	214.88	231.21	243.84	(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	13	x	19.64	x	0.63	x	0.7	=	78.03	(76)
East	0.9x	0.77	x	13	x	38.42	x	0.63	x	0.7	=	152.64	(76)
East	0.9x	0.77	x	13	x	63.27	x	0.63	x	0.7	=	251.38	(76)
East	0.9x	0.77	x	13	x	92.28	x	0.63	x	0.7	=	366.63	(76)
East	0.9x	0.77	x	13	x	113.09	x	0.63	x	0.7	=	449.31	(76)
East	0.9x	0.77	x	13	x	115.77	x	0.63	x	0.7	=	459.95	(76)
East	0.9x	0.77	x	13	x	110.22	x	0.63	x	0.7	=	437.89	(76)
East	0.9x	0.77	x	13	x	94.68	x	0.63	x	0.7	=	376.14	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	13	x	73.59	x	0.63	x	0.7	=	292.37	(76)
East	0.9x	0.77	x	13	x	45.59	x	0.63	x	0.7	=	181.12	(76)
East	0.9x	0.77	x	13	x	24.49	x	0.63	x	0.7	=	97.29	(76)
East	0.9x	0.77	x	13	x	16.15	x	0.63	x	0.7	=	64.17	(76)

Solar gains in watts, calculated for each month

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

(83)m=	78.03	152.64	251.38	366.63	449.31	459.95	437.89	376.14	292.37	181.12	97.29	64.17	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	329.36	402.92	493.06	594.23	662.23	659.01	628.12	569.46	493.06	396	328.51	308.01	(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=	0.97	0.95	0.92	0.86	0.76	0.64	0.53	0.58	0.76	0.9	0.95	0.97	(86)

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

(87)m=	19.18	19.32	19.57	19.93	20.23	20.48	20.59	20.56	20.36	19.95	19.52	19.17	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.34	19.35	19.36	19.41	19.41	19.45	19.45	19.46	19.44	19.41	19.4	19.38	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(89)m=	0.96	0.94	0.9	0.83	0.71	0.55	0.38	0.44	0.68	0.87	0.94	0.97	(89)
--------	------	------	-----	------	------	------	------	------	------	------	------	------	------

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

(90)m=	16.97	17.18	17.55	18.08	18.49	18.83	18.94	18.93	18.69	18.13	17.5	16.99	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =

0.41

(91)

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

(92)m=	17.87	18.05	18.37	18.83	19.2	19.5	19.61	19.6	19.37	18.87	18.32	17.88	(92)
--------	-------	-------	-------	-------	------	------	-------	------	-------	-------	-------	-------	------

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

(93)m=	17.87	18.05	18.37	18.83	19.2	19.5	19.61	19.6	19.37	18.87	18.32	17.88	(93)
--------	-------	-------	-------	-------	------	------	-------	------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.95	0.93	0.89	0.81	0.7	0.55	0.4	0.45	0.68	0.86	0.94	0.96	(94)
--------	------	------	------	------	-----	------	-----	------	------	------	------	------	------

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

(95)m=	313.89	375.14	438.49	482.22	463.35	361.56	251.39	256.34	333.76	340.75	307.16	295.18	(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=	1406.39	1353.36	1213.51	981.45	736.62	466.56	286.84	302.79	507.97	812.09	1116.13	1379.2	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	--------	------

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

(98)m=	812.82	657.36	576.62	359.44	203.31	0	0	0	0	350.68	582.45	806.51	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

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

4349.21

Space heating requirement in kWh/m²/year

83.29

(99)

DER WorkSheet: New dwelling design stage

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		100	(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)

812.82	657.36	576.62	359.44	203.31	0	0	0	0	350.68	582.45	806.51	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												(211)
812.82	657.36	576.62	359.44	203.31	0	0	0	0	350.68	582.45	806.51	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												4349.21
												(211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91	
Efficiency of water heater												100
(217)m =	100	100	100	100	100	100	100	100	100	100	100	
												(217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	105.23	92.04	94.98	82.8	79.45	68.56	63.53	72.9	73.77	85.97	93.85	101.91		
Total = Sum(219a) _{1...12} =													1015	(219)

Annual totals

		kWh/year	kWh/year
Space heating fuel used, main system 1		4349.21	
Water heating fuel used		1015	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		240.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5605.09	(338)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.519	= 2257.24
Space heating (secondary)	(215) ×	0.519	= 0
Water heating	(219) ×	0.519	= 526.78
Space and water heating	(261) + (262) + (263) + (264) =		2784.02
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	= 0

DER WorkSheet: New dwelling design stage

Electricity for lighting	(232) x	0.519	=	125.02	(268)
Total CO2, kg/year		sum of (265)...(271) =			2909.04 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			55.71 (273)
EI rating (section 14)				60	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N1 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	52.22 (1a) x	4 (2a) =	208.88 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.22 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.88 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20 ÷ (5) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.35 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.27 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

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

0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31
------	------	------	------	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.56 0.56 0.55 0.54 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 0.55 0.54 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
Windows			13	$\times 1/[1/(1.4) + 0.04] =$	17.23		(27)
Floor			52.22	$\times$ 0.13	6.7886		(28)
Walls	50.03	13	37.03	$\times$ 0.18	6.67		(29)
Total area of elements, m²			102.25				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 30.69 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 6077.47 (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 5.11 (36)

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

Total fabric heat loss (33) + (36) = 35.8 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	38.49	38.33	38.18	37.46	37.32	36.7	36.7	36.58	36.94	37.32	37.6	37.88

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

(39)m= 74.29 74.13 73.98 73.26 73.13 72.5 72.5 72.38 72.74 73.13 73.4 73.68
Average = Sum(39)_{1...12} /12= 73.26 (39)

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

(40)m= 1.42 1.42 1.42 1.4 1.4 1.39 1.39 1.39 1.39 1.4 1.41 1.41
Average = Sum(40)_{1...12} /12= 1.4 (40)

TER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.76 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.89 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	83.48	80.45	77.41	74.38	71.34	68.31	68.31	71.34	74.38	77.41	80.45	83.48	
Total = Sum(44) _{1...12} =												910.73	(44)

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

(45)m=	123.8	108.28	111.74	97.41	93.47	80.66	74.74	85.77	86.79	101.15	110.41	119.9	
Total = Sum(45) _{1...12} =												1194.12	(45)

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

(46)m=	18.57	16.24	16.76	14.61	14.02	12.1	11.21	12.87	13.02	15.17	16.56	17.98	(46)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

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

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

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

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

TER WorkSheet: New dwelling design stage

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

(62)m=	170.4	150.37	158.33	142.51	140.07	125.75	121.34	132.36	131.88	147.74	155.5	166.49	(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=	170.4	150.37	158.33	142.51	140.07	125.75	121.34	132.36	131.88	147.74	155.5	166.49	
Output from water heater (annual) _{1...12}												1742.73	(64)

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

(65)m=	78.44	69.67	74.43	68.46	68.35	62.89	62.13	65.79	64.93	70.91	72.78	77.14	(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=	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	87.78	(66)

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

(67)m=	13.64	12.11	9.85	7.46	5.58	4.71	5.09	6.61	8.87	11.27	13.15	14.02	(67)
--------	-------	-------	------	------	------	------	------	------	------	-------	-------	-------	------

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

(68)m=	153	154.58	150.58	142.07	131.31	121.21	114.46	112.87	116.87	125.39	136.14	146.25	(68)
--------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	31.78	(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=	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	-70.22	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	105.43	103.68	100.04	95.09	91.87	87.35	83.5	88.43	90.18	95.31	101.09	103.69	(72)
--------	--------	--------	--------	-------	-------	-------	------	-------	-------	-------	--------	--------	------

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

(73)m=	324.4	322.71	312.81	296.95	281.1	265.6	255.38	260.25	268.26	284.3	302.71	316.28	(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	13	x	19.64	x	0.63	x	0.7	=	78.03 (76)
East	0.9x	0.77	x	13	x	38.42	x	0.63	x	0.7	=	152.64 (76)
East	0.9x	0.77	x	13	x	63.27	x	0.63	x	0.7	=	251.38 (76)
East	0.9x	0.77	x	13	x	92.28	x	0.63	x	0.7	=	366.63 (76)
East	0.9x	0.77	x	13	x	113.09	x	0.63	x	0.7	=	449.31 (76)
East	0.9x	0.77	x	13	x	115.77	x	0.63	x	0.7	=	459.95 (76)
East	0.9x	0.77	x	13	x	110.22	x	0.63	x	0.7	=	437.89 (76)
East	0.9x	0.77	x	13	x	94.68	x	0.63	x	0.7	=	376.14 (76)

TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	13	x	73.59	x	0.63	x	0.7	=	292.37	(76)
East	0.9x	0.77	x	13	x	45.59	x	0.63	x	0.7	=	181.12	(76)
East	0.9x	0.77	x	13	x	24.49	x	0.63	x	0.7	=	97.29	(76)
East	0.9x	0.77	x	13	x	16.15	x	0.63	x	0.7	=	64.17	(76)

Solar gains in watts, calculated for each month

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

(83)m=	78.03	152.64	251.38	366.63	449.31	459.95	437.89	376.14	292.37	181.12	97.29	64.17	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	402.43	475.35	564.19	663.57	730.41	725.55	693.28	636.39	560.63	465.42	400.01	380.45	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.91	0.78	0.6	0.45	0.51	0.76	0.95	0.99	1	(86)

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

(87)m=	19.56	19.76	20.1	20.51	20.81	20.95	20.99	20.98	20.87	20.45	19.93	19.53	(87)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.75	19.75	19.75	19.76	19.76	19.77	19.77	19.77	19.77	19.76	19.76	19.75	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.96	0.88	0.72	0.5	0.33	0.38	0.67	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=	17.87	18.16	18.65	19.22	19.6	19.75	19.77	19.77	19.68	19.16	18.41	17.82	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.41

(91)

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

(92)m=	18.56	18.81	19.24	19.75	20.09	20.24	20.27	20.26	20.16	19.69	19.03	18.52	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.56	18.81	19.24	19.75	20.09	20.24	20.27	20.26	20.16	19.69	19.03	18.52	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.88	0.73	0.54	0.38	0.43	0.7	0.92	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

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

(95)m=	398.34	465.74	537	581.63	536.76	393.12	263.15	275.08	394.86	429.95	392.37	377.35	(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=	1059.09	1031.15	942.17	794.64	613.53	408.67	265.73	279.54	441.13	664.39	875.46	1054.81	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

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

(98)m=	491.6	379.96	301.45	153.37	57.11	0	0	0	0	174.42	347.83	504.03	(98)
--------	-------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

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

2409.76

Space heating requirement in kWh/m²/year

46.15

(99)

TER WorkSheet: New dwelling design stage

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

Space heating:

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

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

Space heating requirement (calculated above)

491.6	379.96	301.45	153.37	57.11	0	0	0	0	174.42	347.83	504.03
-------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

525.77	406.37	322.41	164.03	61.09	0	0	0	0	186.54	372.01	539.07
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1...5,10...12} = 2577.29 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

170.4	150.37	158.33	142.51	140.07	125.75	121.34	132.36	131.88	147.74	155.5	166.49
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Efficiency of water heater 79.8 (216)

(217)m=	87.48	87.19	86.51	85.01	82.63	79.8	79.8	79.8	79.8	85.26	86.9	87.58	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	194.79	172.47	183.03	167.63	169.51	157.58	152.05	165.87	165.27	173.29	178.94	190.1	Total = Sum(219a) _{1...12} = 2070.52 (219)
---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	---

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	2577.29	
Water heating fuel used	2070.52	

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 240.88 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 4963.69 (338)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.216	= 556.69 (261)
Space heating (secondary)	(215) ×	0.519	= 0 (263)
Water heating	(219) ×	0.216	= 447.23 (264)

TER WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			1003.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	125.02	(268)
Total CO2, kg/year	sum of (265)...(271) =			1167.87	(272)
TER	=			32.94	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 30 October 2024 at 11:20:05

Project Information:

Assessed By: John Ashe (STRO031268)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 71.73m²

Site Reference : Victoria Mill, Stockport

Plot Reference: N2 Victoria Mill, Stockport

Address :

Client Details:

Name:

Address :

**This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.**

1a TER and DER

Fuel for main heating system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

28.99 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

50.45 kg/m²

Fail

Excess emissions = 21.46 kg/m² (74 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

59.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

76.0 kWh/m²

Fail

Excess energy = 16.70 kg/m² (28.2 %)

2 Fabric U-values

Element

Average

Highest

External wall

0.19 (max. 0.30)

0.19 (max. 0.70)

OK

Floor

0.16 (max. 0.25)

0.16 (max. 0.70)

OK

Roof

(no roof)

Openings

1.60 (max. 2.00)

1.60 (max. 3.30)

OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals

15.00

OK

4 Heating efficiency

Main Heating system:

Electric storage systems - electric
Modern (slimline) storage heaters with Celect-type control

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

No cylinder

6 Controls

Space heating controls

Controls for high heat retention storage heaters

OK

Hot water controls:

No cylinder thermostat
No cylinder

Regulations Compliance Report

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines):	Not assessed	?
-----------------------------------	--------------	---

10 Key features

None

Thermal Bridge Report

Property Details: N2 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

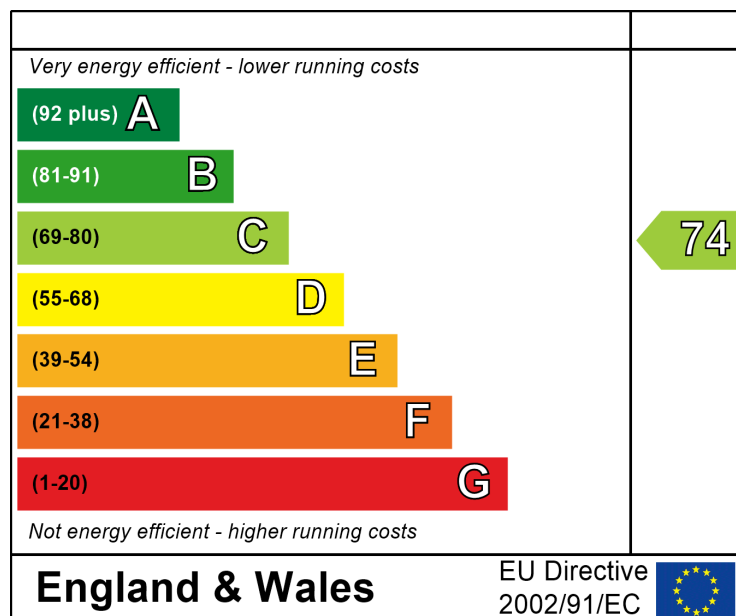
Predicted Energy Assessment

Dwelling type: Ground floor Flat
Date of assessment: 30 October 2024
Produced by: John Ashe
Total floor area: 71.73 m²

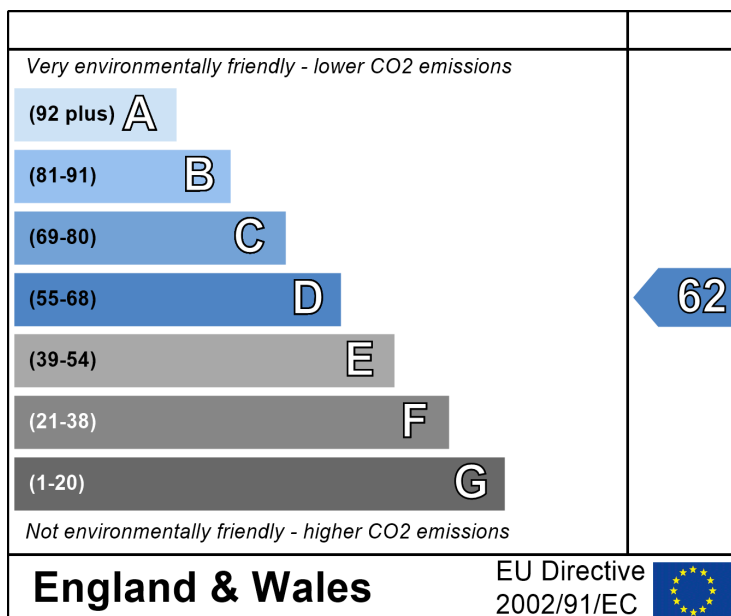
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

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

Energy Efficiency Rating



Environmental Impact (CO₂) Rating



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

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

Developer Confirmation Report

Property Details: N2 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines
UPRN:
Date of assessment: 30 October 2024
Date of certificate: 30 October 2024
Assessment type: New dwelling design stage
Transaction type: New dwelling
Thermal Mass Parameter: Indicative Value Low
Comments:

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2024
Front of dwelling faces: North
Comments:

Opening types:

Name:	Type:	Frame Factor:	g-value:	U-Value:	Area:
Windows	Windows	0.7	0.63	1.6	19.5

Overshading: Average or unknown
Comments:

Opaque Elements:

Type:	U-Value:	Kappa:
<u>External Elements</u>		
Walls	0.19 Please provide the U-Value calculation to justify the U-Value entered into the assessment.	N/A

Materials Used:	Name:	Thickness:	Conductivity:	R-Value:
Type:				
Walls	Internal Surface Resistance	0	0	0.13
Walls	Plaster (Lightweight) (0 mm)	3	0.18	0.02
Walls	Plasterboard Standard (0 mm)	12.5	0.21	0.06

Developer Confirmation Report

Walls	Thermawall TW50 (100 mm)	100	0.022	4.55
Walls	Plaster Dabs Cavity (15 mm)	15	0	0.17
Walls	Brickwork Outer Leaf - BRE (102.5 mm)	300	0.77	0.39
Walls	External Surface Resistance	0	0	0.04

Comments:

GF 0.16 Please provide the U-Value calculation to justify the U-Value entered into the assessment. N/A

Internal Elements (Area, Kappa)

Party Elements (Area, Kappa)

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Comments:

If specific construction details have been adopted then please provide the associated checklists; signed and dated.

Ventilation:

Pressure test: No (Assumed)
Ventilation: Natural ventilation (extract fans)
Pressure test: 15

Comments:

Please provide the pressure test certificate, or certificates if the result is based on an average; signed and dated.

Main heating system:

Main heating system: Electric storage systems
Off-peak tariffs
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 405
Modern (slimline) storage heaters with Celect-type control
Systems with radiators

Comments:

Main heating Control:

Developer Confirmation Report

Main heating Control:

Controls for high heat retention storage heaters

Comments:

Secondary heating system:

Secondary heating system:

None

Comments:

Water heating:

Water heating:

No hot water cylinder

Comments:

Solar panel: False

Others:

Electricity tariff:

7-Hour Tariff

Low energy lights:

100%

Terrain type:

Low rise urban / suburban

Wind turbine:

No

Photovoltaics:

None

Comments:

Please provide the MCS certificate or data sheet equivalent confirming the size of the array on the roof. This should include any calculations to support a proportioned amount included in the assessment.

Declaration :

I confirm that the property has been built to the above specification.

Signed:

.....

Date:

.....

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N2 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	<input type="text" value="71.73"/> (1a)	<input type="text" value="4"/> (2a)	<input type="text" value="286.92"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="71.73"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="286.92"/> (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="0"/>	÷ (5) =	<input type="text" value="0"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="15"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			<input type="text" value="0.75"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="3"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="0.78"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.58"/> (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

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

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

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

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			19.5	$\times 1/[1/(1.6) + 0.04] =$	29.32		(27)
Floor			71.73	$\times$ 0.16	11.4768		(28)
Walls	34.48	19.5	14.98	$\times$ 0.19	2.85		(29)
Total area of elements, m²			106.21				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 43.65 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 8025.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 15.93 (36)

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

Total fabric heat loss (33) + (36) = 59.58 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	73.34	72.33	71.34	66.7	65.83	61.78	61.78	61.03	63.34	65.83	67.58	69.42

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

(39)m=	132.92	131.91	130.92	126.27	125.4	121.35	121.35	120.6	122.91	125.4	127.16	129
Average = Sum(39) _{1...12} /12=												126.27

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

(40)m=	1.85	1.84	1.83	1.76	1.75	1.69	1.69	1.68	1.71	1.75	1.77	1.8
Average = Sum(40) _{1...12} /12=												1.76

SAP WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.29 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 88.53 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	97.38	93.84	90.3	86.75	83.21	79.67	79.67	83.21	86.75	90.3	93.84	97.38	
Total = Sum(44) _{1...12} =												1062.3	(44)

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

(45)m=	144.41	126.3	130.33	113.63	109.03	94.08	87.18	100.04	101.24	117.98	128.78	139.85	
Total = Sum(45) _{1...12} =												1392.85	(45)

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

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

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

SAP WorkSheet: New dwelling design stage

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

(62)m=	122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87	(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=	122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87	
Output from water heater (annual) _{1...12}												1183.92	(64)

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

(65)m=	30.69	26.84	27.7	24.15	23.17	19.99	18.53	21.26	21.51	25.07	27.37	29.72	(65)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	137.24	137.24	137.24	137.24	137.24	137.24	137.24	137.24	137.24	137.24	137.24	137.24	(66)

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

(67)m=	44.87	39.85	32.41	24.53	18.34	15.48	16.73	21.75	29.19	37.06	43.26	46.11	(67)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(68)m=	300.45	303.57	295.71	278.98	257.87	238.03	224.77	221.65	229.51	246.24	267.35	287.19	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	51.01	51.01	51.01	51.01	51.01	51.01	51.01	51.01	51.01	51.01	51.01	51.01	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	(71)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water heating gains (Table 5)

(72)m=	41.25	39.94	37.22	33.54	31.14	27.77	24.9	28.57	29.88	33.7	38.01	39.94	(72)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	------

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

(73)m=	483.32	480.11	462.1	433.81	404.11	378.04	363.16	368.73	385.34	413.75	445.37	470.01	(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	19.5	x	19.64	x	0.63	x	0.7	=	117.05	(76)	
East	0.9x	0.77	x	19.5	x	38.42	x	0.63	x	0.7	=	228.97	(76)	
East	0.9x	0.77	x	19.5	x	63.27	x	0.63	x	0.7	=	377.07	(76)	
East	0.9x	0.77	x	19.5	x	92.28	x	0.63	x	0.7	=	549.94	(76)	
East	0.9x	0.77	x	19.5	x	113.09	x	0.63	x	0.7	=	673.97	(76)	
East	0.9x	0.77	x	19.5	x	115.77	x	0.63	x	0.7	=	689.93	(76)	
East	0.9x	0.77	x	19.5	x	110.22	x	0.63	x	0.7	=	656.84	(76)	
East	0.9x	0.77	x	19.5	x	94.68	x	0.63	x	0.7	=	564.22	(76)	

SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	19.5	x	73.59	x	0.63	x	0.7	=	438.55	(76)
East	0.9x	0.77	x	19.5	x	45.59	x	0.63	x	0.7	=	271.69	(76)
East	0.9x	0.77	x	19.5	x	24.49	x	0.63	x	0.7	=	145.94	(76)
East	0.9x	0.77	x	19.5	x	16.15	x	0.63	x	0.7	=	96.25	(76)

Solar gains in watts, calculated for each month

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

(83)m=	117.05	228.97	377.07	549.94	673.97	689.93	656.84	564.22	438.55	271.69	145.94	96.25	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(84)m=	600.36	709.08	839.17	983.75	1078.08	1067.97	1020	932.95	823.89	685.44	591.31	566.26	(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=	0.95	0.92	0.88	0.8	0.7	0.56	0.45	0.49	0.69	0.85	0.93	0.95	(86)

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

(87)m=	19.36	19.5	19.75	20.08	20.35	20.55	20.63	20.62	20.46	20.1	19.69	19.36	(87)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

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

(88)m=	19.43	19.44	19.45	19.5	19.51	19.55	19.55	19.55	19.53	19.51	19.49	19.47	(88)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.94	0.91	0.86	0.77	0.64	0.47	0.32	0.37	0.6	0.82	0.91	0.94	(89)
--------	------	------	------	------	------	------	------	------	-----	------	------	------	------

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

(90)m=	17.29	17.5	17.85	18.35	18.71	18.99	19.07	19.07	18.88	18.39	17.8	17.32	(90)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =

0.4

(91)

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

(92)m=	18.11	18.29	18.61	19.04	19.36	19.61	19.69	19.68	19.5	19.07	18.55	18.13	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(93)m=	18.11	18.29	18.61	19.04	19.36	19.61	19.69	19.68	19.5	19.07	18.55	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=	0.93	0.9	0.85	0.76	0.63	0.48	0.34	0.38	0.6	0.8	0.9	0.93	(94)
--------	------	-----	------	------	------	------	------	------	-----	-----	-----	------	------

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

(95)m=	555.56	636.49	710.62	743.58	683.12	510.33	344.5	355.46	494.73	551.74	531.86	527.89	(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=	1835.9	1766.94	1585.11	1280.31	960.75	607.76	375.05	395.92	664.3	1061.82	1456.24	1797.08	(97)
--------	--------	---------	---------	---------	--------	--------	--------	--------	-------	---------	---------	---------	------

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

(98)m=	952.57	759.67	650.62	386.45	206.56	0	0	0	0	379.5	665.55	944.27	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------	------

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

4945.19

Space heating requirement in kWh/m²/year

68.94

(99)

SAP WorkSheet: New dwelling design stage

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		100	(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)

952.57	759.67	650.62	386.45	206.56	0	0	0	0	379.5	665.55	944.27	
(211)m = {[[(98)m x (204)] } x 100 ÷ (206)												(211)
952.57	759.67	650.62	386.45	206.56	0	0	0	0	379.5	665.55	944.27	
Total (kWh/year) =Sum(211) _{1...5,10...12} =												4945.19 (211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87	
Efficiency of water heater												100 (216)
(217)m=	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87		
Total = Sum(219a) _{1..12} =													1183.92	(219)

Annual totals

												kWh/year	kWh/year
Space heating fuel used, main system 1												4945.19	
Water heating fuel used												1183.92	
Electricity for pumps, fans and electric keep-hot													
Total electricity for the above, kWh/year												0	(231)
Electricity for lighting												316.93	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =												6446.04	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	5.5	x 0.01 = 271.99 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	15.29	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	14.31	x 0.01 = 169.43 (247)
Pumps, fans and electric keep-hot	(231)	0	x 0.01 = 0 (249)

SAP WorkSheet: New dwelling design stage

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting (232) 14.31 x 0.01 = 45.36 (250)

Additional standing charges (Table 12) 24 (251)

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

Total energy cost (245)...(247) + (250)...(254) = 510.77 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12) 0.42 (256)

Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] = 1.84 (257)

SAP rating (Section 12) 74.36 (258)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1) (211) x	0.519	=	2566.55 (261)
Space heating (secondary) (215) x	0.519	=	0 (263)
Water heating (219) x	0.519	=	614.45 (264)
Space and water heating (261) + (262) + (263) + (264) =			3181.01 (265)
Electricity for pumps, fans and electric keep-hot (231) x	0.519	=	0 (267)
Electricity for lighting (232) x	0.519	=	164.49 (268)
Total CO2, kg/year		sum of (265)...(271) =	3345.5 (272)
CO2 emissions per m²		(272) ÷ (4) =	46.64 (273)
El rating (section 14)			62 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1) (211) x	3.07	=	15181.73 (261)
Space heating (secondary) (215) x	3.07	=	0 (263)
Energy for water heating (219) x	3.07	=	3634.64 (264)
Space and water heating (261) + (262) + (263) + (264) =			18816.36 (265)
Electricity for pumps, fans and electric keep-hot (231) x	3.07	=	0 (267)
Electricity for lighting (232) x	0	=	972.99 (268)
'Total Primary Energy		sum of (265)...(271) =	19789.35 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	275.89 (273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N2 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	<input type="text" value="71.73"/> (1a)	<input type="text" value="4"/> (2a)	<input type="text" value="286.92"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="71.73"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="286.92"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="3"/> x 10 =	<input type="text" value="30"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="30"/>	÷ (5) =	<input type="text" value="0.1"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="5"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			<input type="text" value="0.35"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="3"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="0.78"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.27"/> (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TFEE WorkSheet: New dwelling design stage

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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.56 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
Windows			17.93	x1/[1/(1.4)+0.04] =	23.77		(27)
Floor			71.73	x 0.13 =	9.3249		(28)
Walls	34.48	17.93	16.55	x 0.18 =	2.98		(29)
Total area of elements, m²			106.21				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.07 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 8039.25 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 5.31 (36)

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

Total fabric heat loss (33) + (36) = 41.39 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	53.15	52.93	52.71	51.67	51.47	50.57	50.57	50.4	50.92	51.47	51.87	52.28

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

(39)m=	94.54	94.31	94.09	93.05	92.86	91.95	91.95	91.79	92.3	92.86	93.25	93.66		
	Average = Sum(39) _{1...12} /12=												93.05	(39)

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

(40)m=	1.32	1.31	1.31	1.3	1.29	1.28	1.28	1.28	1.29	1.29	1.3	1.31		
Average = Sum(40) _{1...12} /12=													1.3	(40)

TFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.29 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 88.53 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	97.38	93.84	90.3	86.75	83.21	79.67	79.67	83.21	86.75	90.3	93.84	97.38	
Total = Sum(44) _{1...12} =												1062.3	(44)

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

(45)m=	144.41	126.3	130.33	113.63	109.03	94.08	87.18	100.04	101.24	117.98	128.78	139.85	
Total = Sum(45) _{1...12} =												1392.85	(45)

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

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

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

TFEE WorkSheet: New dwelling design stage

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

(62)m=	122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87	(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=	122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87	
Output from water heater (annual) _{1...12}												1183.92	(64)

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

(65)m=	30.69	26.84	27.7	24.15	23.17	19.99	18.53	21.26	21.51	25.07	27.37	29.72	(65)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	(66)

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

(67)m=	17.95	15.94	12.96	9.81	7.34	6.19	6.69	8.7	11.68	14.82	17.3	18.44	(67)
--------	-------	-------	-------	------	------	------	------	-----	-------	-------	------	-------	------

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

(68)m=	201.3	203.39	198.13	186.92	172.77	159.48	150.6	148.51	153.77	164.98	179.12	192.42	(68)
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

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

(69)m=	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	(71)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water heating gains (Table 5)

(72)m=	41.25	39.94	37.22	33.54	31.14	27.77	24.9	28.57	29.88	33.7	38.01	39.94	(72)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	------

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

(73)m=	317.8	316.58	305.62	287.58	268.56	250.75	239.5	243.09	252.64	270.81	291.75	308.12	(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	17.93	x	19.64	x	0.63	x	0.7	=	107.62 (76)
East	0.9x	0.77	x	17.93	x	38.42	x	0.63	x	0.7	=	210.53 (76)
East	0.9x	0.77	x	17.93	x	63.27	x	0.63	x	0.7	=	346.71 (76)
East	0.9x	0.77	x	17.93	x	92.28	x	0.63	x	0.7	=	505.66 (76)
East	0.9x	0.77	x	17.93	x	113.09	x	0.63	x	0.7	=	619.71 (76)
East	0.9x	0.77	x	17.93	x	115.77	x	0.63	x	0.7	=	634.38 (76)
East	0.9x	0.77	x	17.93	x	110.22	x	0.63	x	0.7	=	603.96 (76)
East	0.9x	0.77	x	17.93	x	94.68	x	0.63	x	0.7	=	518.79 (76)

TFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	17.93	x	73.59	x	0.63	x	0.7	=	403.24	(76)
East	0.9x	0.77	x	17.93	x	45.59	x	0.63	x	0.7	=	249.81	(76)
East	0.9x	0.77	x	17.93	x	24.49	x	0.63	x	0.7	=	134.19	(76)
East	0.9x	0.77	x	17.93	x	16.15	x	0.63	x	0.7	=	88.5	(76)

Solar gains in watts, calculated for each month

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

(83)m=	107.62	210.53	346.71	505.66	619.71	634.38	603.96	518.79	403.24	249.81	134.19	88.5	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------	------

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

(84)m=	425.42	527.11	652.34	793.24	888.27	885.13	843.46	761.88	655.88	520.62	425.94	396.62	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.81	0.63	0.47	0.54	0.81	0.97	1	1	(86)

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

(87)m=	19.53	19.74	20.08	20.51	20.81	20.96	20.99	20.98	20.86	20.41	19.89	19.5	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

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

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

(89)m=	1	0.99	0.97	0.91	0.75	0.53	0.35	0.41	0.73	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=	18.5	18.7	19.04	19.46	19.73	19.84	19.85	19.85	19.78	19.39	18.87	18.48	(90)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.4

(91)

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

(92)m=	18.91	19.12	19.46	19.88	20.16	20.28	20.31	20.3	20.21	19.79	19.27	18.88	(92)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(93)m=	18.91	19.12	19.46	19.88	20.16	20.28	20.31	20.3	20.21	19.79	19.27	18.88	(93)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.91	0.77	0.57	0.4	0.46	0.75	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	-----	------	------	------	------	---	------

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

(95)m=	423.97	522.38	633.9	719.33	681.26	502.68	337.62	352.31	494.87	498.07	422.88	395.63	(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=	1381.38	1340.65	1219.07	1021.39	785.69	522.56	340.75	358.21	564.14	853.8	1135.15	1375.3	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	-------	---------	--------	------

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

(98)m=	712.31	549.88	435.36	217.49	77.69	0	0	0	0	264.66	512.83	728.87	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

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

3499.09

Space heating requirement in kWh/m²/year

48.78

(99)

TFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

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

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

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

(100)m=	0	0	0	0	0	864.36	680.45	697.57	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.91	0.95	0.93	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

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

(102)m=	0	0	0	0	0	786.32	647.01	647.7	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	-------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	1119.52	1069.08	975.11	0	0	0	0	(103)
---------	---	---	---	---	---	---------	---------	--------	---	---	---	---	-------

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

(104)m=	0	0	0	0	0	239.91	314.03	243.6	0	0	0	0	
---------	---	---	---	---	---	--------	--------	-------	---	---	---	---	--

Total = Sum(104) = 797.53 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

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

Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	59.98	78.51	60.9	0	0	0	0	
---------	---	---	---	---	---	-------	-------	------	---	---	---	---	--

Total = Sum(107) = 199.38 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 2.78 (108)

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

Fabric Energy Efficiency (99) + (108) = 51.56 (109)

Target Fabric Energy Efficiency (TFEE) 59.3 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N2 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	71.73 (1a)	4 (2a)	286.92 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.73 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	286.92 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.85 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.66 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DFEE WorkSheet: New dwelling design stage

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

0.84	0.83	0.81	0.73	0.71	0.63	0.63	0.61	0.66	0.71	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.86 0.84 0.83 0.77 0.75 0.7 0.7 0.69 0.72 0.75 0.78 0.8 (24d)

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

(25)m= 0.86 0.84 0.83 0.77 0.75 0.7 0.7 0.69 0.72 0.75 0.78 0.8 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			19.5	$\times 1/[1/(1.6) + 0.04] =$	29.32		(27)
Floor			71.73	$\times$	0.16	11.4768	(28)
Walls	34.48	19.5	14.98	$\times$	0.19	2.85	(29)
Total area of elements, m²			106.21				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 43.65 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 8025.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 15.93 (36)

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

Total fabric heat loss (33) + (36) = 59.58 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	81.1	79.79	78.5	72.47	71.34	66.08	66.08	65.11	68.11	71.34	73.62	76.01

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

(39)m=	140.68	139.36	138.08	132.05	130.92	125.66	125.66	124.69	127.68	130.92	133.2	135.59
	Average = Sum(39) _{1...12} /12= 132.04											(39)

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

(40)m=	1.96	1.94	1.92	1.84	1.83	1.75	1.75	1.74	1.78	1.83	1.86	1.89
	Average = Sum(40) _{1...12} /12= 1.84											(40)

DFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.29 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 88.53 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	97.38	93.84	90.3	86.75	83.21	79.67	79.67	83.21	86.75	90.3	93.84	97.38	
Total = Sum(44) _{1...12} =												1062.3	(44)

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

(45)m=	144.41	126.3	130.33	113.63	109.03	94.08	87.18	100.04	101.24	117.98	128.78	139.85	
Total = Sum(45) _{1...12} =												1392.85	(45)

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

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

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (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) × (51) × (52) × (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, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

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

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

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

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

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

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

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

DFEE WorkSheet: New dwelling design stage

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

(62)m=	122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87	(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=	122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87	
Output from water heater (annual) _{1...12}												1183.92	(64)

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

(65)m=	30.69	26.84	27.7	24.15	23.17	19.99	18.53	21.26	21.51	25.07	27.37	29.72	(65)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	(66)

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

(67)m=	17.95	15.94	12.96	9.81	7.34	6.19	6.69	8.7	11.68	14.82	17.3	18.44	(67)
--------	-------	-------	-------	------	------	------	------	-----	-------	-------	------	-------	------

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

(68)m=	201.3	203.39	198.13	186.92	172.77	159.48	150.6	148.51	153.77	164.98	179.12	192.42	(68)
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

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

(69)m=	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	(71)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water heating gains (Table 5)

(72)m=	41.25	39.94	37.22	33.54	31.14	27.77	24.9	28.57	29.88	33.7	38.01	39.94	(72)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	------

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

(73)m=	317.8	316.58	305.62	287.58	268.56	250.75	239.5	243.09	252.64	270.81	291.75	308.12	(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	19.5	x	19.64	x	0.63	x	0.7	=	117.05	(76)	
East	0.9x	0.77	x	19.5	x	38.42	x	0.63	x	0.7	=	228.97	(76)	
East	0.9x	0.77	x	19.5	x	63.27	x	0.63	x	0.7	=	377.07	(76)	
East	0.9x	0.77	x	19.5	x	92.28	x	0.63	x	0.7	=	549.94	(76)	
East	0.9x	0.77	x	19.5	x	113.09	x	0.63	x	0.7	=	673.97	(76)	
East	0.9x	0.77	x	19.5	x	115.77	x	0.63	x	0.7	=	689.93	(76)	
East	0.9x	0.77	x	19.5	x	110.22	x	0.63	x	0.7	=	656.84	(76)	
East	0.9x	0.77	x	19.5	x	94.68	x	0.63	x	0.7	=	564.22	(76)	

DFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	19.5	x	73.59	x	0.63	x	0.7	=	438.55	(76)
East	0.9x	0.77	x	19.5	x	45.59	x	0.63	x	0.7	=	271.69	(76)
East	0.9x	0.77	x	19.5	x	24.49	x	0.63	x	0.7	=	145.94	(76)
East	0.9x	0.77	x	19.5	x	16.15	x	0.63	x	0.7	=	96.25	(76)

Solar gains in watts, calculated for each month

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

(83)m=	117.05	228.97	377.07	549.94	673.97	689.93	656.84	564.22	438.55	271.69	145.94	96.25	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(84)m=	434.85	545.54	682.7	837.52	942.53	940.68	896.34	807.31	691.19	542.5	437.69	404.37	(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=	0.97	0.95	0.92	0.85	0.75	0.62	0.5	0.55	0.75	0.9	0.96	0.97	(86)

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

(87)m=	17.26	17.64	18.3	19.22	19.97	20.54	20.79	20.74	20.26	19.24	18.14	17.27	(87)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.36	19.37	19.38	19.44	19.45	19.5	19.5	19.51	19.48	19.45	19.43	19.41	(88)
--------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

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

(89)m=	0.96	0.94	0.9	0.82	0.69	0.52	0.37	0.42	0.67	0.87	0.95	0.97	(89)
--------	------	------	-----	------	------	------	------	------	------	------	------	------	------

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

(90)m=	16.06	16.44	17.1	18.02	18.72	19.25	19.43	19.41	19.02	18.07	16.98	16.1	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =

0.4

(91)

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

(92)m=	16.54	16.92	17.58	18.5	19.22	19.76	19.97	19.94	19.51	18.53	17.44	16.56	(92)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	16.54	16.92	17.58	18.5	19.22	19.76	19.97	19.94	19.51	18.53	17.44	16.56	(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=	0.95	0.92	0.87	0.79	0.68	0.54	0.41	0.46	0.67	0.85	0.93	0.95	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	412.06	502.85	597.23	663.7	643.4	510.79	370.39	373.12	463.9	460.96	406.42	385.73	(95)
--------	--------	--------	--------	-------	-------	--------	--------	--------	-------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1721.65	1674.65	1529.75	1267.07	984.21	649.02	423.56	441.28	691.35	1038.61	1376.87	1676.5	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	---------	--------	------

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

(98)m=	974.33	787.45	693.79	434.43	253.56	0	0	0	0	429.78	698.73	960.33	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

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

5232.4

(98)

Space heating requirement in kWh/m²/year

72.95

(99)

DFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

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

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

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

(100)m=	0	0	0	0	0	1181.2	929.88	947.62	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.67	0.74	0.7	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	-----	---	---	---	---	-------

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

(102)m=	0	0	0	0	0	795.91	684.45	664.13	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

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

(103)m=	0	0	0	0	0	1184.45	1130.9	1028.21	0	0	0	0	(103)
---------	---	---	---	---	---	---------	--------	---------	---	---	---	---	-------

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

(104)m=	0	0	0	0	0	279.75	332.16	270.87	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = Sum(104) = 882.78 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

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

Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	69.94	83.04	67.72	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 220.69 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 3.08 (108)

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

Fabric Energy Efficiency (99) + (108) = 76.02 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N2 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	<input type="text" value="71.73"/> (1a)	<input type="text" value="4"/> (2a)	<input type="text" value="286.92"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="71.73"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="286.92"/> (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="0"/>	÷ (5) =	<input type="text" value="0"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="15"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			<input type="text" value="0.75"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="3"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="0.78"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.58"/> (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

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

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

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			19.5	$\times 1/[1/(1.6) + 0.04] =$	29.32		(27)
Floor			71.73	$\times$ 0.16	11.4768		(28)
Walls	34.48	19.5	14.98	$\times$ 0.19	2.85		(29)
Total area of elements, m²			106.21				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 43.65 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 8025.12 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 15.93 (36)

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

Total fabric heat loss (33) + (36) = 59.58 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	73.34	72.33	71.34	66.7	65.83	61.78	61.78	61.03	63.34	65.83	67.58	69.42

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

(39)m=	132.92	131.91	130.92	126.27	125.4	121.35	121.35	120.6	122.91	125.4	127.16	129
	Average = Sum(39) _{1...12} /12= 126.27											(39)

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

(40)m=	1.85	1.84	1.83	1.76	1.75	1.69	1.69	1.68	1.71	1.75	1.77	1.8
	Average = Sum(40) _{1...12} /12= 1.76											(40)

DER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.29 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 88.53 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	97.38	93.84	90.3	86.75	83.21	79.67	79.67	83.21	86.75	90.3	93.84	97.38	
Total = Sum(44) _{1...12} =												1062.3	(44)

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

(45)m=	144.41	126.3	130.33	113.63	109.03	94.08	87.18	100.04	101.24	117.98	128.78	139.85	
Total = Sum(45) _{1...12} =												1392.85	(45)

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

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

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

DER WorkSheet: New dwelling design stage

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

(62)m=	122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87	(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=	122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87	
Output from water heater (annual) _{1...12}												1183.92	(64)

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

(65)m=	30.69	26.84	27.7	24.15	23.17	19.99	18.53	21.26	21.51	25.07	27.37	29.72	(65)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	(66)

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

(67)m=	17.95	15.94	12.96	9.81	7.34	6.19	6.69	8.7	11.68	14.82	17.3	18.44	(67)
--------	-------	-------	-------	------	------	------	------	-----	-------	-------	------	-------	------

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

(68)m=	201.3	203.39	198.13	186.92	172.77	159.48	150.6	148.51	153.77	164.98	179.12	192.42	(68)
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

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

(69)m=	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	(71)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water heating gains (Table 5)

(72)m=	41.25	39.94	37.22	33.54	31.14	27.77	24.9	28.57	29.88	33.7	38.01	39.94	(72)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	------

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

(73)m=	317.8	316.58	305.62	287.58	268.56	250.75	239.5	243.09	252.64	270.81	291.75	308.12	(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	19.5	x	19.64	x	0.63	x	0.7	=	117.05	(76)
East	0.9x	0.77	x	19.5	x	38.42	x	0.63	x	0.7	=	228.97	(76)
East	0.9x	0.77	x	19.5	x	63.27	x	0.63	x	0.7	=	377.07	(76)
East	0.9x	0.77	x	19.5	x	92.28	x	0.63	x	0.7	=	549.94	(76)
East	0.9x	0.77	x	19.5	x	113.09	x	0.63	x	0.7	=	673.97	(76)
East	0.9x	0.77	x	19.5	x	115.77	x	0.63	x	0.7	=	689.93	(76)
East	0.9x	0.77	x	19.5	x	110.22	x	0.63	x	0.7	=	656.84	(76)
East	0.9x	0.77	x	19.5	x	94.68	x	0.63	x	0.7	=	564.22	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	19.5	x	73.59	x	0.63	x	0.7	=	438.55	(76)
East	0.9x	0.77	x	19.5	x	45.59	x	0.63	x	0.7	=	271.69	(76)
East	0.9x	0.77	x	19.5	x	24.49	x	0.63	x	0.7	=	145.94	(76)
East	0.9x	0.77	x	19.5	x	16.15	x	0.63	x	0.7	=	96.25	(76)

Solar gains in watts, calculated for each month

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

(83)m=	117.05	228.97	377.07	549.94	673.97	689.93	656.84	564.22	438.55	271.69	145.94	96.25	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

(84)m=	434.85	545.54	682.7	837.52	942.53	940.68	896.34	807.31	691.19	542.5	437.69	404.37	(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=	0.97	0.95	0.91	0.84	0.74	0.61	0.49	0.55	0.74	0.9	0.96	0.97	(86)

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

(87)m=	19.24	19.39	19.65	20.01	20.3	20.52	20.62	20.6	20.41	20.01	19.58	19.24	(87)
--------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	------

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

(88)m=	19.43	19.44	19.45	19.5	19.51	19.55	19.55	19.55	19.53	19.51	19.49	19.47	(88)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.96	0.94	0.9	0.81	0.69	0.52	0.36	0.41	0.66	0.87	0.95	0.97	(89)
--------	------	------	-----	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.12	17.34	17.73	18.26	18.66	18.96	19.06	19.05	18.83	18.28	17.65	17.15	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.4

(91)

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

(92)m=	17.97	18.16	18.49	18.96	19.31	19.58	19.68	19.67	19.46	18.97	18.42	17.98	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	17.97	18.16	18.49	18.96	19.31	19.58	19.68	19.67	19.46	18.97	18.42	17.98	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.96	0.93	0.89	0.8	0.68	0.52	0.38	0.43	0.66	0.86	0.94	0.96	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(95)m=	415.61	508.19	604.26	668.76	638.44	489.98	336.45	344.09	455.54	464.87	410.25	388.73	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1816.42	1749	1570.13	1269.87	954.53	604.94	373.85	394.26	658.82	1049.73	1439.51	1778	(97)
--------	---------	------	---------	---------	--------	--------	--------	--------	--------	---------	---------	------	------

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

(98)m=	1042.2	833.82	718.61	432.8	235.17	0	0	0	0	435.13	741.07	1033.62	(98)
--------	--------	--------	--------	-------	--------	---	---	---	---	--------	--------	---------	------

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

5472.41

Space heating requirement in kWh/m²/year

76.29

(99)

DER WorkSheet: New dwelling design stage

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		100	(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)

1042.2	833.82	718.61	432.8	235.17	0	0	0	0	435.13	741.07	1033.62	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												(211)
1042.2	833.82	718.61	432.8	235.17	0	0	0	0	435.13	741.07	1033.62	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												5472.41
												(211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87	
Efficiency of water heater												100
(217)m =	100	100	100	100	100	100	100	100	100	100	100	
												(217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	122.75	107.36	110.78	96.58	92.67	79.97	74.1	85.03	86.05	100.28	109.47	118.87		
Total = Sum(219a) _{1...12} =													1183.92	(219)

Annual totals

		kWh/year	kWh/year
Space heating fuel used, main system 1		5472.41	
Water heating fuel used		1183.92	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		316.93	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6973.27	(338)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.519	= 2840.18
Space heating (secondary)	(215) ×	0.519	= 0
Water heating	(219) ×	0.519	= 614.45
Space and water heating	(261) + (262) + (263) + (264) =		3454.64
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	= 0

DER WorkSheet: New dwelling design stage

Electricity for lighting	(232) x	0.519	=	164.49	(268)
Total CO2, kg/year		sum of (265)...(271) =			3619.13 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			50.45 (273)
EI rating (section 14)				58	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N2 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	<input type="text" value="71.73"/> (1a) x	<input type="text" value="4"/> (2a) =	<input type="text" value="286.92"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="71.73"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="286.92"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="3"/> x 10 =	<input type="text" value="30"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="30"/>	÷ (5) =	<input type="text" value="0.1"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="5"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			<input type="text" value="0.35"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="3"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="0.78"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.27"/> (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.56 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
Windows			17.93	$\times 1/[1/(1.4) + 0.04] =$	23.77		(27)
Floor			71.73	$\times$ 0.13	9.3249		(28)
Walls	34.48	17.93	16.55	$\times$ 0.18	2.98		(29)
Total area of elements, m²			106.21				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.07 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 8039.25 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 5.31 (36)

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

Total fabric heat loss (33) + (36) = 41.39 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	53.15	52.93	52.71	51.67	51.47	50.57	50.57	50.4	50.92	51.47	51.87	52.28

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

(39)m=	94.54	94.31	94.09	93.05	92.86	91.95	91.95	91.79	92.3	92.86	93.25	93.66		
Average = Sum(39) _{1...12} /12=													93.05	(39)

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

(40)m=	1.32	1.31	1.31	1.3	1.29	1.28	1.28	1.28	1.29	1.29	1.3	1.31		
Average = Sum(40) _{1...12} /12=													1.3	(40)

TER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.29 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 88.53 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	97.38	93.84	90.3	86.75	83.21	79.67	79.67	83.21	86.75	90.3	93.84	97.38	
Total = Sum(44) _{1...12} =												1062.3	(44)

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

(45)m=	144.41	126.3	130.33	113.63	109.03	94.08	87.18	100.04	101.24	117.98	128.78	139.85	
Total = Sum(45) _{1...12} =												1392.85	(45)

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

(46)m=	21.66	18.95	19.55	17.04	16.35	14.11	13.08	15.01	15.19	17.7	19.32	20.98	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

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

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

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

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

TER WorkSheet: New dwelling design stage

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

(62)m=	191	168.39	176.93	158.72	155.62	139.17	133.78	146.64	146.33	164.58	173.88	186.45	(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=	191	168.39	176.93	158.72	155.62	139.17	133.78	146.64	146.33	164.58	173.88	186.45	
Output from water heater (annual) _{1...12}												1941.47	(64)

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

(65)m=	85.29	75.66	80.61	73.85	73.53	67.36	66.26	70.54	69.73	76.5	78.89	83.78	(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=	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	114.37	(66)

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

(67)m=	17.95	15.94	12.96	9.81	7.34	6.19	6.69	8.7	11.68	14.82	17.3	18.44	(67)
--------	-------	-------	-------	------	------	------	------	-----	-------	-------	------	-------	------

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

(68)m=	201.3	203.39	198.13	186.92	172.77	159.48	150.6	148.51	153.77	164.98	179.12	192.42	(68)
--------	-------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

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

(69)m=	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	34.44	(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=	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	-91.5	(71)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water heating gains (Table 5)

(72)m=	114.64	112.59	108.35	102.58	98.83	93.55	89.06	94.81	96.85	102.83	109.58	112.6	(72)
--------	--------	--------	--------	--------	-------	-------	-------	-------	-------	--------	--------	-------	------

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

(73)m=	394.2	392.23	379.75	359.62	339.25	319.53	306.66	312.33	322.61	342.94	366.31	383.78	(73)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	17.93	x	19.64	x	0.63	x	0.7	=	107.62	(76)
East	0.9x	0.77	x	17.93	x	38.42	x	0.63	x	0.7	=	210.53	(76)
East	0.9x	0.77	x	17.93	x	63.27	x	0.63	x	0.7	=	346.71	(76)
East	0.9x	0.77	x	17.93	x	92.28	x	0.63	x	0.7	=	505.66	(76)
East	0.9x	0.77	x	17.93	x	113.09	x	0.63	x	0.7	=	619.71	(76)
East	0.9x	0.77	x	17.93	x	115.77	x	0.63	x	0.7	=	634.38	(76)
East	0.9x	0.77	x	17.93	x	110.22	x	0.63	x	0.7	=	603.96	(76)
East	0.9x	0.77	x	17.93	x	94.68	x	0.63	x	0.7	=	518.79	(76)

TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	17.93	x	73.59	x	0.63	x	0.7	=	403.24	(76)
East	0.9x	0.77	x	17.93	x	45.59	x	0.63	x	0.7	=	249.81	(76)
East	0.9x	0.77	x	17.93	x	24.49	x	0.63	x	0.7	=	134.19	(76)
East	0.9x	0.77	x	17.93	x	16.15	x	0.63	x	0.7	=	88.5	(76)

Solar gains in watts, calculated for each month

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

(83)m=	107.62	210.53	346.71	505.66	619.71	634.38	603.96	518.79	403.24	249.81	134.19	88.5	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------	------

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

(84)m=	501.82	602.76	726.46	865.28	958.95	953.91	910.62	831.12	725.85	592.75	500.5	472.28	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.78	0.59	0.44	0.5	0.76	0.96	0.99	1	(86)

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

(87)m=	19.63	19.83	20.16	20.57	20.85	20.97	20.99	20.99	20.89	20.49	19.98	19.6	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

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

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

(89)m=	0.99	0.99	0.96	0.88	0.71	0.5	0.33	0.38	0.67	0.93	0.99	1	(89)
--------	------	------	------	------	------	-----	------	------	------	------	------	---	------

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

(90)m=	18.02	18.32	18.8	19.36	19.71	19.84	19.85	19.85	19.77	19.28	18.55	17.98	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.4

(91)

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

(92)m=	18.66	18.92	19.34	19.84	20.16	20.29	20.31	20.3	20.22	19.76	19.12	18.62	(92)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(93)m=	18.66	18.92	19.34	19.84	20.16	20.29	20.31	20.3	20.22	19.76	19.12	18.62	(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	0.98	0.96	0.88	0.73	0.53	0.37	0.43	0.71	0.93	0.99	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	498.26	593.23	695.69	761.62	700.66	507.51	338.52	354.14	512.46	553.03	493.41	469.69	(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=	1357.84	1322.07	1208.23	1018.26	785.66	522.79	340.82	358.36	564.91	850.54	1120.63	1351.04	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	639.53	489.78	381.32	184.78	63.24	0	0	0	0	221.35	451.6	655.72	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	-------	--------	------

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

3087.32

Space heating requirement in kWh/m²/year

43.04

(99)

TER WorkSheet: New dwelling design stage

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

Space heating:

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

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

Space heating requirement (calculated above)

639.53	489.78	381.32	184.78	63.24	0	0	0	0	221.35	451.6	655.72
--------	--------	--------	--------	-------	---	---	---	---	--------	-------	--------

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

683.99	523.83	407.83	197.62	67.64	0	0	0	0	236.74	482.99	701.31
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

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

3301.94 (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
---------	---	---	---	---	---	---	---	---	---	---	---

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

0 (215)

Water heating

Output from water heater (calculated above)

191	168.39	176.93	158.72	155.62	139.17	133.78	146.64	146.33	164.58	173.88	186.45
-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater 79.8 (216)

(217)m= 87.79 87.5 86.81 85.22 82.62 79.8 79.8 79.8 79.8 85.61 87.25 87.89 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	217.56	192.45	203.81	186.24	188.35	174.4	167.64	183.75	183.37	192.25	199.29	212.13
---------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

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

2301.25 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3301.94
Water heating fuel used		2301.25

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 316.93 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 5995.12 (338)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 713.22 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 497.07 (264)

TER WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			1210.29	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.49	(268)
Total CO2, kg/year	sum of (265)...(271) =			1413.7	(272)
TER	=			28.99	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 30 October 2024 at 11:20:02

Project Information:

Assessed By: John Ashe (STRO031268)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 51.08m²

Site Reference : Victoria Mill, Stockport

Plot Reference: N3 Victoria Mill, Stockport

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

31.23 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

51.87 kg/m²

Fail

Excess emissions = 20.64 kg/m² (66.1 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

58.0 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

75.0 kWh/m²

Fail

Excess energy = 17.01 kg/m² (29.3 %)

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.60 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals	15.00	OK
--------------------------------	-------	----

4 Heating efficiency

Main Heating system:	Electric storage systems - electric Modern (slimline) storage heaters with Celect-type control
----------------------	---

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

5 Cylinder insulation

Hot water Storage:	No cylinder
--------------------	-------------

6 Controls

Space heating controls	Controls for high heat retention storage heaters	OK
Hot water controls:	No cylinder thermostat No cylinder	

Regulations Compliance Report

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines):	Not assessed	?
-----------------------------------	--------------	---

10 Key features

None

Thermal Bridge Report

Property Details: N3 Victoria Mill, Stockport

Address:

Located in:

England

Region:

West Pennines

Thermal bridges:

Thermal bridges:

No information on thermal bridging (y=0.15) (y =0.15)

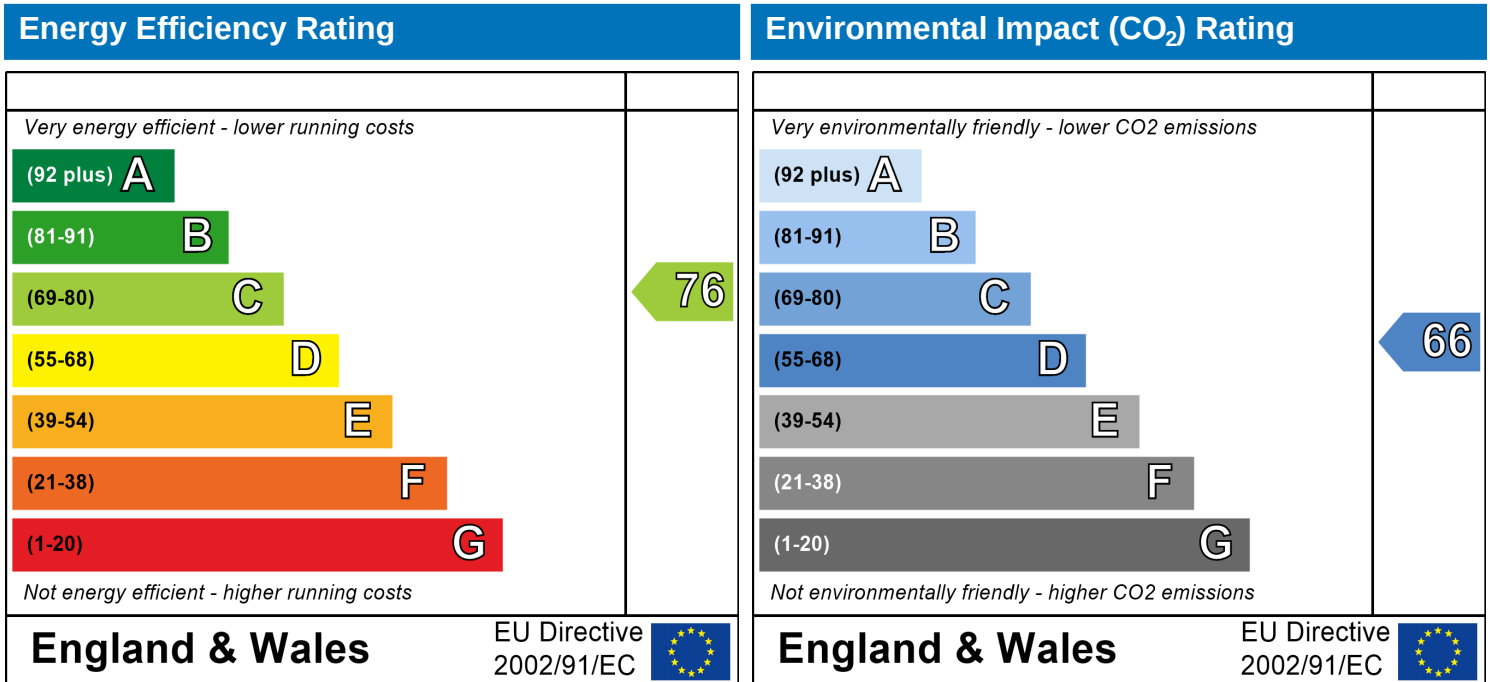
Predicted Energy Assessment

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

Ground floor Flat
30 October 2024
John Ashe
51.08 m²

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

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



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

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

Developer Confirmation Report

Property Details: N3 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines
UPRN:
Date of assessment: 30 October 2024
Date of certificate: 30 October 2024
Assessment type: New dwelling design stage
Transaction type: New dwelling
Thermal Mass Parameter: Indicative Value Low
Comments:

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2024
Front of dwelling faces: North
Comments:

Opening types:

Name:	Type:	Frame Factor:	g-value:	U-Value:	Area:
Windows	Windows	0.7	0.63	1.6	13
Overshading:	Average or unknown				
Comments:					

Opaque Elements:

Type:	U-Value:	Kappa:
<u>External Elements</u>		
Walls	0.19 Please provide the U-Value calculation to justify the U-Value entered into the assessment.	N/A

Materials Used:		Thickness:	Conductivity:	R-Value:
Type:	Name:			
Walls	Internal Surface Resistance	0	0	0.13
Walls	Plaster (Lightweight) (0 mm)	3	0.18	0.02
Walls	Plasterboard Standard (0 mm)	12.5	0.21	0.06

Developer Confirmation Report

Walls	Thermawall TW50 (100 mm)	100	0.022	4.55
Walls	Plaster Dabs Cavity (15 mm)	15	0	0.17
Walls	Brickwork Outer Leaf - BRE (102.5 mm)	300	0.77	0.39
Walls	External Surface Resistance	0	0	0.04

Comments:

GF 0.16 Please provide the U-Value calculation to justify the U-Value entered into the assessment. N/A

Internal Elements (Area, Kappa)

Party Elements (Area, Kappa)

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Comments:

If specific construction details have been adopted then please provide the associated checklists; signed and dated.

Ventilation:

Pressure test: No (Assumed)
Ventilation: Natural ventilation (extract fans)
Pressure test: 15

Comments:

Please provide the pressure test certificate, or certificates if the result is based on an average; signed and dated.

Main heating system:

Main heating system: Electric storage systems
Off-peak tariffs
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 405
Modern (slimline) storage heaters with Celect-type control
Systems with radiators

Comments:

Main heating Control:

Developer Confirmation Report

Main heating Control:

Controls for high heat retention storage heaters

Comments:

Secondary heating system:

Secondary heating system:

None

Comments:

Water heating:

Water heating:

No hot water cylinder

Comments:

Solar panel: False

Others:

Electricity tariff:

7-Hour Tariff

Low energy lights:

100%

Terrain type:

Low rise urban / suburban

Wind turbine:

No

Photovoltaics:

None

Comments:

Please provide the MCS certificate or data sheet equivalent confirming the size of the array on the roof. This should include any calculations to support a proportioned amount included in the assessment.

Declaration :

I confirm that the property has been built to the above specification.

Signed:

.....

Date:

.....

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N3 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.08 (1a) x	4 (2a) =	204.32 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.08 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	204.32 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.75 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.58 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

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

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

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

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			13	$\times 1/[1/(1.6) + 0.04] =$	19.55		(27)
Floor			51.08	$\times$ 0.16	8.1728		(28)
Walls	24.16	13	11.16	$\times$ 0.19	2.12		(29)
Total area of elements, m²			75.24				(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 29.84 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5719.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 11.29 (36)

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

Total fabric heat loss (33) + (36) = 41.13 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	52.23	51.51	50.8	47.49	46.88	43.99	43.99	43.46	45.1	46.88	48.13	49.44

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

(39)m=	93.36	92.64	91.93	88.62	88	85.12	85.12	84.59	86.23	88	89.26	90.57
	Average = Sum(39) _{1...12} /12= 88.62											(39)

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

(40)m=	1.83	1.81	1.8	1.73	1.72	1.67	1.67	1.66	1.69	1.72	1.75	1.77
	Average = Sum(40) _{1...12} /12= 1.73											(40)

SAP WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

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

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.72 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.1 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	82.61	79.6	76.6	73.59	70.59	67.59	67.59	70.59	73.59	76.6	79.6	82.61	
Total = Sum(44) _{1...12} =												901.15	(44)

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

(45)m=	122.5	107.14	110.56	96.39	92.49	79.81	73.95	84.86	85.88	100.08	109.25	118.64	
Total = Sum(45) _{1...12} =												1181.55	(45)

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

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

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

SAP WorkSheet: New dwelling design stage

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

(62)m=	104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84	(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=	104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84	
Output from water heater (annual) _{1...12}												1004.32	(64)

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

(65)m=	26.03	22.77	23.49	20.48	19.65	16.96	15.72	18.03	18.25	21.27	23.22	25.21	(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=	103.32	103.32	103.32	103.32	103.32	103.32	103.32	103.32	103.32	103.32	103.32	103.32	(66)

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

(67)m=	33.44	29.7	24.15	18.29	13.67	11.54	12.47	16.21	21.76	27.62	32.24	34.37	(67)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(68)m=	223.94	226.26	220.41	207.94	192.2	177.41	167.53	165.21	171.06	183.53	199.27	214.06	(68)
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	47.05	47.05	47.05	47.05	47.05	47.05	47.05	47.05	47.05	47.05	47.05	47.05	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	34.99	33.88	31.58	28.45	26.42	23.55	21.12	24.24	25.35	28.59	32.24	33.88	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	373.86	371.34	357.63	336.17	313.78	294	282.62	287.15	299.66	321.23	345.24	363.8	(73)
--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	-------	------

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	13	x	19.64	x	0.63	x	0.7	=	78.03 (76)
East	0.9x	0.77	x	13	x	38.42	x	0.63	x	0.7	=	152.64 (76)
East	0.9x	0.77	x	13	x	63.27	x	0.63	x	0.7	=	251.38 (76)
East	0.9x	0.77	x	13	x	92.28	x	0.63	x	0.7	=	366.63 (76)
East	0.9x	0.77	x	13	x	113.09	x	0.63	x	0.7	=	449.31 (76)
East	0.9x	0.77	x	13	x	115.77	x	0.63	x	0.7	=	459.95 (76)
East	0.9x	0.77	x	13	x	110.22	x	0.63	x	0.7	=	437.89 (76)
East	0.9x	0.77	x	13	x	94.68	x	0.63	x	0.7	=	376.14 (76)

SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	13	x	73.59	x	0.63	x	0.7	=	292.37	(76)
East	0.9x	0.77	x	13	x	45.59	x	0.63	x	0.7	=	181.12	(76)
East	0.9x	0.77	x	13	x	24.49	x	0.63	x	0.7	=	97.29	(76)
East	0.9x	0.77	x	13	x	16.15	x	0.63	x	0.7	=	64.17	(76)

Solar gains in watts, calculated for each month

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

(83)m=	78.03	152.64	251.38	366.63	449.31	459.95	437.89	376.14	292.37	181.12	97.29	64.17	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

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

(84)m=	451.89	523.98	609.01	702.79	763.09	753.95	720.51	663.29	592.03	502.36	442.54	427.97	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.94	0.92	0.88	0.8	0.7	0.56	0.45	0.49	0.68	0.85	0.92	0.95	(86)

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

(87)m=	19.4	19.54	19.77	20.1	20.36	20.55	20.64	20.62	20.47	20.12	19.72	19.4	(87)
--------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(88)m=	19.45	19.46	19.47	19.52	19.52	19.56	19.56	19.57	19.55	19.52	19.51	19.49	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.93	0.9	0.86	0.77	0.64	0.47	0.32	0.37	0.6	0.81	0.9	0.94	(89)
--------	------	-----	------	------	------	------	------	------	-----	------	-----	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.36	17.56	17.9	18.38	18.74	19.01	19.09	19.09	18.9	18.43	17.86	17.39	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.32	18.49	18.78	19.19	19.5	19.74	19.82	19.81	19.64	19.23	18.74	18.34	(92)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.32	18.49	18.78	19.19	19.5	19.74	19.82	19.81	19.64	19.23	18.74	18.34	(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=	0.92	0.89	0.84	0.76	0.64	0.49	0.35	0.39	0.6	0.8	0.89	0.93	(94)
--------	------	------	------	------	------	------	------	------	-----	-----	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	415.64	467.99	514.24	531.89	487.18	366.06	250.75	258.29	356.55	402.03	395.26	396.53	(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=	1308.69	1258.84	1129.18	912.09	686.38	437.3	273.93	288.48	477.73	759.17	1038.85	1280.34	(97)
--------	---------	---------	---------	--------	--------	-------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	664.43	531.45	457.51	273.75	148.2	0	0	0	0	265.72	463.38	657.56	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3462

(98)

Space heating requirement in kWh/m²/year

67.78

(99)

SAP WorkSheet: New dwelling design stage

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		100	(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)

664.43	531.45	457.51	273.75	148.2	0	0	0	0	265.72	463.38	657.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
664.43	531.45	457.51	273.75	148.2	0	0	0	0	265.72	463.38	657.56	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												3462
												(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1...5,10...12} =												0
												(215)

Water heating

Output from water heater (calculated above)

104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84	
Efficiency of water heater												100
(217)m =	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84		
Total = Sum(219a) _{1..12} =													1004.32	(219)

Annual totals

													kWh/year	kWh/year
Space heating fuel used, main system 1													3462	
Water heating fuel used													1004.32	
Electricity for pumps, fans and electric keep-hot														
Total electricity for the above, kWh/year													0	(231)
Electricity for lighting													236.23	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =													4702.54	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	5.5	x 0.01 = 190.41 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	15.29	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	14.31	x 0.01 = 143.73 (247)
Pumps, fans and electric keep-hot	(231)	0	x 0.01 = 0 (249)

SAP WorkSheet: New dwelling design stage

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting (232) 14.31 x 0.01 = 33.81 (250)

Additional standing charges (Table 12) 24 (251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)...(254) = 391.94 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12) 0.42 (256)

Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] = 1.71 (257)

SAP rating (Section 12) 76.1 (258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1) (211) x	0.519	=	1796.78 (261)
Space heating (secondary) (215) x	0.519	=	0 (263)
Water heating (219) x	0.519	=	521.24 (264)
Space and water heating (261) + (262) + (263) + (264) =			2318.02 (265)
Electricity for pumps, fans and electric keep-hot (231) x	0.519	=	0 (267)
Electricity for lighting (232) x	0.519	=	122.6 (268)
Total CO2, kg/year sum of (265)...(271) =			2440.62 (272)
CO2 emissions per m² (272) ÷ (4) =			47.78 (273)
El rating (section 14)			66 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1) (211) x	3.07	=	10628.34 (261)
Space heating (secondary) (215) x	3.07	=	0 (263)
Energy for water heating (219) x	3.07	=	3083.25 (264)
Space and water heating (261) + (262) + (263) + (264) =			13711.59 (265)
Electricity for pumps, fans and electric keep-hot (231) x	3.07	=	0 (267)
Electricity for lighting (232) x	0	=	725.21 (268)
'Total Primary Energy sum of (265)...(271) =			14436.8 (272)
Primary energy kWh/m²/year (272) ÷ (4) =			282.63 (273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N3 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	<input type="text" value="51.08"/> (1a) x	<input type="text" value="4"/> (2a) =	<input type="text" value="204.32"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="51.08"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="204.32"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/> +	<input type="text" value="0"/> +	<input type="text" value="0"/> =	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/> +	<input type="text" value="0"/> +	<input type="text" value="0"/> =	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="20"/> ÷ (5) =	<input type="text" value="0.1"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		<input type="text" value="0"/> (9)
Additional infiltration	[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0		<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped		<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		<input type="text" value="5"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		<input type="text" value="0.35"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		<input type="text" value="3"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	<input type="text" value="0.78"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	<input type="text" value="0.27"/> (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.34	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.3	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.56 0.56 0.55 0.54 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 0.55 0.54 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
Windows			12.77	$\times 1/[1/(1.4) + 0.04] =$	16.93		(27)
Floor			51.08	$\times$ 0.13	6.6404		(28)
Walls	24.16	12.77	11.39	$\times$ 0.18	2.05		(29)
Total area of elements, m²			75.24				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.62 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5721.31 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.76 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 29.38 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	37.7	37.54	37.39	36.68	36.54	35.92	35.92	35.81	36.16	36.54	36.81	37.1

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.08	66.92	66.77	66.06	65.93	65.31	65.31	65.19	65.55	65.93	66.2	66.48
	Average = Sum(39) _{1...12} /12= 66.06											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.31	1.31	1.31	1.29	1.29	1.28	1.28	1.28	1.28	1.29	1.3	1.3
	Average = Sum(40) _{1...12} /12= 1.29											(40)

TFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.72 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.1 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	82.61	79.6	76.6	73.59	70.59	67.59	67.59	70.59	73.59	76.6	79.6	82.61	
Total = Sum(44) _{1...12} =												901.15	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.5	107.14	110.56	96.39	92.49	79.81	73.95	84.86	85.88	100.08	109.25	118.64	
Total = Sum(45) _{1...12} =												1181.55	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) \times (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) \times (51) \times (52) \times (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) \times (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

TFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84	(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=	104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84	
Output from water heater (annual) _{1...12}												1004.32	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	26.03	22.77	23.49	20.48	19.65	16.96	15.72	18.03	18.25	21.27	23.22	25.21	(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=	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.38	11.88	9.66	7.31	5.47	4.62	4.99	6.48	8.7	11.05	12.9	13.75	(67)
--------	-------	-------	------	------	------	------	------	------	-----	-------	------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	150.04	151.6	147.67	139.32	128.78	118.87	112.25	110.69	114.61	122.97	133.51	143.42	(68)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	34.99	33.88	31.58	28.45	26.42	23.55	21.12	24.24	25.35	28.59	32.24	33.88	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	247.23	246.18	237.74	223.91	209.49	195.87	187.19	190.24	197.49	211.43	227.48	239.88	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	12.77	x	19.64	x	0.63	x	0.7	=	76.65 (76)
East	0.9x	0.77	x	12.77	x	38.42	x	0.63	x	0.7	=	149.94 (76)
East	0.9x	0.77	x	12.77	x	63.27	x	0.63	x	0.7	=	246.93 (76)
East	0.9x	0.77	x	12.77	x	92.28	x	0.63	x	0.7	=	360.14 (76)
East	0.9x	0.77	x	12.77	x	113.09	x	0.63	x	0.7	=	441.36 (76)
East	0.9x	0.77	x	12.77	x	115.77	x	0.63	x	0.7	=	451.82 (76)
East	0.9x	0.77	x	12.77	x	110.22	x	0.63	x	0.7	=	430.15 (76)
East	0.9x	0.77	x	12.77	x	94.68	x	0.63	x	0.7	=	369.49 (76)

TFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	12.77	x	73.59	x	0.63	x	0.7	=	287.2	(76)
East	0.9x	0.77	x	12.77	x	45.59	x	0.63	x	0.7	=	177.92	(76)
East	0.9x	0.77	x	12.77	x	24.49	x	0.63	x	0.7	=	95.57	(76)
East	0.9x	0.77	x	12.77	x	16.15	x	0.63	x	0.7	=	63.03	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	76.65	149.94	246.93	360.14	441.36	451.82	430.15	369.49	287.2	177.92	95.57	63.03	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	323.88	396.13	484.68	584.05	650.85	647.68	617.33	559.73	484.69	389.35	323.05	302.91	(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	0.8	0.61	0.46	0.52	0.79	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.58	19.78	20.12	20.53	20.83	20.96	20.99	20.99	20.88	20.45	19.93	19.54	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.83	19.83	19.84	19.85	19.85	19.86	19.86	19.86	19.85	19.85	19.84	19.84	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.73	0.52	0.34	0.4	0.71	0.95	0.99	1	(89)
--------	---	------	------	-----	------	------	------	-----	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.55	18.75	19.08	19.49	19.74	19.84	19.86	19.86	19.79	19.42	18.91	18.52	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.03	19.23	19.57	19.98	20.25	20.37	20.39	20.39	20.3	19.9	19.39	19	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	----	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.03	19.23	19.57	19.98	20.25	20.37	20.39	20.39	20.3	19.9	19.39	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	0.97	0.9	0.76	0.56	0.4	0.46	0.74	0.95	0.99	1	(94)
--------	---	------	------	-----	------	------	-----	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	322.48	391.88	469.17	525.45	493.13	363.22	245.37	255.91	360.05	370.14	320.18	301.93	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	988.18	959.25	872.74	731.97	563.94	376.76	247.56	259.97	406.56	613.24	813.4	983.98	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	495.28	381.27	300.25	148.69	52.68	0	0	0	0	180.86	355.12	507.44	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2421.61

Space heating requirement in kWh/m²/year

47.41

(99)

TFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	613.89	483.27	495.46	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.92	0.96	0.94	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	563.88	462.18	464.11	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	822.1	785.39	719.02	0	0	0	0	(103)
---------	---	---	---	---	---	-------	--------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	185.92	240.46	189.65	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = Sum(104) = 616.03 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	46.48	60.12	47.41	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 154.01 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 3.02 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 50.42 (109)

Target Fabric Energy Efficiency (TFEE) 57.99 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N3 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.08 (1a)	4 (2a)	204.32 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.08 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	204.32 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.85 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.66 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.84	0.82	0.8	0.72	0.71	0.62	0.62	0.61	0.66	0.71	0.74	0.77
------	------	-----	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.85 0.84 0.82 0.76 0.75 0.69 0.69 0.68 0.72 0.75 0.77 0.8 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.85 0.84 0.82 0.76 0.75 0.69 0.69 0.68 0.72 0.75 0.77 0.8 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			13	$\times 1/[1/(1.6) + 0.04] =$	19.55		(27)
Floor			51.08	$\times$ 0.16	8.1728		(28)
Walls	24.16	13	11.16	$\times$ 0.19	2.12		(29)
Total area of elements, m²			75.24				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 29.84 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5719.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 11.29 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	57.38	56.46	55.56	51.33	50.54	46.85	46.85	46.17	48.27	50.54	52.14	53.81

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	98.51	97.59	96.69	92.45	91.66	87.98	87.98	87.3	89.4	91.66	93.26	94.94		
Average = Sum(39) _{1...12} /12=													92.45	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.93	1.91	1.89	1.81	1.79	1.72	1.72	1.71	1.75	1.79	1.83	1.86		
Average = Sum(40) _{1...12} /12=													1.81	(40)

DFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.72 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.1 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	82.61	79.6	76.6	73.59	70.59	67.59	67.59	70.59	73.59	76.6	79.6	82.61	
Total = Sum(44) _{1...12} =												901.15	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.5	107.14	110.56	96.39	92.49	79.81	73.95	84.86	85.88	100.08	109.25	118.64	
Total = Sum(45) _{1...12} =												1181.55	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

DFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84	(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=	104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84	
Output from water heater (annual) _{1...12}												1004.32	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	26.03	22.77	23.49	20.48	19.65	16.96	15.72	18.03	18.25	21.27	23.22	25.21	(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=	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.38	11.88	9.66	7.31	5.47	4.62	4.99	6.48	8.7	11.05	12.9	13.75	(67)
--------	-------	-------	------	------	------	------	------	------	-----	-------	------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	150.04	151.6	147.67	139.32	128.78	118.87	112.25	110.69	114.61	122.97	133.51	143.42	(68)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	34.99	33.88	31.58	28.45	26.42	23.55	21.12	24.24	25.35	28.59	32.24	33.88	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	247.23	246.18	237.74	223.91	209.49	195.87	187.19	190.24	197.49	211.43	227.48	239.88	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	13	x	19.64	x	0.63	x	0.7	=	78.03	(76)
East	0.9x	0.77	x	13	x	38.42	x	0.63	x	0.7	=	152.64	(76)
East	0.9x	0.77	x	13	x	63.27	x	0.63	x	0.7	=	251.38	(76)
East	0.9x	0.77	x	13	x	92.28	x	0.63	x	0.7	=	366.63	(76)
East	0.9x	0.77	x	13	x	113.09	x	0.63	x	0.7	=	449.31	(76)
East	0.9x	0.77	x	13	x	115.77	x	0.63	x	0.7	=	459.95	(76)
East	0.9x	0.77	x	13	x	110.22	x	0.63	x	0.7	=	437.89	(76)
East	0.9x	0.77	x	13	x	94.68	x	0.63	x	0.7	=	376.14	(76)

DFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	13	x	73.59	x	0.63	x	0.7	=	292.37	(76)
East	0.9x	0.77	x	13	x	45.59	x	0.63	x	0.7	=	181.12	(76)
East	0.9x	0.77	x	13	x	24.49	x	0.63	x	0.7	=	97.29	(76)
East	0.9x	0.77	x	13	x	16.15	x	0.63	x	0.7	=	64.17	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	78.03	152.64	251.38	366.63	449.31	459.95	437.89	376.14	292.37	181.12	97.29	64.17	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	325.26	398.83	489.12	590.54	658.8	655.82	625.08	566.39	489.86	392.55	324.77	304.05	(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=	0.97	0.95	0.92	0.85	0.75	0.62	0.51	0.55	0.75	0.9	0.95	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	17.34	17.7	18.35	19.24	19.98	20.55	20.79	20.74	20.27	19.28	18.2	17.35	(87)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.38	19.39	19.41	19.46	19.47	19.52	19.52	19.53	19.51	19.47	19.45	19.43	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.96	0.94	0.9	0.82	0.7	0.53	0.37	0.42	0.67	0.87	0.94	0.96	(89)
--------	------	------	-----	------	-----	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.15	16.52	17.16	18.06	18.75	19.27	19.45	19.43	19.05	18.12	17.06	16.19	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.71	17.08	17.72	18.62	19.33	19.87	20.08	20.05	19.63	18.67	17.6	16.74	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.71	17.08	17.72	18.62	19.33	19.87	20.08	20.05	19.63	18.67	17.6	16.74	(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=	0.94	0.92	0.87	0.8	0.69	0.55	0.43	0.47	0.68	0.85	0.92	0.95	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	307.1	366.71	427.85	470.02	454.5	362.89	266.35	268	331.12	332.96	300.38	288.95	(95)
--------	-------	--------	--------	--------	-------	--------	--------	-----	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1222.71	1188.26	1084.75	898.2	699.16	463.91	306.39	318.64	494.19	739.5	978.97	1190.51	(97)
--------	---------	---------	---------	-------	--------	--------	--------	--------	--------	-------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	681.22	552.09	488.73	308.29	182.03	0	0	0	0	302.47	488.58	670.76	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3674.15

Space heating requirement in kWh/m²/year

71.93

(99)

DFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	827	651.04	663.45	0	0	0	0	(100)
---------	---	---	---	---	---	-----	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.68	0.74	0.71	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	559.62	481.22	468.37	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	831.61	794.44	726.8	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	-------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	195.83	233.04	192.27	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = Sum(104) = 621.14 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	48.96	58.26	48.07	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 155.28 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 3.04 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 74.97 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N3 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.08 (1a)	4 (2a)	204.32 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.08 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	204.32 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.75 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.58 (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

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			13	$\times 1/[1/(1.6) + 0.04] =$	19.55		(27)
Floor			51.08	$\times$ 0.16	8.1728		(28)
Walls	24.16	13	11.16	$\times$ 0.19	2.12		(29)
Total area of elements, m²			75.24				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 29.84 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5719.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 11.29 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.13 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	52.23	51.51	50.8	47.49	46.88	43.99	43.99	43.46	45.1	46.88	48.13	49.44

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	93.36	92.64	91.93	88.62	88	85.12	85.12	84.59	86.23	88	89.26	90.57
Average = Sum(39) _{1...12} /12=											88.62	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.83	1.81	1.8	1.73	1.72	1.67	1.67	1.66	1.69	1.72	1.75	1.77
Average = Sum(40) _{1...12} /12=											1.73	(40)

DER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.72 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.1 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	82.61	79.6	76.6	73.59	70.59	67.59	67.59	70.59	73.59	76.6	79.6	82.61	
Total = Sum(44) _{1...12} =												901.15	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.5	107.14	110.56	96.39	92.49	79.81	73.95	84.86	85.88	100.08	109.25	118.64	
Total = Sum(45) _{1...12} =												1181.55	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (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) × (51) × (52) × (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, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

DER WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=

104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84
--------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	--------

 (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=

104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84
--------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	--------

Output from water heater (annual)_{1...12}

1004.32

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

26.03	22.77	23.49	20.48	19.65	16.96	15.72	18.03	18.25	21.27	23.22	25.21
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

13.38	11.88	9.66	7.31	5.47	4.62	4.99	6.48	8.7	11.05	12.9	13.75
-------	-------	------	------	------	------	------	------	-----	-------	------	-------

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

150.04	151.6	147.67	139.32	128.78	118.87	112.25	110.69	114.61	122.97	133.51	143.42
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

34.99	33.88	31.58	28.45	26.42	23.55	21.12	24.24	25.35	28.59	32.24	33.88
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

247.23	246.18	237.74	223.91	209.49	195.87	187.19	190.24	197.49	211.43	227.48	239.88
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)							
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>13</td></tr></table>	13	x	<table><tr><td>19.64</td></tr></table>	19.64	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>78.03</td></tr></table> (76)	78.03
0.77																		
13																		
19.64																		
0.63																		
0.7																		
78.03																		
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>13</td></tr></table>	13	x	<table><tr><td>38.42</td></tr></table>	38.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>152.64</td></tr></table> (76)	152.64
0.77																		
13																		
38.42																		
0.63																		
0.7																		
152.64																		
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>13</td></tr></table>	13	x	<table><tr><td>63.27</td></tr></table>	63.27	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>251.38</td></tr></table> (76)	251.38
0.77																		
13																		
63.27																		
0.63																		
0.7																		
251.38																		
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>13</td></tr></table>	13	x	<table><tr><td>92.28</td></tr></table>	92.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>366.63</td></tr></table> (76)	366.63
0.77																		
13																		
92.28																		
0.63																		
0.7																		
366.63																		
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>13</td></tr></table>	13	x	<table><tr><td>113.09</td></tr></table>	113.09	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>449.31</td></tr></table> (76)	449.31
0.77																		
13																		
113.09																		
0.63																		
0.7																		
449.31																		
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>13</td></tr></table>	13	x	<table><tr><td>115.77</td></tr></table>	115.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>459.95</td></tr></table> (76)	459.95
0.77																		
13																		
115.77																		
0.63																		
0.7																		
459.95																		
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>13</td></tr></table>	13	x	<table><tr><td>110.22</td></tr></table>	110.22	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>437.89</td></tr></table> (76)	437.89
0.77																		
13																		
110.22																		
0.63																		
0.7																		
437.89																		
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>13</td></tr></table>	13	x	<table><tr><td>94.68</td></tr></table>	94.68	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>376.14</td></tr></table> (76)	376.14
0.77																		
13																		
94.68																		
0.63																		
0.7																		
376.14																		

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	13	x	73.59	x	0.63	x	0.7	=	292.37	(76)
East	0.9x	0.77	x	13	x	45.59	x	0.63	x	0.7	=	181.12	(76)
East	0.9x	0.77	x	13	x	24.49	x	0.63	x	0.7	=	97.29	(76)
East	0.9x	0.77	x	13	x	16.15	x	0.63	x	0.7	=	64.17	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	78.03	152.64	251.38	366.63	449.31	459.95	437.89	376.14	292.37	181.12	97.29	64.17	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	325.26	398.83	489.12	590.54	658.8	655.82	625.08	566.39	489.86	392.55	324.77	304.05	(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=	0.97	0.95	0.91	0.84	0.74	0.61	0.5	0.55	0.74	0.89	0.95	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.27	19.42	19.67	20.02	20.31	20.53	20.62	20.6	20.42	20.03	19.61	19.28	(87)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.45	19.46	19.47	19.52	19.52	19.56	19.56	19.57	19.55	19.52	19.51	19.49	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.96	0.94	0.9	0.81	0.69	0.52	0.37	0.42	0.66	0.87	0.94	0.96	(89)
--------	------	------	-----	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.18	17.39	17.76	18.29	18.68	18.99	19.08	19.08	18.86	18.32	17.71	17.21	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.17	18.35	18.66	19.1	19.45	19.71	19.81	19.8	19.59	19.13	18.6	18.18	(92)
--------	-------	-------	-------	------	-------	-------	-------	------	-------	-------	------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.17	18.35	18.66	19.1	19.45	19.71	19.81	19.8	19.59	19.13	18.6	18.18	(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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.95	0.93	0.89	0.8	0.69	0.53	0.39	0.44	0.67	0.86	0.93	0.96	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	309.93	370.8	433.14	474.13	452.09	349.7	244.04	249	326.06	336.03	303.4	291.38	(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=	1294.44	1245.69	1118.14	904.32	681.67	435.12	272.98	287.18	473.63	750.31	1026.63	1266.39	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	732.48	587.93	509.64	309.73	170.81	0	0	0	0	308.22	520.73	725.4	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	-------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3864.94

(98)

Space heating requirement in kWh/m²/year

75.66

(99)

DER WorkSheet: New dwelling design stage

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		100	(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)

732.48	587.93	509.64	309.73	170.81	0	0	0	0	308.22	520.73	725.4	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												(211)
732.48	587.93	509.64	309.73	170.81	0	0	0	0	308.22	520.73	725.4	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												3864.94 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1...5,10...12} =												0 (215)

Water heating

Output from water heater (calculated above)

104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84	
Efficiency of water heater												100 (216)
(217)m =	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	104.13	91.07	93.98	81.93	78.61	67.84	62.86	72.13	73	85.07	92.86	100.84		
Total = Sum(219a) _{1..12} =													1004.32	(219)

Annual totals

		kWh/year	kWh/year
Space heating fuel used, main system 1		3864.94	
Water heating fuel used		1004.32	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		236.23	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5105.48	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.519	= 2005.9 (261)
Space heating (secondary)	(215) ×	0.519	= 0 (263)
Water heating	(219) ×	0.519	= 521.24 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2527.15 (265)
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	= 0 (267)

DER WorkSheet: New dwelling design stage

Electricity for lighting	(232) x	0.519	=	122.6	(268)
Total CO2, kg/year		sum of (265)...(271) =			2649.75 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			51.87 (273)
EI rating (section 14)				63	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N3 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	51.08 (1a) x	4 (2a) =	204.32 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	51.08 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	204.32 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.35 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.27 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.34	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.3	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.56 0.56 0.55 0.54 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 0.55 0.54 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
Windows			12.77	x1/[1/(1.4)+0.04] =	16.93		(27)
Floor			51.08	x 0.13 =	6.6404		(28)
Walls	24.16	12.77	11.39	x 0.18 =	2.05		(29)
Total area of elements, m²			75.24				(31)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.62 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5721.31 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.76 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 29.38 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	37.7	37.54	37.39	36.68	36.54	35.92	35.92	35.81	36.16	36.54	36.81	37.1

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	67.08	66.92	66.77	66.06	65.93	65.31	65.31	65.19	65.55	65.93	66.2	66.48
	Average = Sum(39) _{1...12} /12= 66.06											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.31	1.31	1.31	1.29	1.29	1.28	1.28	1.28	1.28	1.29	1.3	1.3
	Average = Sum(40) _{1...12} /12= 1.29											(40)

TER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.72 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.1 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	82.61	79.6	76.6	73.59	70.59	67.59	67.59	70.59	73.59	76.6	79.6	82.61	
Total = Sum(44) _{1...12} =												901.15	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	122.5	107.14	110.56	96.39	92.49	79.81	73.95	84.86	85.88	100.08	109.25	118.64	
Total = Sum(45) _{1...12} =												1181.55	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.38	16.07	16.58	14.46	13.87	11.97	11.09	12.73	12.88	15.01	16.39	17.8	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

TER WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	169.1	149.23	157.15	141.48	139.08	124.9	120.55	131.46	130.97	146.68	154.34	165.23	(62)
--------	-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	169.1	149.23	157.15	141.48	139.08	124.9	120.55	131.46	130.97	146.68	154.34	165.23	
Output from water heater (annual) _{1...12}												1730.17	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	78.01	69.29	74.04	68.12	68.03	62.61	61.87	65.49	64.63	70.55	72.4	76.72	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.38	11.88	9.66	7.31	5.47	4.62	4.99	6.48	8.7	11.05	12.9	13.75	(67)
--------	-------	-------	------	------	------	------	------	------	-----	-------	------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	150.04	151.6	147.67	139.32	128.78	118.87	112.25	110.69	114.61	122.97	133.51	143.42	(68)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	31.61	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	-68.88	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	104.85	103.11	99.51	94.61	91.44	86.96	83.15	88.03	89.76	94.83	100.55	103.12	(72)
--------	--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	320.09	318.42	308.67	293.08	277.51	262.27	252.22	257.03	264.91	280.67	298.79	312.12	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	12.77	x	19.64	x	0.63	x	0.7	=	76.65 (76)
East	0.9x	0.77	x	12.77	x	38.42	x	0.63	x	0.7	=	149.94 (76)
East	0.9x	0.77	x	12.77	x	63.27	x	0.63	x	0.7	=	246.93 (76)
East	0.9x	0.77	x	12.77	x	92.28	x	0.63	x	0.7	=	360.14 (76)
East	0.9x	0.77	x	12.77	x	113.09	x	0.63	x	0.7	=	441.36 (76)
East	0.9x	0.77	x	12.77	x	115.77	x	0.63	x	0.7	=	451.82 (76)
East	0.9x	0.77	x	12.77	x	110.22	x	0.63	x	0.7	=	430.15 (76)
East	0.9x	0.77	x	12.77	x	94.68	x	0.63	x	0.7	=	369.49 (76)

TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	12.77	x	73.59	x	0.63	x	0.7	=	287.2	(76)
East	0.9x	0.77	x	12.77	x	45.59	x	0.63	x	0.7	=	177.92	(76)
East	0.9x	0.77	x	12.77	x	24.49	x	0.63	x	0.7	=	95.57	(76)
East	0.9x	0.77	x	12.77	x	16.15	x	0.63	x	0.7	=	63.03	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	76.65	149.94	246.93	360.14	441.36	451.82	430.15	369.49	287.2	177.92	95.57	63.03	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	396.74	468.36	555.61	653.22	718.87	714.09	682.36	626.52	552.1	458.59	394.36	375.15	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.96	0.89	0.75	0.56	0.42	0.47	0.73	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.7	19.9	20.23	20.61	20.87	20.97	20.99	20.99	20.91	20.54	20.05	19.67	(87)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.83	19.83	19.84	19.85	19.85	19.86	19.86	19.86	19.85	19.85	19.84	19.84	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.86	0.69	0.47	0.31	0.36	0.64	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=	18.14	18.42	18.89	19.42	19.73	19.84	19.86	19.86	19.79	19.35	18.65	18.09	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.87	19.12	19.52	19.98	20.27	20.37	20.39	20.39	20.32	19.91	19.31	18.83	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.87	19.12	19.52	19.98	20.27	20.37	20.39	20.39	20.32	19.91	19.31	18.83	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.86	0.71	0.51	0.36	0.41	0.68	0.92	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	392.73	458.61	526.96	564.51	510.69	367.51	246.18	257.51	375.44	420.74	386.63	372.14	(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=	977.61	951.56	869.32	732.13	564.77	377.08	247.64	260.13	407.7	613.95	808.14	972.91	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	435.15	331.26	254.72	120.69	40.23	0	0	0	0	143.75	303.49	446.97	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2076.27

(98)

Space heating requirement in kWh/m²/year

40.65

(99)

TER WorkSheet: New dwelling design stage

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

435.15	331.26	254.72	120.69	40.23	0	0	0	0	143.75	303.49	446.97
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m × (204)] } × 100 ÷ (206) (211)

465.4	354.29	272.43	129.08	43.03	0	0	0	0	153.74	324.59	478.05
-------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) = Sum(211)_{1...5,10...12} = 2220.61 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

(215)m =	0	0	0	0	0	0	0	0	0	0	0	Total (kWh/year) = Sum(215) _{1...5,10...12} = 0 (215)
----------	---	---	---	---	---	---	---	---	---	---	---	--

Water heating

Output from water heater (calculated above)

169.1	149.23	157.15	141.48	139.08	124.9	120.55	131.46	130.97	146.68	154.34	165.23
-------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

Efficiency of water heater 79.8 (216)

(217)m =	87.23	86.88	86.1	84.39	81.97	79.8	79.8	79.8	79.8	84.76	86.59	87.34	(217)
----------	-------	-------	------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m =	193.86	171.76	182.54	167.64	169.66	156.52	151.07	164.74	164.12	173.05	178.25	189.18	Total = Sum(219a) _{1...12} = 2062.38 (219)
----------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	2220.61	
Water heating fuel used	2062.38	

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 236.23 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 4594.22 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.216	= 479.65 (261)
Space heating (secondary)	(215) ×	0.519	= 0 (263)
Water heating	(219) ×	0.216	= 445.47 (264)

TER WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			925.13	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	122.6	(268)
Total CO2, kg/year	sum of (265)...(271) =			1086.65	(272)
TER	=			31.23	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 30 October 2024 at 11:19:58

Project Information:

Assessed By: John Ashe (STRO031268)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 53.83m²

Site Reference : Victoria Mill, Stockport

Plot Reference: N4 Victoria Mill, Stockport

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

32.94 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

57.70 kg/m²

Fail

Excess emissions = 24.76 kg/m² (75.2 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

65.0 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

85.6 kWh/m²

Fail

Excess energy = 20.55 kg/m² (31.6 %)

2 Fabric U-values

Element

Average

Highest

External wall

0.19 (max. 0.30)

0.19 (max. 0.70)

OK

Floor

0.16 (max. 0.25)

0.16 (max. 0.70)

OK

Roof

(no roof)

Openings

1.60 (max. 2.00)

1.60 (max. 3.30)

OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals

15.00

OK

4 Heating efficiency

Main Heating system:

Electric storage systems - electric
Modern (slimline) storage heaters with Celect-type control

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

No cylinder

6 Controls

Space heating controls

Controls for high heat retention storage heaters

OK

Hot water controls:

No cylinder thermostat
No cylinder

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines):	Not assessed	?
-----------------------------------	--------------	---

10 Key features

None

Thermal Bridge Report

Property Details: N4 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

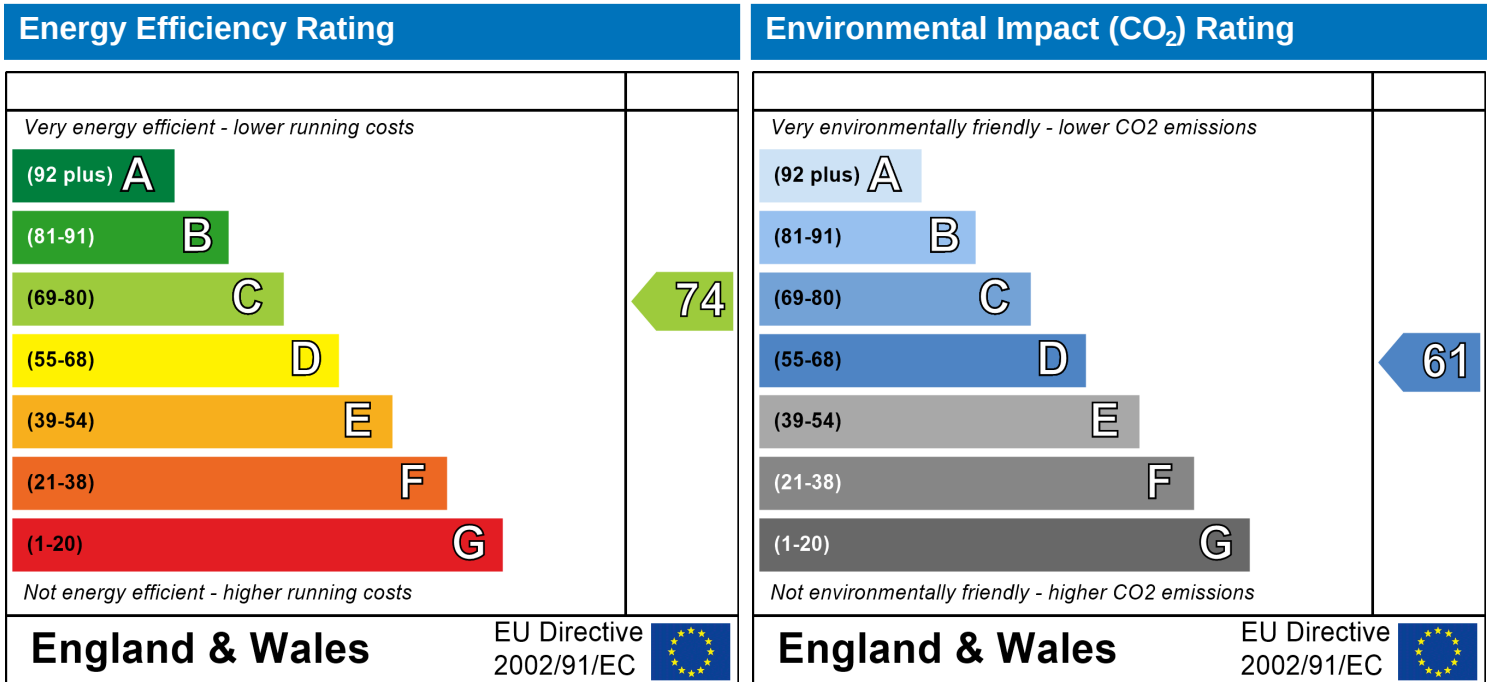
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Ground floor Flat
30 October 2024
John Ashe
53.83 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Developer Confirmation Report

Property Details: N4 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines
UPRN:
Date of assessment: 30 October 2024
Date of certificate: 30 October 2024
Assessment type: New dwelling design stage
Transaction type: New dwelling
Thermal Mass Parameter: Indicative Value Low
Comments:

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2024
Front of dwelling faces: North
Comments:

Opening types:

Name:	Type:	Frame Factor:	g-value:	U-Value:	Area:
Windows	Windows	0.7	0.63	1.6	19.5

Overshading: Average or unknown
Comments:

Opaque Elements:

Type:	U-Value:	Kappa:
<u>External Elements</u>		
Walls	0.19 Please provide the U-Value calculation to justify the U-Value entered into the assessment.	N/A

Materials Used:

Type:	Name:	Thickness:	Conductivity:	R-Value:
Walls	Internal Surface Resistance	0	0	0.13
Walls	Plaster (Lightweight) (0 mm)	3	0.18	0.02
Walls	Plasterboard Standard (0 mm)	12.5	0.21	0.06

Developer Confirmation Report

Walls	Thermawall TW50 (100 mm)	100	0.022	4.55
Walls	Plaster Dabs Cavity (15 mm)	15	0	0.17
Walls	Brickwork Outer Leaf - BRE (102.5 mm)	300	0.77	0.39
Walls	External Surface Resistance	0	0	0.04

Comments:

GF 0.16 Please provide the U-Value calculation to justify the U-Value entered into the assessment. N/A

Internal Elements (Area, Kappa)

Party Elements (Area, Kappa)

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Comments:

If specific construction details have been adopted then please provide the associated checklists; signed and dated.

Ventilation:

Pressure test: No (Assumed)
Ventilation: Natural ventilation (extract fans)
Pressure test: 15

Comments:

Please provide the pressure test certificate, or certificates if the result is based on an average; signed and dated.

Main heating system:

Main heating system: Electric storage systems
Off-peak tariffs
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 405
Modern (slimline) storage heaters with Celect-type control
Systems with radiators

Comments:

Main heating Control:

Developer Confirmation Report

Main heating Control:

Controls for high heat retention storage heaters

Comments:

Secondary heating system:

Secondary heating system:

None

Comments:

Water heating:

Water heating:

No hot water cylinder

Comments:

Solar panel: False

Others:

Electricity tariff:

7-Hour Tariff

Low energy lights:

100%

Terrain type:

Low rise urban / suburban

Wind turbine:

No

Photovoltaics:

None

Comments:

Please provide the MCS certificate or data sheet equivalent confirming the size of the array on the roof. This should include any calculations to support a proportioned amount included in the assessment.

Declaration :

I confirm that the property has been built to the above specification.

Signed:

.....

Date:

.....

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N4 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	53.83 (1a) x	4 (2a) =	215.32 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.83 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.32 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0 +	0 +	0 =	0 x 40 =	0 (6a)
Number of open flues	0 +	0 +	0 =	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.75 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.58 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			19.5	$\times 1/[1/(1.6) + 0.04] =$	29.32		(27)
Floor			53.83	$\times$ 0.16	8.6128		(28)
Walls	50.68	19.5	31.18	$\times$ 0.19	5.92		(29)
Total area of elements, m²			104.51				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 43.86 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 6201.92 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 15.68 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 59.54 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	55.04	54.28	53.54	50.05	49.4	46.36	46.36	45.8	47.53	49.4	50.72	52.1

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	114.58	113.82	113.08	109.59	108.94	105.9	105.9	105.33	107.07	108.94	110.26	111.64
Average = Sum(39) _{1...12} /12=											109.59	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	2.13	2.11	2.1	2.04	2.02	1.97	1.97	1.96	1.99	2.02	2.05	2.07
Average = Sum(40) _{1...12} /12=											2.04	(40)

SAP WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 77.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	84.72	81.64	78.56	75.48	72.4	69.32	69.32	72.4	75.48	78.56	81.64	84.72	
Total = Sum(44) _{1...12} =												924.26	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.64	109.89	113.39	98.86	94.86	81.86	75.85	87.04	88.08	102.65	112.05	121.68	
Total = Sum(45) _{1...12} =												1211.85	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) \times (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) \times (51) \times (52) \times (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) \times (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

SAP WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43	(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=	106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43	
Output from water heater (annual) _{1...12}												1030.07	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	26.7	23.35	24.1	21.01	20.16	17.39	16.12	18.5	18.72	21.81	23.81	25.86	(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=	108.18	108.18	108.18	108.18	108.18	108.18	108.18	108.18	108.18	108.18	108.18	108.18	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	35.03	31.11	25.3	19.16	14.32	12.09	13.06	16.98	22.79	28.94	33.77	36	(67)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	----	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	234.58	237.01	230.88	217.82	201.33	185.84	175.49	173.06	179.19	192.25	208.73	224.23	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	47.62	47.62	47.62	47.62	47.62	47.62	47.62	47.62	47.62	47.62	47.62	47.62	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.89	34.75	32.39	29.18	27.09	24.16	21.66	24.86	26	29.32	33.07	34.75	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	389.17	386.55	372.25	349.83	326.43	305.77	293.9	298.58	311.66	334.18	359.26	378.66	(73)
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
East	0.9x	0.77	x	19.5	x	19.64	x	0.63	x	0.7	=	117.05	(76)
East	0.9x	0.77	x	19.5	x	38.42	x	0.63	x	0.7	=	228.97	(76)
East	0.9x	0.77	x	19.5	x	63.27	x	0.63	x	0.7	=	377.07	(76)
East	0.9x	0.77	x	19.5	x	92.28	x	0.63	x	0.7	=	549.94	(76)
East	0.9x	0.77	x	19.5	x	113.09	x	0.63	x	0.7	=	673.97	(76)
East	0.9x	0.77	x	19.5	x	115.77	x	0.63	x	0.7	=	689.93	(76)
East	0.9x	0.77	x	19.5	x	110.22	x	0.63	x	0.7	=	656.84	(76)
East	0.9x	0.77	x	19.5	x	94.68	x	0.63	x	0.7	=	564.22	(76)

SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	19.5	x	73.59	x	0.63	x	0.7	=	438.55	(76)
East	0.9x	0.77	x	19.5	x	45.59	x	0.63	x	0.7	=	271.69	(76)
East	0.9x	0.77	x	19.5	x	24.49	x	0.63	x	0.7	=	145.94	(76)
East	0.9x	0.77	x	19.5	x	16.15	x	0.63	x	0.7	=	96.25	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	117.05	228.97	377.07	549.94	673.97	689.93	656.84	564.22	438.55	271.69	145.94	96.25	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	506.22	615.52	749.32	899.77	1000.4	995.7	950.74	862.79	750.21	605.87	505.2	474.91	(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=	0.94	0.91	0.86	0.77	0.66	0.53	0.42	0.46	0.65	0.83	0.92	0.94	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.24	19.4	19.67	20.03	20.31	20.52	20.6	20.59	20.42	20.03	19.59	19.24	(87)
--------	-------	------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.25	19.26	19.27	19.31	19.32	19.36	19.36	19.36	19.34	19.32	19.3	19.28	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.93	0.89	0.84	0.73	0.59	0.43	0.28	0.33	0.56	0.79	0.9	0.93	(89)
--------	------	------	------	------	------	------	------	------	------	------	-----	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17	17.23	17.61	18.13	18.49	18.77	18.85	18.85	18.66	18.15	17.53	17.01	(90)
--------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.09	18.29	18.62	19.05	19.38	19.62	19.7	19.69	19.51	19.06	18.53	18.09	(92)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.09	18.29	18.62	19.05	19.38	19.62	19.7	19.69	19.51	19.06	18.53	18.09	(93)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.92	0.88	0.82	0.72	0.6	0.45	0.32	0.36	0.57	0.78	0.89	0.92	(94)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	463.65	543.17	616.98	650.73	597.05	444.4	299.89	308.97	428.57	474.18	448.06	438.67	(95)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1579.98	1523.57	1369.95	1112.39	836.32	531.31	328.45	346.71	579.41	921.97	1259.92	1551.01	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	830.55	658.83	560.21	332.4	178.01	0	0	0	0	333.16	584.54	827.59	(98)
--------	--------	--------	--------	-------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

4305.28

(98)

Space heating requirement in kWh/m²/year

79.98

(99)

SAP WorkSheet: New dwelling design stage

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		100	(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)

830.55	658.83	560.21	332.4	178.01	0	0	0	0	333.16	584.54	827.59
--------	--------	--------	-------	--------	---	---	---	---	--------	--------	--------

(211)m = {[[(98)m x (204)] } x 100 ÷ (206) (211)

830.55	658.83	560.21	332.4	178.01	0	0	0	0	333.16	584.54	827.59
--------	--------	--------	-------	--------	---	---	---	---	--------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} =

4305.28 (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)

106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(219a)_{1...12} =

1030.07 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		4305.28
Water heating fuel used		1030.07

Electricity for pumps, fans and electric keep-hot

Total electricity for the above, kWh/year sum of (230a)...(230g) = 0 (231)

Electricity for lighting 247.45 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 5582.8 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	5.5	x 0.01 = 236.79 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	15.29	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	14.31	x 0.01 = 147.41 (247)
Pumps, fans and electric keep-hot	(231)	0	x 0.01 = 0 (249)

SAP WorkSheet: New dwelling design stage

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting (232) 14.31 x 0.01 = 35.41 (250)

Additional standing charges (Table 12) 24 (251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)...(254) = 443.62 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12) 0.42 (256)

Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] = 1.89 (257)

SAP rating (Section 12) 73.7 (258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1) (211) x	0.519	=	2234.44 (261)
Space heating (secondary) (215) x	0.519	=	0 (263)
Water heating (219) x	0.519	=	534.61 (264)
Space and water heating (261) + (262) + (263) + (264) =			2769.05 (265)
Electricity for pumps, fans and electric keep-hot (231) x	0.519	=	0 (267)
Electricity for lighting (232) x	0.519	=	128.42 (268)
Total CO2, kg/year		sum of (265)...(271) =	2897.47 (272)
CO2 emissions per m²		(272) ÷ (4) =	53.83 (273)
El rating (section 14)			61 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1) (211) x	3.07	=	13217.22 (261)
Space heating (secondary) (215) x	3.07	=	0 (263)
Energy for water heating (219) x	3.07	=	3162.31 (264)
Space and water heating (261) + (262) + (263) + (264) =			16379.53 (265)
Electricity for pumps, fans and electric keep-hot (231) x	3.07	=	0 (267)
Electricity for lighting (232) x	0	=	759.66 (268)
'Total Primary Energy		sum of (265)...(271) =	17139.19 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	318.39 (273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N4 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	<input type="text" value="53.83"/> (1a) x	<input type="text" value="4"/> (2a) =	<input type="text" value="215.32"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="53.83"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="215.32"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="20"/>	÷ (5) =	<input type="text" value="0.09"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="5"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			<input type="text" value="0.34"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="3"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="0.78"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.27"/> (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31
------	------	------	------	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.56 0.56 0.55 0.54 0.54 0.53 0.53 0.53 0.54 0.54 0.54 0.55 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.56 0.56 0.55 0.54 0.54 0.53 0.53 0.53 0.54 0.54 0.54 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
Windows			13.46	$\times 1/[1/(1.4) + 0.04] =$	17.84		(27)
Floor			53.83	$\times$ 0.13	6.9979		(28)
Walls	50.68	13.46	37.22	$\times$ 0.18	6.7		(29)
Total area of elements, m²			104.51				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 31.54 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 6256.28 (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 5.23 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.77 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	39.61	39.45	39.29	38.56	38.43	37.79	37.79	37.67	38.04	38.43	38.7	38.99

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.37	76.22	76.06	75.33	75.19	74.56	74.56	74.44	74.8	75.19	75.47	75.76
	Average = Sum(39) _{1...12} /12= 75.33											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.42	1.42	1.41	1.4	1.4	1.39	1.39	1.38	1.39	1.4	1.4	1.41
	Average = Sum(40) _{1...12} /12= 1.4											(40)

TFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 77.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	84.72	81.64	78.56	75.48	72.4	69.32	69.32	72.4	75.48	78.56	81.64	84.72	
Total = Sum(44) _{1...12} =												924.26	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.64	109.89	113.39	98.86	94.86	81.86	75.85	87.04	88.08	102.65	112.05	121.68	
Total = Sum(45) _{1...12} =												1211.85	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (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) × (51) × (52) × (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, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

TFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43	(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=	106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43	
Output from water heater (annual) _{1...12}												1030.07	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	26.7	23.35	24.1	21.01	20.16	17.39	16.12	18.5	18.72	21.81	23.81	25.86	(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=	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.01	12.44	10.12	7.66	5.73	4.84	5.22	6.79	9.12	11.57	13.51	14.4	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.17	158.8	154.69	145.94	134.89	124.51	117.58	115.95	120.06	128.81	139.85	150.23	(68)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.89	34.75	32.39	29.18	27.09	24.16	21.66	24.86	26	29.32	33.07	34.75	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	257.11	256.03	247.24	232.82	217.76	203.55	194.51	197.64	205.21	219.74	236.47	249.43	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	13.46	x	19.64	x	0.63	x	0.7	=	80.79	(76)
East	0.9x	0.77	x	13.46	x	38.42	x	0.63	x	0.7	=	158.04	(76)
East	0.9x	0.77	x	13.46	x	63.27	x	0.63	x	0.7	=	260.28	(76)
East	0.9x	0.77	x	13.46	x	92.28	x	0.63	x	0.7	=	379.6	(76)
East	0.9x	0.77	x	13.46	x	113.09	x	0.63	x	0.7	=	465.21	(76)
East	0.9x	0.77	x	13.46	x	115.77	x	0.63	x	0.7	=	476.23	(76)
East	0.9x	0.77	x	13.46	x	110.22	x	0.63	x	0.7	=	453.39	(76)
East	0.9x	0.77	x	13.46	x	94.68	x	0.63	x	0.7	=	389.45	(76)

TFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	13.46	x	73.59	x	0.63	x	0.7	=	302.71	(76)
East	0.9x	0.77	x	13.46	x	45.59	x	0.63	x	0.7	=	187.53	(76)
East	0.9x	0.77	x	13.46	x	24.49	x	0.63	x	0.7	=	100.74	(76)
East	0.9x	0.77	x	13.46	x	16.15	x	0.63	x	0.7	=	66.44	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	80.79	158.04	260.28	379.6	465.21	476.23	453.39	389.45	302.71	187.53	100.74	66.44	(83)
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	337.9	414.08	507.52	612.42	682.97	679.78	647.9	587.1	507.93	407.28	337.21	315.87	(84)
--------	-------	--------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.82	0.65	0.49	0.56	0.82	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.44	19.64	19.99	20.43	20.77	20.94	20.99	20.98	20.83	20.35	19.81	19.4	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.75	19.75	19.75	19.76	19.77	19.77	19.77	19.78	19.77	19.77	19.76	19.76	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.76	0.55	0.36	0.42	0.73	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=	18.35	18.55	18.9	19.33	19.62	19.75	19.77	19.77	19.68	19.26	18.73	18.32	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.88	19.08	19.43	19.86	20.18	20.33	20.36	20.36	20.24	19.79	19.25	18.85	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.88	19.08	19.43	19.86	20.18	20.33	20.36	20.36	20.24	19.79	19.25	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	0.97	0.91	0.78	0.59	0.43	0.49	0.77	0.96	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	336.44	409.8	492.55	557.56	534.68	404.06	276.22	287.01	390.9	389.12	334.32	314.84	(95)
--------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1113.34	1080.84	983.4	825.9	637.55	427.08	280.46	294.5	459.48	691.34	917.17	1109.58	(97)
--------	---------	---------	-------	-------	--------	--------	--------	-------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	578.02	450.94	365.19	193.21	76.53	0	0	0	0	224.85	419.66	591.29	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2899.68

(98)

Space heating requirement in kWh/m²/year

53.87

(99)

TFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	700.86	551.74	565.76	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.89	0.93	0.91	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	621.23	515.53	514.09	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	862.4	823.83	753.78	0	0	0	0	(103)
---------	---	---	---	---	---	-------	--------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	173.64	229.38	178.33	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = Sum(104) = 581.35 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	43.41	57.34	44.58	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 145.34 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 2.7 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 56.57 (109)

Target Fabric Energy Efficiency (TFEE) 65.05 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N4 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	53.83 (1a)	4 (2a)	215.32 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.83 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.32 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.09 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.84 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.65 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.83	0.82	0.8	0.72	0.7	0.62	0.62	0.6	0.65	0.7	0.73	0.77
------	------	-----	------	-----	------	------	-----	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

(23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0.85	0.83	0.82	0.76	0.75	0.69	0.69	0.68	0.71	0.75	0.77	0.79
------	------	------	------	------	------	------	------	------	------	------	------

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.85	0.83	0.82	0.76	0.75	0.69	0.69	0.68	0.71	0.75	0.77	0.79
------	------	------	------	------	------	------	------	------	------	------	------

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			19.5	$\times 1/[1/(1.6) + 0.04] =$	29.32		(27)
Floor			53.83	$\times$	0.16		(28)
Walls	50.68	19.5	31.18	$\times$	0.19		(29)
Total area of elements, m²			104.51				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 43.86 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 6201.92 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 15.68 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 59.54 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	60.17	59.22	58.28	53.87	53.05	49.21	49.21	48.5	50.69	53.05	54.72	56.46

(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	119.71	118.75	117.81	113.41	112.58	108.75	108.75	108.04	110.22	112.58	114.25	116
Average = Sum(39) _{1...12} /12=												113.4

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	2.22	2.21	2.19	2.11	2.09	2.02	2.02	2.01	2.05	2.09	2.12	2.15
Average = Sum(40) _{1...12} /12=												2.11

(40)

DFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 77.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	84.72	81.64	78.56	75.48	72.4	69.32	69.32	72.4	75.48	78.56	81.64	84.72	
Total = Sum(44) _{1...12} =												924.26	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.64	109.89	113.39	98.86	94.86	81.86	75.85	87.04	88.08	102.65	112.05	121.68	
Total = Sum(45) _{1...12} =												1211.85	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) \times (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) \times (51) \times (52) \times (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) \times (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

DFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43	(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=	106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43	
Output from water heater (annual) _{1...12}												1030.07	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	26.7	23.35	24.1	21.01	20.16	17.39	16.12	18.5	18.72	21.81	23.81	25.86	(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=	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.01	12.44	10.12	7.66	5.73	4.84	5.22	6.79	9.12	11.57	13.51	14.4	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.17	158.8	154.69	145.94	134.89	124.51	117.58	115.95	120.06	128.81	139.85	150.23	(68)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.89	34.75	32.39	29.18	27.09	24.16	21.66	24.86	26	29.32	33.07	34.75	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	257.11	256.03	247.24	232.82	217.76	203.55	194.51	197.64	205.21	219.74	236.47	249.43	(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	19.5	x	19.64	x	0.63	x	0.7	=	117.05	(76)	
East	0.9x	0.77	x	19.5	x	38.42	x	0.63	x	0.7	=	228.97	(76)	
East	0.9x	0.77	x	19.5	x	63.27	x	0.63	x	0.7	=	377.07	(76)	
East	0.9x	0.77	x	19.5	x	92.28	x	0.63	x	0.7	=	549.94	(76)	
East	0.9x	0.77	x	19.5	x	113.09	x	0.63	x	0.7	=	673.97	(76)	
East	0.9x	0.77	x	19.5	x	115.77	x	0.63	x	0.7	=	689.93	(76)	
East	0.9x	0.77	x	19.5	x	110.22	x	0.63	x	0.7	=	656.84	(76)	
East	0.9x	0.77	x	19.5	x	94.68	x	0.63	x	0.7	=	564.22	(76)	

DFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	19.5	x	73.59	x	0.63	x	0.7	=	438.55	(76)
East	0.9x	0.77	x	19.5	x	45.59	x	0.63	x	0.7	=	271.69	(76)
East	0.9x	0.77	x	19.5	x	24.49	x	0.63	x	0.7	=	145.94	(76)
East	0.9x	0.77	x	19.5	x	16.15	x	0.63	x	0.7	=	96.25	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	117.05	228.97	377.07	549.94	673.97	689.93	656.84	564.22	438.55	271.69	145.94	96.25	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	374.15	485	624.31	782.76	891.73	893.48	851.35	761.86	643.77	491.43	382.42	345.68	(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=	0.96	0.94	0.9	0.81	0.7	0.57	0.46	0.51	0.71	0.88	0.95	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	17.07	17.49	18.21	19.18	19.96	20.53	20.78	20.73	20.23	19.16	17.97	17.05	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.19	19.2	19.21	19.26	19.27	19.32	19.32	19.33	19.3	19.27	19.25	19.23	(88)
--------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.95	0.93	0.87	0.77	0.64	0.47	0.32	0.37	0.62	0.84	0.93	0.96	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	15.77	16.19	16.9	17.85	18.57	19.08	19.25	19.23	18.86	17.87	16.71	15.78	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.4	16.82	17.54	18.5	19.24	19.79	20	19.96	19.53	18.5	17.32	16.4	(92)
--------	------	-------	-------	------	-------	-------	----	-------	-------	------	-------	------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.4	16.82	17.54	18.5	19.24	19.79	20	19.96	19.53	18.5	17.32	16.4	(93)
--------	------	-------	-------	------	-------	-------	----	-------	-------	------	-------	------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.94	0.9	0.85	0.75	0.64	0.5	0.38	0.43	0.63	0.82	0.91	0.94	(94)
--------	------	-----	------	------	------	-----	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	350.41	438.31	528.74	589.66	568.35	447.39	323.08	325.43	406.41	403.69	349.28	326.32	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1448.3	1415.42	1300.67	1088.16	849.2	563.94	369.32	384.64	598.06	889	1167.81	1414.66	(97)
--------	--------	---------	---------	---------	-------	--------	--------	--------	--------	-----	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	816.83	656.61	574.32	358.92	208.95	0	0	0	0	361.07	589.35	809.72	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

4375.77

Space heating requirement in kWh/m²/year

81.29

(99)

DFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	1022.22	804.73	821.07	0	0	0	0	(100)
---------	---	---	---	---	---	---------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.68	0.74	0.71	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	699.68	598.15	580.67	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	1112.18	1061.63	958.05	0	0	0	0	(103)
---------	---	---	---	---	---	---------	---------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	297	344.83	280.77	0	0	0	0	
---------	---	---	---	---	---	-----	--------	--------	---	---	---	---	--

Total = Sum(104) = 922.6 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	74.25	86.21	70.19	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 230.65 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 4.28 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 85.57 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N4 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	53.83 (1a) x	4 (2a) =	215.32 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.83 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.32 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.75 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.58 (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

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			19.5	$\times 1/[1/(1.6) + 0.04] =$	29.32		(27)
Floor			53.83	$\times$ 0.16	8.6128		(28)
Walls	50.68	19.5	31.18	$\times$ 0.19	5.92		(29)
Total area of elements, m²			104.51				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 43.86 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 6201.92 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 15.68 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 59.54 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	55.04	54.28	53.54	50.05	49.4	46.36	46.36	45.8	47.53	49.4	50.72	52.1

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	114.58	113.82	113.08	109.59	108.94	105.9	105.9	105.33	107.07	108.94	110.26	111.64
Average = Sum(39) _{1...12} /12=											109.59	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	2.13	2.11	2.1	2.04	2.02	1.97	1.97	1.96	1.99	2.02	2.05	2.07
Average = Sum(40) _{1...12} /12=											2.04	(40)

DER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 77.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	84.72	81.64	78.56	75.48	72.4	69.32	69.32	72.4	75.48	78.56	81.64	84.72	
Total = Sum(44) _{1...12} =												924.26	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.64	109.89	113.39	98.86	94.86	81.86	75.85	87.04	88.08	102.65	112.05	121.68	
Total = Sum(45) _{1...12} =												1211.85	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) \times (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) \times (51) \times (52) \times (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) \times (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

DER WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43	(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=	106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43	
Output from water heater (annual) _{1...12}												1030.07	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	26.7	23.35	24.1	21.01	20.16	17.39	16.12	18.5	18.72	21.81	23.81	25.86	(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=	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.01	12.44	10.12	7.66	5.73	4.84	5.22	6.79	9.12	11.57	13.51	14.4	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.17	158.8	154.69	145.94	134.89	124.51	117.58	115.95	120.06	128.81	139.85	150.23	(68)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.89	34.75	32.39	29.18	27.09	24.16	21.66	24.86	26	29.32	33.07	34.75	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	257.11	256.03	247.24	232.82	217.76	203.55	194.51	197.64	205.21	219.74	236.47	249.43	(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	19.5	x	19.64	x	0.63	x	0.7	=	117.05	(76)	
East	0.9x	0.77	x	19.5	x	38.42	x	0.63	x	0.7	=	228.97	(76)	
East	0.9x	0.77	x	19.5	x	63.27	x	0.63	x	0.7	=	377.07	(76)	
East	0.9x	0.77	x	19.5	x	92.28	x	0.63	x	0.7	=	549.94	(76)	
East	0.9x	0.77	x	19.5	x	113.09	x	0.63	x	0.7	=	673.97	(76)	
East	0.9x	0.77	x	19.5	x	115.77	x	0.63	x	0.7	=	689.93	(76)	
East	0.9x	0.77	x	19.5	x	110.22	x	0.63	x	0.7	=	656.84	(76)	
East	0.9x	0.77	x	19.5	x	94.68	x	0.63	x	0.7	=	564.22	(76)	

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	19.5	x	73.59	x	0.63	x	0.7	=	438.55	(76)
East	0.9x	0.77	x	19.5	x	45.59	x	0.63	x	0.7	=	271.69	(76)
East	0.9x	0.77	x	19.5	x	24.49	x	0.63	x	0.7	=	145.94	(76)
East	0.9x	0.77	x	19.5	x	16.15	x	0.63	x	0.7	=	96.25	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	117.05	228.97	377.07	549.94	673.97	689.93	656.84	564.22	438.55	271.69	145.94	96.25	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	374.15	485	624.31	782.76	891.73	893.48	851.35	761.86	643.77	491.43	382.42	345.68	(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=	0.96	0.94	0.89	0.81	0.7	0.57	0.45	0.51	0.7	0.87	0.95	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.13	19.3	19.59	19.97	20.27	20.49	20.59	20.57	20.38	19.95	19.49	19.12	(87)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.25	19.26	19.27	19.31	19.32	19.36	19.36	19.36	19.34	19.32	19.3	19.28	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.95	0.93	0.87	0.77	0.63	0.46	0.31	0.36	0.61	0.84	0.93	0.96	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.84	17.09	17.5	18.05	18.45	18.75	18.84	18.84	18.62	18.05	17.39	16.85	(90)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.95	18.16	18.51	18.98	19.34	19.6	19.69	19.68	19.47	18.98	18.41	17.96	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.95	18.16	18.51	18.98	19.34	19.6	19.69	19.68	19.47	18.98	18.41	17.96	(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=	0.95	0.92	0.86	0.76	0.63	0.48	0.35	0.39	0.62	0.83	0.92	0.95	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	354.21	444.32	536.87	596.07	565.24	429.88	293.97	300.58	399.91	408.45	353.54	329.54	(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=	1564.36	1509.38	1358.37	1104.55	831.77	529.24	327.54	345.44	575.28	912.54	1246.52	1535.63	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	900.35	715.72	611.2	366.1	198.3	0	0	0	0	375.04	642.95	897.33	(98)
--------	--------	--------	-------	-------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

4706.99

Space heating requirement in kWh/m²/year

87.44

(99)

DER WorkSheet: New dwelling design stage

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		100	(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)

900.35	715.72	611.2	366.1	198.3	0	0	0	0	375.04	642.95	897.33
--------	--------	-------	-------	-------	---	---	---	---	--------	--------	--------

(211)m = {[[(98)m x (204)] } x 100 ÷ (206) (211)

900.35	715.72	611.2	366.1	198.3	0	0	0	0	375.04	642.95	897.33
--------	--------	-------	-------	-------	---	---	---	---	--------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}=

4706.99 (211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---

Total (kWh/year) =Sum(215)_{1...5,10...12}=

0 (215)

Water heating

Output from water heater (calculated above)

106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	106.8	93.4	96.39	84.03	80.63	69.58	64.47	73.98	74.87	87.25	95.24	103.43
---------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(219a)_{1...12} =

1030.07 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	4706.99	
Water heating fuel used	1030.07	

Electricity for pumps, fans and electric keep-hot

Total electricity for the above, kWh/year sum of (230a)...(230g) = 0 (231)

Electricity for lighting 247.45 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 5984.5 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	= 2442.93 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.519	= 534.61 (264)
Space and water heating	(261) + (262) + (263) + (264) =		2977.53 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 0 (267)

DER WorkSheet: New dwelling design stage

Electricity for lighting	(232) x	0.519	=	128.42	(268)
Total CO2, kg/year		sum of (265)...(271) =			3105.96 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			57.7 (273)
EI rating (section 14)				58	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N4 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	53.83 (1a)	4 (2a)	215.32 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	53.83 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	215.32 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.09 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.34 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.27 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31
------	------	------	------	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.56 0.56 0.55 0.54 0.54 0.53 0.53 0.53 0.54 0.54 0.54 0.55 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.56 0.56 0.55 0.54 0.54 0.53 0.53 0.53 0.54 0.54 0.54 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
Windows			13.46	$\times 1/[1/(1.4) + 0.04] =$	17.84		(27)
Floor			53.83	$\times$ 0.13	6.9979		(28)
Walls	50.68	13.46	37.22	$\times$ 0.18	6.7		(29)
Total area of elements, m²			104.51				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 31.54 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 6256.28 (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 5.23 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.77 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	39.61	39.45	39.29	38.56	38.43	37.79	37.79	37.67	38.04	38.43	38.7	38.99

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	76.37	76.22	76.06	75.33	75.19	74.56	74.56	74.44	74.8	75.19	75.47	75.76
	Average = Sum(39) _{1...12} /12= 75.33											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.42	1.42	1.41	1.4	1.4	1.39	1.39	1.38	1.39	1.4	1.4	1.41
	Average = Sum(40) _{1...12} /12= 1.4											(40)

TER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.8 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 77.02 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	84.72	81.64	78.56	75.48	72.4	69.32	69.32	72.4	75.48	78.56	81.64	84.72	
Total = Sum(44) _{1...12} =												924.26	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	125.64	109.89	113.39	98.86	94.86	81.86	75.85	87.04	88.08	102.65	112.05	121.68	
Total = Sum(45) _{1...12} =												1211.85	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.85	16.48	17.01	14.83	14.23	12.28	11.38	13.06	13.21	15.4	16.81	18.25	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) × (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) × (51) × (52) × (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

TER WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	172.24	151.97	159.99	143.95	141.45	126.95	122.45	133.64	133.17	149.24	157.14	168.27	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	172.24	151.97	159.99	143.95	141.45	126.95	122.45	133.64	133.17	149.24	157.14	168.27	
Output from water heater (annual) _{1...12}												1760.46	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	79.05	70.21	74.98	68.94	68.82	63.29	62.5	66.22	65.36	71.41	73.33	77.73	(65)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	90.15	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.01	12.44	10.12	7.66	5.73	4.84	5.22	6.79	9.12	11.57	13.51	14.4	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	157.17	158.8	154.69	145.94	134.89	124.51	117.58	115.95	120.06	128.81	139.85	150.23	(68)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	32.02	(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=	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	-72.12	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	106.25	104.47	100.78	95.76	92.5	87.9	84	89	90.78	95.98	101.85	104.48	(72)
--------	--------	--------	--------	-------	------	------	----	----	-------	-------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	330.47	328.76	318.63	302.4	286.16	270.3	259.85	264.79	273	289.4	308.25	322.16	(73)
--------	--------	--------	--------	-------	--------	-------	--------	--------	-----	-------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	13.46	x	19.64	x	0.63	x	0.7	=	80.79 (76)
East	0.9x	0.77	x	13.46	x	38.42	x	0.63	x	0.7	=	158.04 (76)
East	0.9x	0.77	x	13.46	x	63.27	x	0.63	x	0.7	=	260.28 (76)
East	0.9x	0.77	x	13.46	x	92.28	x	0.63	x	0.7	=	379.6 (76)
East	0.9x	0.77	x	13.46	x	113.09	x	0.63	x	0.7	=	465.21 (76)
East	0.9x	0.77	x	13.46	x	115.77	x	0.63	x	0.7	=	476.23 (76)
East	0.9x	0.77	x	13.46	x	110.22	x	0.63	x	0.7	=	453.39 (76)
East	0.9x	0.77	x	13.46	x	94.68	x	0.63	x	0.7	=	389.45 (76)

TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	13.46	x	73.59	x	0.63	x	0.7	=	302.71	(76)
East	0.9x	0.77	x	13.46	x	45.59	x	0.63	x	0.7	=	187.53	(76)
East	0.9x	0.77	x	13.46	x	24.49	x	0.63	x	0.7	=	100.74	(76)
East	0.9x	0.77	x	13.46	x	16.15	x	0.63	x	0.7	=	66.44	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	80.79	158.04	260.28	379.6	465.21	476.23	453.39	389.45	302.71	187.53	100.74	66.44	(83)
--------	-------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	411.27	486.8	578.91	682	751.37	746.52	713.24	654.24	575.71	476.94	408.99	388.6	(84)
--------	--------	-------	--------	-----	--------	--------	--------	--------	--------	--------	--------	-------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.91	0.78	0.6	0.45	0.51	0.77	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.56	19.76	20.1	20.51	20.81	20.95	20.99	20.98	20.87	20.45	19.93	19.52	(87)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.75	19.75	19.75	19.76	19.77	19.77	19.77	19.78	19.77	19.77	19.76	19.76	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.88	0.72	0.5	0.33	0.38	0.67	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=	17.87	18.16	18.65	19.23	19.6	19.75	19.77	19.77	19.68	19.16	18.41	17.82	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.69	18.94	19.35	19.85	20.19	20.33	20.36	20.36	20.26	19.79	19.15	18.65	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.69	18.94	19.35	19.85	20.19	20.33	20.36	20.36	20.26	19.79	19.15	18.65	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.88	0.74	0.55	0.39	0.44	0.71	0.93	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	407.35	477.46	552.1	600.13	556.32	410.44	277.62	289.64	410.36	442.24	401.64	385.64	(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=	1099.05	1069.84	977.55	824.97	638.31	427.55	280.61	294.78	460.84	690.89	909.19	1094.71	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	514.63	398.08	316.53	161.89	61.01	0	0	0	0	184.99	365.43	527.56	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2530.11

(98)

Space heating requirement in kWh/m²/year

47

(99)

TER WorkSheet: New dwelling design stage

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

514.63	398.08	316.53	161.89	61.01	0	0	0	0	184.99	365.43	527.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
550.4	425.75	338.54	173.14	65.25	0	0	0	0	197.85	390.84	564.23	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												2706
												(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1...5,10...12} =												0
												(215)

Water heating

Output from water heater (calculated above)

172.24	151.97	159.99	143.95	141.45	126.95	122.45	133.64	133.17	149.24	157.14	168.27	
Efficiency of water heater												79.8
(217)m =	87.56	87.27	86.6	85.13	82.75	79.8	79.8	79.8	79.8	85.39	86.99	87.66
												(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.72	174.15	184.74	169.1	170.94	159.08	153.44	167.46	166.88	174.78	180.64	191.97		
Total = Sum(219a) _{1...12} =													2089.91	(219)

Annual totals

Space heating fuel used, main system 1	2706	kWh/year	kWh/year
Water heating fuel used	2089.91		

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	75	(231)
Electricity for lighting	247.45	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =	5118.35	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 584.5
Space heating (secondary)	(215) x	0.519	= 0
Water heating	(219) x	0.216	= 451.42

TER WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			1035.92	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	128.42	(268)
Total CO2, kg/year	sum of (265)...(271) =			1203.27	(272)
TER	=			32.94	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 30 October 2024 at 11:19:55

Project Information:

Assessed By: John Ashe (STRO031268)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 52.15m²

Site Reference : Victoria Mill, Stockport

Plot Reference: N5 Victoria Mill, Stockport

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

30.25 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

49.65 kg/m²

Fail

Excess emissions = 19.4 kg/m² (64.1 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

53.1 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

69.6 kWh/m²

Fail

Excess energy = 16.46 kg/m² (31.0 %)

2 Fabric U-values

Element

Average

Highest

External wall

0.19 (max. 0.30)

0.19 (max. 0.70)

OK

Floor

0.16 (max. 0.25)

0.16 (max. 0.70)

OK

Roof

(no roof)

Openings

1.60 (max. 2.00)

1.60 (max. 3.30)

OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals

15.00

OK

4 Heating efficiency

Main Heating system:

Electric storage systems - electric
Modern (slimline) storage heaters with Celect-type control

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

No cylinder

6 Controls

Space heating controls

Controls for high heat retention storage heaters

OK

Hot water controls:

No cylinder thermostat
No cylinder

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines):	Not assessed	?
-----------------------------------	--------------	---

10 Key features

None

Thermal Bridge Report

Property Details: N5 Victoria Mill, Stockport

Address:

Located in:

England

Region:

West Pennines

Thermal bridges:

Thermal bridges:

No information on thermal bridging (y=0.15) (y =0.15)

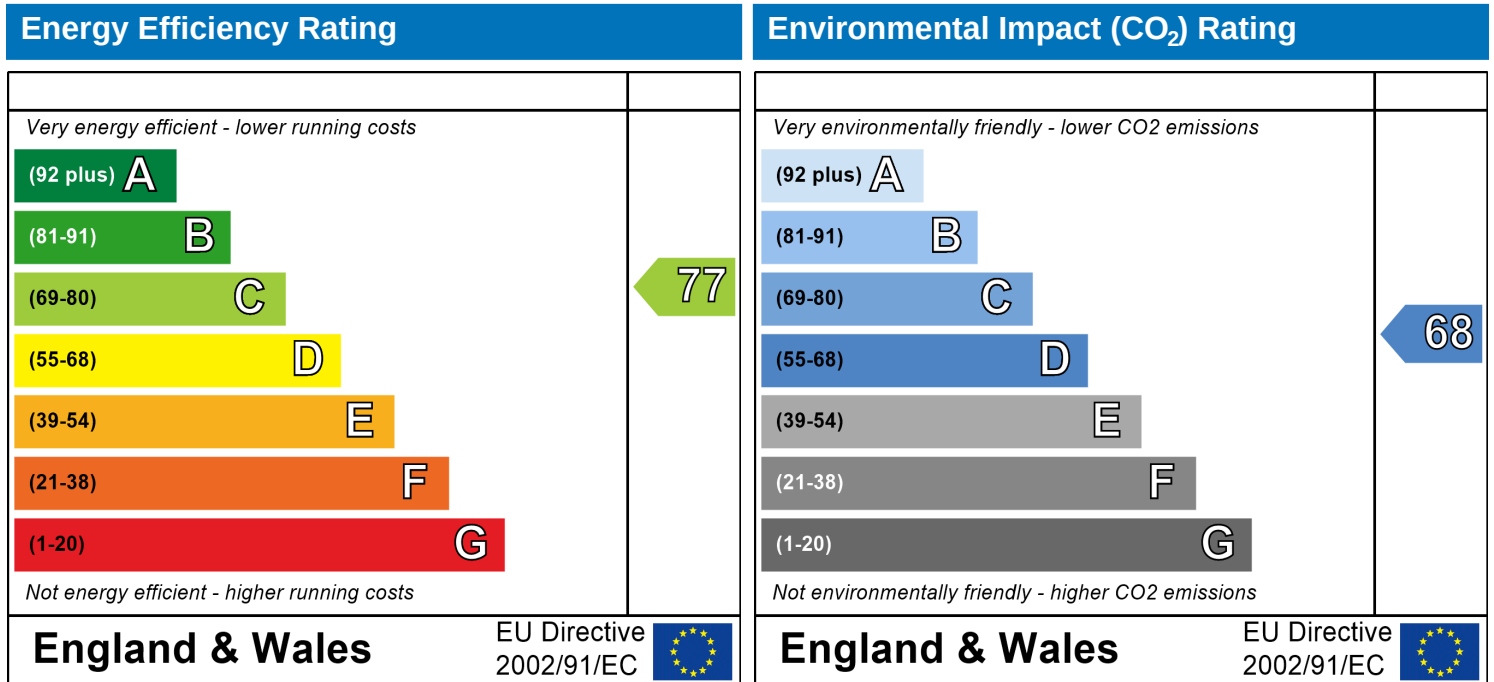
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Ground floor Flat
30 October 2024
John Ashe
52.15 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Developer Confirmation Report

Property Details: N5 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines
UPRN:
Date of assessment: 30 October 2024
Date of certificate: 30 October 2024
Assessment type: New dwelling design stage
Transaction type: New dwelling
Thermal Mass Parameter: Indicative Value Low
Comments:

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2024
Front of dwelling faces: North
Comments:

Opening types:

Name:	Type:	Frame Factor:	g-value:	U-Value:	Area:
Windows	Windows	0.7	0.63	1.6	6.5

Overshading: Average or unknown
Comments:

Opaque Elements:

Type:	U-Value:	Kappa:
<u>External Elements</u>		
Walls	0.19 Please provide the U-Value calculation to justify the U-Value entered into the assessment.	N/A

Materials Used:	Name:	Thickness:	Conductivity:	R-Value:
Walls	Internal Surface Resistance	0	0	0.13
Walls	Plaster (Lightweight) (0 mm)	3	0.18	0.02
Walls	Plasterboard Standard (0 mm)	12.5	0.21	0.06

Developer Confirmation Report

Walls	Thermawall TW50 (100 mm)	100	0.022	4.55
Walls	Plaster Dabs Cavity (15 mm)	15	0	0.17
Walls	Brickwork Outer Leaf - BRE (102.5 mm)	300	0.77	0.39
Walls	External Surface Resistance	0	0	0.04

Comments:

GF 0.16 Please provide the U-Value calculation to justify the U-Value entered into the assessment. N/A

Internal Elements (Area, Kappa)

Party Elements (Area, Kappa)

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Comments:

If specific construction details have been adopted then please provide the associated checklists; signed and dated.

Ventilation:

Pressure test: No (Assumed)
Ventilation: Natural ventilation (extract fans)
Pressure test: 15

Comments:

Please provide the pressure test certificate, or certificates if the result is based on an average; signed and dated.

Main heating system:

Main heating system: Electric storage systems
Off-peak tariffs
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 405
Modern (slimline) storage heaters with Celect-type control
Systems with radiators

Comments:

Main heating Control:

Developer Confirmation Report

Main heating Control:

Controls for high heat retention storage heaters

Comments:

Secondary heating system:

Secondary heating system:

None

Comments:

Water heating:

Water heating:

No hot water cylinder

Comments:

Solar panel: False

Others:

Electricity tariff:

7-Hour Tariff

Low energy lights:

100%

Terrain type:

Low rise urban / suburban

Wind turbine:

No

Photovoltaics:

None

Comments:

Please provide the MCS certificate or data sheet equivalent confirming the size of the array on the roof. This should include any calculations to support a proportioned amount included in the assessment.

Declaration :

I confirm that the property has been built to the above specification.

Signed:

.....

Date:

.....

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N5 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	52.15 (1a) x	4 (2a) =	208.6 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.15 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.6 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.75 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.58 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			6.5	$\times 1/[1/(1.6) + 0.04] =$	9.77		(27)
Floor			52.15	$\times$ 0.16	8.344		(28)
Walls	18.16	6.5	11.66	$\times$ 0.19	2.22		(29)
Total area of elements, m²			70.31				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 20.33 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5841.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 10.55 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 30.88 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	53.32	52.59	51.87	48.49	47.86	44.91	44.91	44.37	46.05	47.86	49.14	50.47

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.2	83.47	82.75	79.37	78.74	75.79	75.79	75.25	76.93	78.74	80.02	81.35
	Average = Sum(39) _{1...12} /12= 79.37											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.61	1.6	1.59	1.52	1.51	1.45	1.45	1.44	1.48	1.51	1.53	1.56
	Average = Sum(40) _{1...12} /12= 1.52											(40)

SAP WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.75 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.85 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	83.43	80.4	77.36	74.33	71.29	68.26	68.26	71.29	74.33	77.36	80.4	83.43	
Total = Sum(44) _{1...12} =												910.15	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	123.72	108.21	111.66	97.35	93.41	80.61	74.69	85.71	86.74	101.08	110.34	119.82	
Total = Sum(45) _{1...12} =												1193.35	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

SAP WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85	(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=	105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85	
Output from water heater (annual) _{1...12}												1014.34	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	26.29	22.99	23.73	20.69	19.85	17.13	15.87	18.21	18.43	21.48	23.45	25.46	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	105.21	105.21	105.21	105.21	105.21	105.21	105.21	105.21	105.21	105.21	105.21	105.21	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	37.49	33.3	27.08	20.5	15.32	12.94	13.98	18.17	24.39	30.97	36.14	38.53	(67)
--------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	228.08	230.45	224.48	211.79	195.76	180.7	170.63	168.27	174.23	186.93	202.95	218.02	(68)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	47.27	47.27	47.27	47.27	47.27	47.27	47.27	47.27	47.27	47.27	47.27	47.27	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.34	34.22	31.89	28.73	26.68	23.79	21.33	24.48	25.6	28.87	32.57	34.22	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	383.25	380.31	365.8	343.36	320.11	299.77	288.29	293.26	306.56	329.11	354.01	373.12	(73)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	6.5	x	19.64	x	0.63	x	0.7	=	39.02 (76)
East	0.9x	0.77	x	6.5	x	38.42	x	0.63	x	0.7	=	76.32 (76)
East	0.9x	0.77	x	6.5	x	63.27	x	0.63	x	0.7	=	125.69 (76)
East	0.9x	0.77	x	6.5	x	92.28	x	0.63	x	0.7	=	183.31 (76)
East	0.9x	0.77	x	6.5	x	113.09	x	0.63	x	0.7	=	224.66 (76)
East	0.9x	0.77	x	6.5	x	115.77	x	0.63	x	0.7	=	229.98 (76)
East	0.9x	0.77	x	6.5	x	110.22	x	0.63	x	0.7	=	218.95 (76)
East	0.9x	0.77	x	6.5	x	94.68	x	0.63	x	0.7	=	188.07 (76)

SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.5	x	73.59	x	0.63	x	0.7	=	146.18	(76)
East	0.9x	0.77	x	6.5	x	45.59	x	0.63	x	0.7	=	90.56	(76)
East	0.9x	0.77	x	6.5	x	24.49	x	0.63	x	0.7	=	48.65	(76)
East	0.9x	0.77	x	6.5	x	16.15	x	0.63	x	0.7	=	32.08	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	39.02	76.32	125.69	183.31	224.66	229.98	218.95	188.07	146.18	90.56	48.65	32.08	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	422.27	456.63	491.49	526.68	544.76	529.74	507.24	481.33	452.75	419.67	402.65	405.2	(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=	0.95	0.93	0.91	0.86	0.78	0.66	0.54	0.58	0.75	0.88	0.93	0.95	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.51	19.62	19.81	20.1	20.34	20.55	20.64	20.63	20.48	20.16	19.82	19.53	(87)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.6	19.61	19.62	19.67	19.68	19.72	19.72	19.73	19.71	19.68	19.66	19.64	(88)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.94	0.92	0.89	0.83	0.74	0.58	0.42	0.46	0.68	0.85	0.92	0.94	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.63	17.78	18.07	18.51	18.86	19.16	19.27	19.26	19.06	18.62	18.11	17.68	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.5

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.58	18.7	18.94	19.31	19.6	19.86	19.96	19.95	19.77	19.39	18.97	18.61	(92)
--------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.58	18.7	18.94	19.31	19.6	19.86	19.96	19.95	19.77	19.39	18.97	18.61	(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=	0.93	0.91	0.88	0.83	0.73	0.59	0.44	0.48	0.68	0.84	0.91	0.93	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	392.16	417.06	434.25	434.65	400.14	313.43	225.05	230.99	307.91	352.01	365.37	378.32	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1202.09	1152.2	1029.57	825.99	622.17	398.82	254.58	267.27	436.55	692.41	949.72	1172.27	(97)
--------	---------	--------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	602.59	494.01	442.91	281.76	165.19	0	0	0	0	253.26	420.74	590.7	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	-------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3251.17

(98)

Space heating requirement in kWh/m²/year

62.34

(99)

SAP WorkSheet: New dwelling design stage

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		100	(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)

602.59	494.01	442.91	281.76	165.19	0	0	0	0	253.26	420.74	590.7	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
602.59	494.01	442.91	281.76	165.19	0	0	0	0	253.26	420.74	590.7	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												3251.17
												(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	
Total (kWh/year) = Sum(215) _{1...5,10...12} =												0
												(215)

Water heating

Output from water heater (calculated above)

105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85	
Efficiency of water heater												100
(217)m=	100	100	100	100	100	100	100	100	100	100	100	
												(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85		
Total = Sum(219a) _{1...12} =													1014.34	(219)

Annual totals

													kWh/year	kWh/year
Space heating fuel used, main system 1													3251.17	
Water heating fuel used													1014.34	
Electricity for pumps, fans and electric keep-hot														
Total electricity for the above, kWh/year													0	(231)
Electricity for lighting													264.82	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =													4530.33	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	5.5	x 0.01 = 178.81 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	15.29	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	14.31	x 0.01 = 145.16 (247)
Pumps, fans and electric keep-hot	(231)	0	x 0.01 = 0 (249)

SAP WorkSheet: New dwelling design stage

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting (232) 14.31 x 0.01 = 37.9 (250)

Additional standing charges (Table 12) 24 (251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)...(254) = 385.87 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12) 0.42 (256)

Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] = 1.67 (257)

SAP rating (Section 12) 76.73 (258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1) (211) x	0.519	=	1687.36 (261)
Space heating (secondary) (215) x	0.519	=	0 (263)
Water heating (219) x	0.519	=	526.44 (264)
Space and water heating (261) + (262) + (263) + (264) =			2213.8 (265)
Electricity for pumps, fans and electric keep-hot (231) x	0.519	=	0 (267)
Electricity for lighting (232) x	0.519	=	137.44 (268)
Total CO2, kg/year sum of (265)...(271) =			2351.24 (272)
CO2 emissions per m² (272) ÷ (4) =			45.09 (273)
El rating (section 14)			68 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1) (211) x	3.07	=	9981.08 (261)
Space heating (secondary) (215) x	3.07	=	0 (263)
Energy for water heating (219) x	3.07	=	3114.04 (264)
Space and water heating (261) + (262) + (263) + (264) =			13095.11 (265)
Electricity for pumps, fans and electric keep-hot (231) x	3.07	=	0 (267)
Electricity for lighting (232) x	0	=	812.99 (268)
'Total Primary Energy sum of (265)...(271) =			13908.1 (272)
Primary energy kWh/m²/year (272) ÷ (4) =			266.69 (273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	John Ashe	Stroma Number:	STRO031268
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.5.60

Property Address: N5 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	52.15	(1a) x	4	(2a) =	208.6
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.15	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			208.6

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							2	x 10 =	20
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.1	(8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.35	(18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>				
Number of sides sheltered			3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.27	(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
--------------	------	------	-----	------	------	------	------	---	------	------	------

TFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.34	0.34	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31
------	------	------	------	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.56 0.56 0.55 0.54 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 0.55 0.54 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
Windows			6.5	$\times 1/[1/(1.4) + 0.04] =$	8.62		(27)
Floor			52.15	$\times$ 0.13	6.7795		(28)
Walls	18.16	6.5	11.66	$\times$ 0.18	2.1		(29)
Total area of elements, m²			70.31				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 17.5 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5841.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.52 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.01 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	38.44	38.28	38.13	37.41	37.28	36.65	36.65	36.54	36.89	37.28	37.55	37.83

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	59.45	59.29	59.14	58.42	58.29	57.66	57.66	57.55	57.9	58.29	58.56	58.84
	Average = Sum(39) _{1...12} /12= 58.42											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.13	1.12	1.12	1.11	1.11	1.1	1.11	1.12	1.12	1.13
	Average = Sum(40) _{1...12} /12= 1.12											(40)

TFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.75 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.85 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	83.43	80.4	77.36	74.33	71.29	68.26	68.26	71.29	74.33	77.36	80.4	83.43	
Total = Sum(44) _{1...12} =												910.15	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	123.72	108.21	111.66	97.35	93.41	80.61	74.69	85.71	86.74	101.08	110.34	119.82	
Total = Sum(45) _{1...12} =												1193.35	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

TFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=

105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	--------

 (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=

105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	--------

Output from water heater (annual)_{1...12}

1014.34

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

26.29	22.99	23.73	20.69	19.85	17.13	15.87	18.21	18.43	21.48	23.45	25.46
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

15	13.32	10.83	8.2	6.13	5.17	5.59	7.27	9.76	12.39	14.46	15.41
----	-------	-------	-----	------	------	------	------	------	-------	-------	-------

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

152.81	154.4	150.4	141.9	131.16	121.07	114.32	112.74	116.73	125.24	135.98	146.07
--------	-------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

35.34	34.22	31.89	28.73	26.68	23.79	21.33	24.48	25.6	28.87	32.57	34.22
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

252.45	251.24	242.43	228.13	213.27	199.33	190.55	193.79	201.39	215.8	232.3	245.01
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	--------

 (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	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>19.64</td></tr></table>	19.64	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>39.02</td></tr></table>	39.02	(76)
0.77																			
6.5																			
19.64																			
0.63																			
0.7																			
39.02																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>38.42</td></tr></table>	38.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>76.32</td></tr></table>	76.32	(76)
0.77																			
6.5																			
38.42																			
0.63																			
0.7																			
76.32																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>63.27</td></tr></table>	63.27	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>125.69</td></tr></table>	125.69	(76)
0.77																			
6.5																			
63.27																			
0.63																			
0.7																			
125.69																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>92.28</td></tr></table>	92.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>183.31</td></tr></table>	183.31	(76)
0.77																			
6.5																			
92.28																			
0.63																			
0.7																			
183.31																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>113.09</td></tr></table>	113.09	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>224.66</td></tr></table>	224.66	(76)
0.77																			
6.5																			
113.09																			
0.63																			
0.7																			
224.66																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>115.77</td></tr></table>	115.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>229.98</td></tr></table>	229.98	(76)
0.77																			
6.5																			
115.77																			
0.63																			
0.7																			
229.98																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>110.22</td></tr></table>	110.22	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>218.95</td></tr></table>	218.95	(76)
0.77																			
6.5																			
110.22																			
0.63																			
0.7																			
218.95																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>94.68</td></tr></table>	94.68	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>188.07</td></tr></table>	188.07	(76)
0.77																			
6.5																			
94.68																			
0.63																			
0.7																			
188.07																			

TFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.5	x	73.59	x	0.63	x	0.7	=	146.18	(76)
East	0.9x	0.77	x	6.5	x	45.59	x	0.63	x	0.7	=	90.56	(76)
East	0.9x	0.77	x	6.5	x	24.49	x	0.63	x	0.7	=	48.65	(76)
East	0.9x	0.77	x	6.5	x	16.15	x	0.63	x	0.7	=	32.08	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	39.02	76.32	125.69	183.31	224.66	229.98	218.95	188.07	146.18	90.56	48.65	32.08	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	291.47	327.56	368.12	411.44	437.93	429.31	409.5	381.86	347.57	306.36	280.95	277.09	(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	0.97	0.91	0.77	0.6	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=	19.73	19.87	20.11	20.44	20.74	20.93	20.98	20.98	20.84	20.45	20.03	19.71	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.98	19.99	20	20	20	19.99	19.99	19.98	19.98	(88)
--------	-------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.88	0.68	0.47	0.53	0.83	0.98	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.81	18.95	19.19	19.53	19.81	19.96	19.99	19.99	19.9	19.54	19.12	18.8	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	------

fLA = Living area ÷ (4) =

0.5

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.28	19.41	19.65	19.99	20.28	20.45	20.49	20.49	20.37	20	19.58	19.26	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.28	19.41	19.65	19.99	20.28	20.45	20.49	20.49	20.37	20	19.58	19.26	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.96	0.89	0.72	0.54	0.6	0.86	0.98	1	1	(94)
--------	---	---	------	------	------	------	------	-----	------	------	---	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	290.78	326.04	363.75	395.88	388.52	310.56	219.77	227.46	297.37	299.36	279.66	276.59	(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=	890.31	860.29	777.93	647.85	499.89	337.23	224.36	235.11	363	547.64	730.89	886.12	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	446.05	359.02	308.15	181.42	82.85	0	0	0	0	184.72	324.89	453.49	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2340.59

Space heating requirement in kWh/m²/year

44.88

(99)

TFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	542.02	426.7	437.35	0	0	0	0	(100)
---------	---	---	---	---	---	--------	-------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.86	0.92	0.9	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	-----	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	464.91	393.17	392.53	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	568.57	544.2	513.09	0	0	0	0	(103)
---------	---	---	---	---	---	--------	-------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	74.64	112.37	89.69	0	0	0	0	
---------	---	---	---	---	---	-------	--------	-------	---	---	---	---	--

Total = Sum(104) = 276.7 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	18.66	28.09	22.42	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 69.17 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 1.33 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 46.21 (109)

Target Fabric Energy Efficiency (TFEE) 53.14 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N5 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	52.15 (1a)	4 (2a)	208.6 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.15 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	208.6 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.85 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.66 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.84	0.82	0.8	0.72	0.7	0.62	0.62	0.61	0.66	0.7	0.74	0.77
------	------	-----	------	-----	------	------	------	------	-----	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.85 0.84 0.82 0.76 0.75 0.69 0.69 0.68 0.71 0.75 0.77 0.8 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.85 0.84 0.82 0.76 0.75 0.69 0.69 0.68 0.71 0.75 0.77 0.8 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			6.5	$\times 1/[1/(1.6) + 0.04] =$	9.77		(27)
Floor			52.15	$\times$ 0.16	8.344		(28)
Walls	18.16	6.5	11.66	$\times$ 0.19	2.22		(29)
Total area of elements, m²			70.31				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 20.33 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5841.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 10.55 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 30.88 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	58.46	57.53	56.62	52.32	51.51	47.77	47.77	47.08	49.21	51.51	53.14	54.84

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	89.35	88.41	87.5	83.2	82.39	78.65	78.65	77.96	80.09	82.39	84.02	85.72
	Average = Sum(39) _{1...12} /12= 83.19											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.71	1.7	1.68	1.6	1.58	1.51	1.51	1.49	1.54	1.58	1.61	1.64
	Average = Sum(40) _{1...12} /12= 1.6											(40)

DFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.75 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.85 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	83.43	80.4	77.36	74.33	71.29	68.26	68.26	71.29	74.33	77.36	80.4	83.43	
Total = Sum(44) _{1...12} =												910.15	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	123.72	108.21	111.66	97.35	93.41	80.61	74.69	85.71	86.74	101.08	110.34	119.82	
Total = Sum(45) _{1...12} =												1193.35	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

DFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85	(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=	105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85	
Output from water heater (annual) _{1...12}												1014.34	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	26.29	22.99	23.73	20.69	19.85	17.13	15.87	18.21	18.43	21.48	23.45	25.46	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15	13.32	10.83	8.2	6.13	5.17	5.59	7.27	9.76	12.39	14.46	15.41	(67)
--------	----	-------	-------	-----	------	------	------	------	------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	152.81	154.4	150.4	141.9	131.16	121.07	114.32	112.74	116.73	125.24	135.98	146.07	(68)
--------	--------	-------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.34	34.22	31.89	28.73	26.68	23.79	21.33	24.48	25.6	28.87	32.57	34.22	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	252.45	251.24	242.43	228.13	213.27	199.33	190.55	193.79	201.39	215.8	232.3	245.01	(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	6.5	x	19.64	x	0.63	x	0.7	=	39.02 (76)
East	0.9x	0.77	x	6.5	x	38.42	x	0.63	x	0.7	=	76.32 (76)
East	0.9x	0.77	x	6.5	x	63.27	x	0.63	x	0.7	=	125.69 (76)
East	0.9x	0.77	x	6.5	x	92.28	x	0.63	x	0.7	=	183.31 (76)
East	0.9x	0.77	x	6.5	x	113.09	x	0.63	x	0.7	=	224.66 (76)
East	0.9x	0.77	x	6.5	x	115.77	x	0.63	x	0.7	=	229.98 (76)
East	0.9x	0.77	x	6.5	x	110.22	x	0.63	x	0.7	=	218.95 (76)
East	0.9x	0.77	x	6.5	x	94.68	x	0.63	x	0.7	=	188.07 (76)

DFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.5	x	73.59	x	0.63	x	0.7	=	146.18	(76)
East	0.9x	0.77	x	6.5	x	45.59	x	0.63	x	0.7	=	90.56	(76)
East	0.9x	0.77	x	6.5	x	24.49	x	0.63	x	0.7	=	48.65	(76)
East	0.9x	0.77	x	6.5	x	16.15	x	0.63	x	0.7	=	32.08	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	39.02	76.32	125.69	183.31	224.66	229.98	218.95	188.07	146.18	90.56	48.65	32.08	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	291.47	327.56	368.12	411.44	437.93	429.31	409.5	381.86	347.57	306.36	280.95	277.09	(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=	0.97	0.96	0.95	0.91	0.85	0.74	0.63	0.67	0.83	0.93	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	17.54	17.81	18.33	19.12	19.82	20.44	20.73	20.68	20.2	19.29	18.35	17.58	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.53	19.54	19.56	19.62	19.63	19.68	19.68	19.69	19.66	19.63	19.61	19.58	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.96	0.94	0.89	0.81	0.67	0.5	0.55	0.77	0.91	0.96	0.97	(89)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.44	16.72	17.25	18.06	18.73	19.33	19.57	19.55	19.12	18.24	17.3	16.51	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

fLA = Living area ÷ (4) =

0.5

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.99	17.27	17.79	18.59	19.28	19.89	20.15	20.12	19.66	18.77	17.83	17.05	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.99	17.27	17.79	18.59	19.28	19.89	20.15	20.12	19.66	18.77	17.83	17.05	(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=	0.96	0.94	0.92	0.87	0.8	0.68	0.55	0.59	0.77	0.89	0.94	0.96	(94)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	278.45	308.68	337.77	357.99	348.36	291.6	225.96	226.05	267.07	273.46	264.75	265.92	(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=	1133.83	1093.26	988.08	806.36	624.61	415.96	279.39	289.84	445.57	673.11	901.16	1101.3	(97)
--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	636.4	527.24	483.83	322.82	205.53	0	0	0	0	297.34	458.21	621.52	(98)
--------	-------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3552.9

(98)

Space heating requirement in kWh/m²/year

68.13

(99)

DFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	739.3	582	592.46	0	0	0	0	(100)
---------	---	---	---	---	---	-------	-----	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.6	0.67	0.64	0	0	0	0	(101)
---------	---	---	---	---	---	-----	------	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	440.59	388.04	379.33	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	568.57	544.2	513.09	0	0	0	0	(103)
---------	---	---	---	---	---	--------	-------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	92.15	116.19	99.52	0	0	0	0	
---------	---	---	---	---	---	-------	--------	-------	---	---	---	---	--

Total = Sum(104) = 307.85 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	23.04	29.05	24.88	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 76.96 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 1.48 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 69.6 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N5 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	52.15 (1a) x	4 (2a) =	208.6 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.15 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	208.6 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.75 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.58 (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

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			6.5	$\times 1/[1/(1.6) + 0.04] =$	9.77		(27)
Floor			52.15	$\times$ 0.16	8.344		(28)
Walls	18.16	6.5	11.66	$\times$ 0.19	2.22		(29)
Total area of elements, m²			70.31				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 20.33 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5841.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 10.55 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 30.88 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	53.32	52.59	51.87	48.49	47.86	44.91	44.91	44.37	46.05	47.86	49.14	50.47

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	84.2	83.47	82.75	79.37	78.74	75.79	75.79	75.25	76.93	78.74	80.02	81.35
	Average = Sum(39) _{1...12} /12= 79.37											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.61	1.6	1.59	1.52	1.51	1.45	1.45	1.44	1.48	1.51	1.53	1.56
	Average = Sum(40) _{1...12} /12= 1.52											(40)

DER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.75 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.85 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	83.43	80.4	77.36	74.33	71.29	68.26	68.26	71.29	74.33	77.36	80.4	83.43	
Total = Sum(44) _{1...12} =												910.15	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	123.72	108.21	111.66	97.35	93.41	80.61	74.69	85.71	86.74	101.08	110.34	119.82	
Total = Sum(45) _{1...12} =												1193.35	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

DER WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85	(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=	105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85	
Output from water heater (annual) _{1...12}												1014.34	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	26.29	22.99	23.73	20.69	19.85	17.13	15.87	18.21	18.43	21.48	23.45	25.46	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15	13.32	10.83	8.2	6.13	5.17	5.59	7.27	9.76	12.39	14.46	15.41	(67)
--------	----	-------	-------	-----	------	------	------	------	------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	152.81	154.4	150.4	141.9	131.16	121.07	114.32	112.74	116.73	125.24	135.98	146.07	(68)
--------	--------	-------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	35.34	34.22	31.89	28.73	26.68	23.79	21.33	24.48	25.6	28.87	32.57	34.22	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	252.45	251.24	242.43	228.13	213.27	199.33	190.55	193.79	201.39	215.8	232.3	245.01	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	6.5	x	19.64	x	0.63	x	0.7	=	39.02 (76)
East	0.9x	0.77	x	6.5	x	38.42	x	0.63	x	0.7	=	76.32 (76)
East	0.9x	0.77	x	6.5	x	63.27	x	0.63	x	0.7	=	125.69 (76)
East	0.9x	0.77	x	6.5	x	92.28	x	0.63	x	0.7	=	183.31 (76)
East	0.9x	0.77	x	6.5	x	113.09	x	0.63	x	0.7	=	224.66 (76)
East	0.9x	0.77	x	6.5	x	115.77	x	0.63	x	0.7	=	229.98 (76)
East	0.9x	0.77	x	6.5	x	110.22	x	0.63	x	0.7	=	218.95 (76)
East	0.9x	0.77	x	6.5	x	94.68	x	0.63	x	0.7	=	188.07 (76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.5	x	73.59	x	0.63	x	0.7	=	146.18	(76)
East	0.9x	0.77	x	6.5	x	45.59	x	0.63	x	0.7	=	90.56	(76)
East	0.9x	0.77	x	6.5	x	24.49	x	0.63	x	0.7	=	48.65	(76)
East	0.9x	0.77	x	6.5	x	16.15	x	0.63	x	0.7	=	32.08	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	39.02	76.32	125.69	183.31	224.66	229.98	218.95	188.07	146.18	90.56	48.65	32.08	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	291.47	327.56	368.12	411.44	437.93	429.31	409.5	381.86	347.57	306.36	280.95	277.09	(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=	0.97	0.96	0.95	0.91	0.84	0.74	0.62	0.66	0.82	0.93	0.96	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.38	19.48	19.69	20	20.27	20.51	20.62	20.6	20.41	20.06	19.69	19.39	(87)
--------	-------	-------	-------	----	-------	-------	-------	------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.6	19.61	19.62	19.67	19.68	19.72	19.72	19.73	19.71	19.68	19.66	19.64	(88)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.96	0.93	0.89	0.8	0.66	0.49	0.54	0.76	0.91	0.96	0.97	(89)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.43	17.6	17.9	18.38	18.77	19.12	19.25	19.24	18.99	18.48	17.93	17.48	(90)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.5

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.41	18.55	18.8	19.19	19.52	19.82	19.94	19.92	19.71	19.27	18.82	18.44	(92)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.41	18.55	18.8	19.19	19.52	19.82	19.94	19.92	19.71	19.27	18.82	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=	0.96	0.95	0.93	0.88	0.8	0.67	0.52	0.56	0.76	0.9	0.95	0.97	(94)
--------	------	------	------	------	-----	------	------	------	------	-----	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	280.57	311.37	341.11	361.27	349.16	285.73	212.19	214.71	265.4	275.71	266.89	267.77	(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=	1188.11	1138.96	1017.87	816.89	615.84	395.42	252.93	265.2	431.28	683	937.63	1158.68	(97)
--------	---------	---------	---------	--------	--------	--------	--------	-------	--------	-----	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	675.21	556.14	503.51	328.05	198.41	0	0	0	0	303.02	482.94	662.84	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3710.12

(98)

Space heating requirement in kWh/m²/year

71.14

(99)

DER WorkSheet: New dwelling design stage

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		100	(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)

675.21	556.14	503.51	328.05	198.41	0	0	0	0	303.02	482.94	662.84	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												(211)
675.21	556.14	503.51	328.05	198.41	0	0	0	0	303.02	482.94	662.84	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												3710.12
												(211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1...5,10...12} =												0
												(215)

Water heating

Output from water heater (calculated above)

105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85	
Efficiency of water heater												100
(217)m =	100	100	100	100	100	100	100	100	100	100	100	
												(217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	105.17	91.98	94.91	82.75	79.4	68.52	63.49	72.85	73.73	85.92	93.79	101.85		
Total = Sum(219a) _{1..12} =													1014.34	(219)

Annual totals

		kWh/year	kWh/year
Space heating fuel used, main system 1		3710.12	
Water heating fuel used		1014.34	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		264.82	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4989.28	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.519	= 1925.55
Space heating (secondary)	(215) ×	0.519	= 0
Water heating	(219) ×	0.519	= 526.44
Space and water heating	(261) + (262) + (263) + (264) =		2452
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	= 0

DER WorkSheet: New dwelling design stage

Electricity for lighting	(232) x	0.519	=	137.44	(268)
Total CO2, kg/year		sum of (265)...(271) =			2589.43 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			49.65 (273)
EI rating (section 14)				64	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N5 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	52.15 (1a)	4 (2a)	208.6 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52.15 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	208.6 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.35 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.27 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.34	0.34	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31
------	------	------	------	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.56 0.56 0.55 0.54 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 0.55 0.54 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
Windows			6.5	$\times 1/[1/(1.4) + 0.04] =$	8.62		(27)
Floor			52.15	$\times$ 0.13	6.7795		(28)
Walls	18.16	6.5	11.66	$\times$ 0.18	2.1		(29)
Total area of elements, m²			70.31				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 17.5 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5841.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.52 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 21.01 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	38.44	38.28	38.13	37.41	37.28	36.65	36.65	36.54	36.89	37.28	37.55	37.83

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	59.45	59.29	59.14	58.42	58.29	57.66	57.66	57.55	57.9	58.29	58.56	58.84
	Average = Sum(39) _{1...12} /12= 58.42											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.13	1.12	1.12	1.11	1.11	1.1	1.11	1.12	1.12	1.13
	Average = Sum(40) _{1...12} /12= 1.12											(40)

TER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.75 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 75.85 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	83.43	80.4	77.36	74.33	71.29	68.26	68.26	71.29	74.33	77.36	80.4	83.43	
Total = Sum(44) _{1...12} =												910.15	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	123.72	108.21	111.66	97.35	93.41	80.61	74.69	85.71	86.74	101.08	110.34	119.82	
Total = Sum(45) _{1...12} =												1193.35	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.56	16.23	16.75	14.6	14.01	12.09	11.2	12.86	13.01	15.16	16.55	17.97	(46)
--------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

TER WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	170.32	150.3	158.26	142.44	140.01	125.7	121.29	132.31	131.83	147.68	155.43	166.42	(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=	170.32	150.3	158.26	142.44	140.01	125.7	121.29	132.31	131.83	147.68	155.43	166.42	
Output from water heater (annual) _{1...12}												1741.96	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	78.41	69.65	74.4	68.44	68.33	62.87	62.11	65.78	64.91	70.89	72.76	77.12	(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=	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	87.67	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	15	13.32	10.83	8.2	6.13	5.17	5.59	7.27	9.76	12.39	14.46	15.41	(67)
--------	----	-------	-------	-----	------	------	------	------	------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	152.81	154.4	150.4	141.9	131.16	121.07	114.32	112.74	116.73	125.24	135.98	146.07	(68)
--------	--------	-------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	31.77	(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=	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	-70.14	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	105.4	103.64	100.01	95.06	91.85	87.33	83.48	88.41	90.16	95.28	101.06	103.65	(72)
--------	-------	--------	--------	-------	-------	-------	-------	-------	-------	-------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	325.51	323.67	313.54	297.46	281.44	265.87	255.7	260.72	268.95	285.21	303.8	317.44	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	6.5	x	19.64	x	0.63	x	0.7	=	39.02 (76)
East	0.9x	0.77	x	6.5	x	38.42	x	0.63	x	0.7	=	76.32 (76)
East	0.9x	0.77	x	6.5	x	63.27	x	0.63	x	0.7	=	125.69 (76)
East	0.9x	0.77	x	6.5	x	92.28	x	0.63	x	0.7	=	183.31 (76)
East	0.9x	0.77	x	6.5	x	113.09	x	0.63	x	0.7	=	224.66 (76)
East	0.9x	0.77	x	6.5	x	115.77	x	0.63	x	0.7	=	229.98 (76)
East	0.9x	0.77	x	6.5	x	110.22	x	0.63	x	0.7	=	218.95 (76)
East	0.9x	0.77	x	6.5	x	94.68	x	0.63	x	0.7	=	188.07 (76)

TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.5	x	73.59	x	0.63	x	0.7	=	146.18	(76)
East	0.9x	0.77	x	6.5	x	45.59	x	0.63	x	0.7	=	90.56	(76)
East	0.9x	0.77	x	6.5	x	24.49	x	0.63	x	0.7	=	48.65	(76)
East	0.9x	0.77	x	6.5	x	16.15	x	0.63	x	0.7	=	32.08	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	39.02	76.32	125.69	183.31	224.66	229.98	218.95	188.07	146.18	90.56	48.65	32.08	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	364.52	399.99	439.23	480.77	506.1	495.85	474.65	448.79	415.13	375.77	352.44	349.52	(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	0.7	0.52	0.57	0.82	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.86	19.99	20.23	20.55	20.81	20.96	20.99	20.99	20.89	20.56	20.16	19.84	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.98	19.99	20	20	20	19.99	19.99	19.98	19.98	(88)
--------	-------	-------	-------	-------	-------	----	----	----	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.93	0.82	0.61	0.41	0.46	0.75	0.95	0.99	1	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.47	18.66	19	19.46	19.8	19.97	19.99	19.99	19.91	19.48	18.91	18.44	(90)
--------	-------	-------	----	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.5

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.17	19.33	19.62	20.01	20.31	20.46	20.49	20.49	20.4	20.02	19.54	19.15	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.17	19.33	19.62	20.01	20.31	20.46	20.49	20.49	20.4	20.02	19.54	19.15	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.98	0.93	0.83	0.65	0.47	0.52	0.78	0.95	0.99	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	362.09	395.44	428.32	448.98	421.88	321.84	222.12	231.5	323.66	357.1	347.97	347.62	(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=	883.91	855.51	775.9	648.81	501.8	338.13	224.59	235.5	365.02	549.26	728.28	879.45	(97)
--------	--------	--------	-------	--------	-------	--------	--------	-------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	388.24	309.17	258.6	143.88	59.46	0	0	0	0	142.97	273.82	395.68	(98)
--------	--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

1971.81

(98)

Space heating requirement in kWh/m²/year

37.81

(99)

TER WorkSheet: New dwelling design stage

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

388.24	309.17	258.6	143.88	59.46	0	0	0	0	142.97	273.82	395.68
--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------

(211)m = {[[(98)m x (204)] } x 100 ÷ (206) (211)

415.23	330.66	276.58	153.88	63.59	0	0	0	0	152.9	292.85	423.19
--------	--------	--------	--------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) = Sum(211)_{1...5,10...12} = 2108.89 (211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	Total (kWh/year) = Sum(215) _{1...5,10...12} = 0 (215)
---------	---	---	---	---	---	---	---	---	---	---	---	--

Water heating

Output from water heater (calculated above)

170.32	150.3	158.26	142.44	140.01	125.7	121.29	132.31	131.83	147.68	155.43	166.42
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

Efficiency of water heater 79.8 (216)

(217)m=	86.95	86.7	86.12	84.84	82.72	79.8	79.8	79.8	79.8	84.73	86.31	87.04	(217)
---------	-------	------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.89	173.36	183.77	167.89	169.26	157.52	151.99	165.8	165.2	174.3	180.08	191.18	Total = Sum(219a) _{1...12} = 2076.24 (219)
---------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	--------	--------	---

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	2108.89	
Water heating fuel used	2076.24	

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 264.82 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 4524.95 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 455.52 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 448.47 (264)

TER WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			903.99	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	137.44	(268)
Total CO2, kg/year	sum of (265)...(271) =			1080.35	(272)
TER	=			30.25	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 30 October 2024 at 11:19:52

Project Information:

Assessed By: John Ashe (STRO031268)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 49.3m²

Site Reference : Victoria Mill, Stockport

Plot Reference: N6 Victoria Mill, Stockport

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

31.34 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

51.20 kg/m²

Fail

Excess emissions = 19.86 kg/m² (63.4 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

55.4 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

72.0 kWh/m²

Fail

Excess energy = 16.59 kg/m² (29.9 %)

2 Fabric U-values

Element

Average

Highest

External wall

0.19 (max. 0.30)

0.19 (max. 0.70)

OK

Floor

0.16 (max. 0.25)

0.16 (max. 0.70)

OK

Roof

(no roof)

Openings

1.60 (max. 2.00)

1.60 (max. 3.30)

OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals

15.00

OK

4 Heating efficiency

Main Heating system:

Electric storage systems - electric
Modern (slimline) storage heaters with Celect-type control

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

No cylinder

6 Controls

Space heating controls

Controls for high heat retention storage heaters

OK

Hot water controls:

No cylinder thermostat
No cylinder

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines):	Not assessed	?
-----------------------------------	--------------	---

10 Key features

None

Thermal Bridge Report

Property Details: N6 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Predicted Energy Assessment

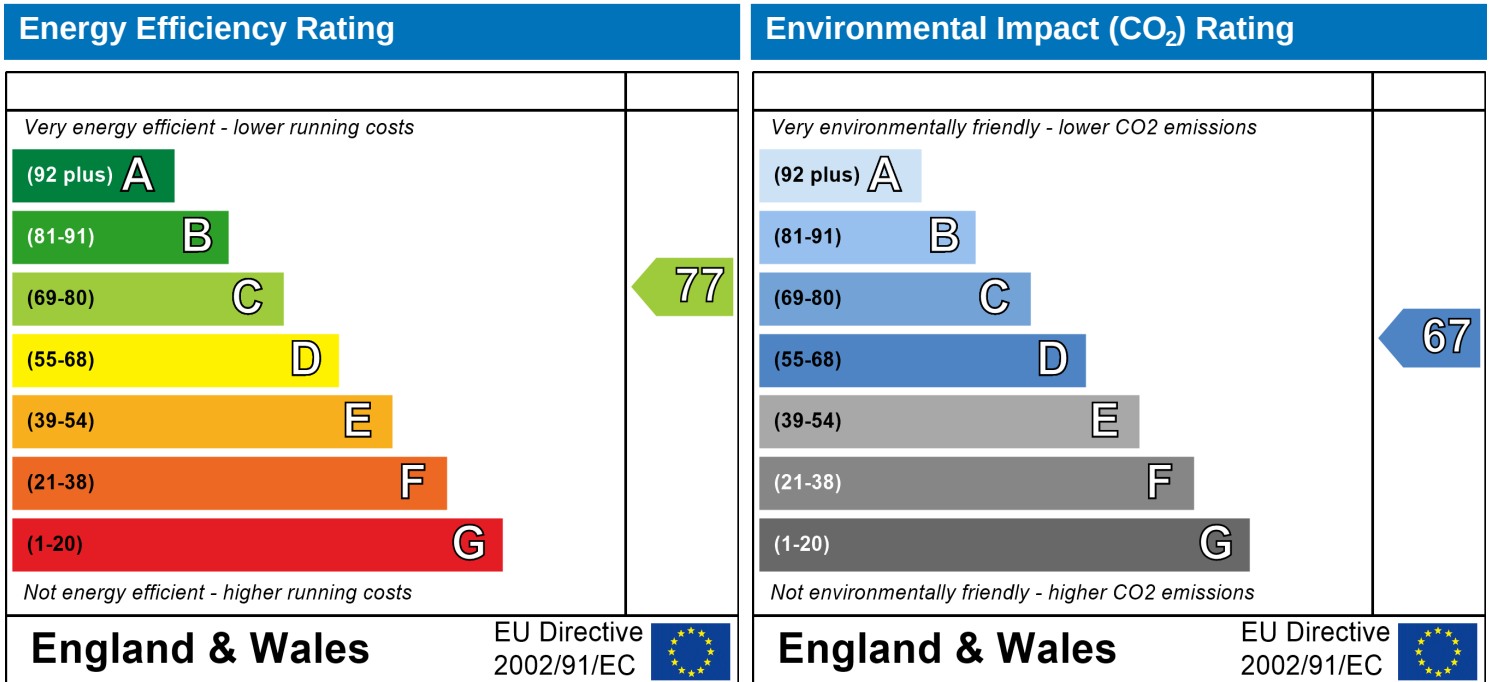


Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Ground floor Flat
30 October 2024
John Ashe
49.3 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Developer Confirmation Report

Property Details: N6 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines
UPRN:
Date of assessment: 30 October 2024
Date of certificate: 30 October 2024
Assessment type: New dwelling design stage
Transaction type: New dwelling
Thermal Mass Parameter: Indicative Value Low
Comments:

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2024
Front of dwelling faces: North
Comments:

Opening types:

Name:	Type:	Frame Factor:	g-value:	U-Value:	Area:
Windows	Windows	0.7	0.63	1.6	6.5
Overshading:	Average or unknown				
Comments:					

Opaque Elements:

Type:	U-Value:	Kappa:
External Elements		
Walls	0.19 Please provide the U-Value calculation to justify the U-Value entered into the assessment.	N/A
Materials Used:		
Type:	Name:	Thickness: Conductivity: R-Value:
Walls	Internal Surface Resistance	0 0 0.13
Walls	Plaster (Lightweight) (0 mm)	3 0.18 0.02
Walls	Plasterboard Standard (0 mm)	12.5 0.21 0.06

Developer Confirmation Report

Walls	Thermawall TW50 (100 mm)	100	0.022	4.55
Walls	Plaster Dabs Cavity (15 mm)	15	0	0.17
Walls	Brickwork Outer Leaf - BRE (102.5 mm)	300	0.77	0.39
Walls	External Surface Resistance	0	0	0.04

Comments:

GF 0.16 Please provide the U-Value calculation to justify the U-Value entered into the assessment. N/A

Internal Elements (Area, Kappa)

Party Elements (Area, Kappa)

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Comments:

If specific construction details have been adopted then please provide the associated checklists; signed and dated.

Ventilation:

Pressure test: No (Assumed)
Ventilation: Natural ventilation (extract fans)
Pressure test: 15

Comments:

Please provide the pressure test certificate, or certificates if the result is based on an average; signed and dated.

Main heating system:

Main heating system: Electric storage systems
Off-peak tariffs
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 405
Modern (slimline) storage heaters with Celect-type control
Systems with radiators

Comments:

Main heating Control:

Developer Confirmation Report

Main heating Control:

Controls for high heat retention storage heaters

Comments:

Secondary heating system:

Secondary heating system:

None

Comments:

Water heating:

Water heating:

No hot water cylinder

Comments:

Solar panel: False

Others:

Electricity tariff:

7-Hour Tariff

Low energy lights:

100%

Terrain type:

Low rise urban / suburban

Wind turbine:

No

Photovoltaics:

None

Comments:

Please provide the MCS certificate or data sheet equivalent confirming the size of the array on the roof. This should include any calculations to support a proportioned amount included in the assessment.

Declaration :

I confirm that the property has been built to the above specification.

Signed:

.....

Date:

.....

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N6 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	49.3 (1a)	4 (2a)	197.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.3 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	197.2 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.75 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.58 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			6.5	$\times 1/[1/(1.6) + 0.04] =$	9.77		(27)
Floor			49.3	$\times$ 0.16	7.888		(28)
Walls	25.24	6.5	18.74	$\times$ 0.19	3.56		(29)
Total area of elements, m²			74.54				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 21.22 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5591.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 11.18 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	50.41	49.71	49.03	45.84	45.24	42.46	42.46	41.94	43.53	45.24	46.45	47.72

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	82.81	82.12	81.44	78.24	77.65	74.86	74.86	74.35	75.94	77.65	78.86	80.12
	Average = Sum(39) _{1...12} /12= 78.24											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.68	1.67	1.65	1.59	1.57	1.52	1.52	1.51	1.54	1.57	1.6	1.63
	Average = Sum(40) _{1...12} /12= 1.59											(40)

SAP WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.67 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 73.85 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	81.24	78.28	75.33	72.37	69.42	66.47	66.47	69.42	72.37	75.33	78.28	81.24	
Total = Sum(44) _{1...12} =												886.21	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.47	105.36	108.73	94.79	90.95	78.49	72.73	83.46	84.45	98.42	107.44	116.67	
Total = Sum(45) _{1...12} =												1161.96	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) \times (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) \times (51) \times (52) \times (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) \times (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

SAP WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17	(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=	102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17	
Output from water heater (annual) _{1...12}												987.67	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	25.6	22.39	23.1	20.14	19.33	16.68	15.45	17.73	17.95	20.91	22.83	24.79	(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=	100.17	100.17	100.17	100.17	100.17	100.17	100.17	100.17	100.17	100.17	100.17	100.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	35.23	31.29	25.45	19.27	14.4	12.16	13.14	17.08	22.92	29.1	33.97	36.21	(67)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	217.04	219.29	213.62	201.53	186.28	171.95	162.37	160.12	165.79	177.88	193.13	207.46	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	34.41	33.32	31.05	27.98	25.98	23.16	20.77	23.84	24.93	28.11	31.71	33.32	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	366.76	363.98	350.19	328.85	306.74	287.35	276.36	281.11	293.72	315.17	338.88	357.07	(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	6.5	x	19.64	x	0.63	x	0.7	=	39.02 (76)
East	0.9x	0.77	x	6.5	x	38.42	x	0.63	x	0.7	=	76.32 (76)
East	0.9x	0.77	x	6.5	x	63.27	x	0.63	x	0.7	=	125.69 (76)
East	0.9x	0.77	x	6.5	x	92.28	x	0.63	x	0.7	=	183.31 (76)
East	0.9x	0.77	x	6.5	x	113.09	x	0.63	x	0.7	=	224.66 (76)
East	0.9x	0.77	x	6.5	x	115.77	x	0.63	x	0.7	=	229.98 (76)
East	0.9x	0.77	x	6.5	x	110.22	x	0.63	x	0.7	=	218.95 (76)
East	0.9x	0.77	x	6.5	x	94.68	x	0.63	x	0.7	=	188.07 (76)

SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.5	x	73.59	x	0.63	x	0.7	=	146.18	(76)
East	0.9x	0.77	x	6.5	x	45.59	x	0.63	x	0.7	=	90.56	(76)
East	0.9x	0.77	x	6.5	x	24.49	x	0.63	x	0.7	=	48.65	(76)
East	0.9x	0.77	x	6.5	x	16.15	x	0.63	x	0.7	=	32.08	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	39.02	76.32	125.69	183.31	224.66	229.98	218.95	188.07	146.18	90.56	48.65	32.08	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	405.77	440.3	475.89	512.17	531.39	517.32	495.3	469.18	439.9	405.73	387.53	389.16	(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=	0.95	0.93	0.91	0.86	0.78	0.66	0.54	0.58	0.75	0.87	0.93	0.95	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.47	19.58	19.77	20.07	20.32	20.54	20.63	20.62	20.46	20.13	19.78	19.49	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.56	19.57	19.58	19.62	19.63	19.67	19.67	19.68	19.66	19.63	19.61	19.59	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.94	0.92	0.89	0.83	0.73	0.58	0.41	0.45	0.67	0.84	0.91	0.94	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.54	17.69	17.98	18.43	18.78	19.1	19.21	19.2	19	18.54	18.02	17.58	(90)
--------	-------	-------	-------	-------	-------	------	-------	------	----	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.44	18.57	18.81	19.19	19.5	19.77	19.87	19.86	19.68	19.28	18.84	18.47	(92)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.44	18.57	18.81	19.19	19.5	19.77	19.87	19.86	19.68	19.28	18.84	18.47	(93)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.93	0.91	0.88	0.82	0.73	0.58	0.44	0.47	0.67	0.84	0.91	0.93	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	376.08	401.08	418.87	420.32	387.14	302.61	215.83	221.72	296.72	338.86	350.76	362.66	(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=	1170.56	1122.34	1002.86	805.19	605.45	386.83	244.7	257.32	423.45	674	925.69	1143.05	(97)
--------	---------	---------	---------	--------	--------	--------	-------	--------	--------	-----	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	591.09	484.69	434.49	277.11	162.42	0	0	0	0	249.34	413.95	580.61	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3193.71

Space heating requirement in kWh/m²/year

64.78

(99)

SAP WorkSheet: New dwelling design stage

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		100	(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)

591.09	484.69	434.49	277.11	162.42	0	0	0	0	249.34	413.95	580.61	
(211)m = {[[(98)m x (204)] } x 100 ÷ (206)												(211)
591.09	484.69	434.49	277.11	162.42	0	0	0	0	249.34	413.95	580.61	
Total (kWh/year) =Sum(211) _{1...5,10...12} =												3193.71
												(211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215) _{1...5,10...12} =												0
												(215)

Water heating

Output from water heater (calculated above)

102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17	
Efficiency of water heater												100
(217)m=	100	100	100	100	100	100	100	100	100	100	100	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17		
Total = Sum(219a) _{1...12} =													987.67	(219)

Annual totals

		kWh/year	kWh/year
Space heating fuel used, main system 1		3193.71	
Water heating fuel used		987.67	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		248.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4430.25	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	5.5	x 0.01 = 175.65 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	15.29	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	14.31	x 0.01 = 141.35 (247)
Pumps, fans and electric keep-hot	(231)	0	x 0.01 = 0 (249)

SAP WorkSheet: New dwelling design stage

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting (232) 14.31 x 0.01 = 35.62 (250)

Additional standing charges (Table 12) 24 (251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)...(254) = 376.62 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12) 0.42 (256)

Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] = 1.68 (257)

SAP rating (Section 12) 76.6 (258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1) (211) x	0.519	=	1657.53 (261)
Space heating (secondary) (215) x	0.519	=	0 (263)
Water heating (219) x	0.519	=	512.6 (264)
Space and water heating (261) + (262) + (263) + (264) =			2170.13 (265)
Electricity for pumps, fans and electric keep-hot (231) x	0.519	=	0 (267)
Electricity for lighting (232) x	0.519	=	129.17 (268)
Total CO2, kg/year		sum of (265)...(271) =	2299.3 (272)
CO2 emissions per m²		(272) ÷ (4) =	46.64 (273)
El rating (section 14)			67 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1) (211) x	3.07	=	9804.68 (261)
Space heating (secondary) (215) x	3.07	=	0 (263)
Energy for water heating (219) x	3.07	=	3032.14 (264)
Space and water heating (261) + (262) + (263) + (264) =			12836.82 (265)
Electricity for pumps, fans and electric keep-hot (231) x	3.07	=	0 (267)
Electricity for lighting (232) x	0	=	764.05 (268)
'Total Primary Energy		sum of (265)...(271) =	13600.86 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	275.88 (273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N6 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	<input type="text" value="49.3"/> (1a)	<input type="text" value="4"/> (2a)	<input type="text" value="197.2"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="49.3"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="197.2"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="2"/> x 10 =	<input type="text" value="20"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="20"/>	÷ (5) =	<input type="text" value="0.1"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="5"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			<input type="text" value="0.35"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="3"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="0.78"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.27"/> (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.35	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.56 0.56 0.56 0.54 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 0.54 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
Windows			6.5	$\times 1/[1/(1.4) + 0.04] =$	8.62		(27)
Floor			49.3	$\times$	0.13	6.408999	(28)
Walls	25.24	6.5	18.74	$\times$	0.18	3.37	(29)
Total area of elements, m²			74.54				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 18.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5591.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.73 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 22.13 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	36.46	36.31	36.16	35.46	35.33	34.72	34.72	34.6	34.95	35.33	35.59	35.87

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	58.59	58.44	58.29	57.58	57.45	56.84	56.84	56.73	57.08	57.45	57.72	58
	Average = Sum(39) _{1...12} /12= 57.58											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.18	1.17	1.17	1.15	1.15	1.15	1.16	1.17	1.17	1.18
	Average = Sum(40) _{1...12} /12= 1.17											(40)

TFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.67 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 73.85 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	81.24	78.28	75.33	72.37	69.42	66.47	66.47	69.42	72.37	75.33	78.28	81.24	
Total = Sum(44) _{1...12} =												886.21	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.47	105.36	108.73	94.79	90.95	78.49	72.73	83.46	84.45	98.42	107.44	116.67	
Total = Sum(45) _{1...12} =												1161.96	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) × (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) × (51) × (52) × (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, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

TFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17	(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=	102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17	
Output from water heater (annual) _{1...12}												987.67	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	25.6	22.39	23.1	20.14	19.33	16.68	15.45	17.73	17.95	20.91	22.83	24.79	(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=	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.09	12.52	10.18	7.71	5.76	4.86	5.26	6.83	9.17	11.64	13.59	14.48	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	145.42	146.92	143.12	135.03	124.81	115.2	108.79	107.28	111.08	119.18	129.4	139	(68)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	-----	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	34.41	33.32	31.05	27.98	25.98	23.16	20.77	23.84	24.93	28.11	31.71	33.32	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	241.96	240.8	232.4	218.75	204.59	191.27	182.86	185.99	193.22	206.97	222.73	234.85	(73)
--------	--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d			Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	6.5	x	19.64	x	0.63	x	0.7	=	39.02	(76)
East	0.9x	0.77	x	6.5	x	38.42	x	0.63	x	0.7	=	76.32	(76)
East	0.9x	0.77	x	6.5	x	63.27	x	0.63	x	0.7	=	125.69	(76)
East	0.9x	0.77	x	6.5	x	92.28	x	0.63	x	0.7	=	183.31	(76)
East	0.9x	0.77	x	6.5	x	113.09	x	0.63	x	0.7	=	224.66	(76)
East	0.9x	0.77	x	6.5	x	115.77	x	0.63	x	0.7	=	229.98	(76)
East	0.9x	0.77	x	6.5	x	110.22	x	0.63	x	0.7	=	218.95	(76)
East	0.9x	0.77	x	6.5	x	94.68	x	0.63	x	0.7	=	188.07	(76)

TFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.5	x	73.59	x	0.63	x	0.7	=	146.18	(76)
East	0.9x	0.77	x	6.5	x	45.59	x	0.63	x	0.7	=	90.56	(76)
East	0.9x	0.77	x	6.5	x	24.49	x	0.63	x	0.7	=	48.65	(76)
East	0.9x	0.77	x	6.5	x	16.15	x	0.63	x	0.7	=	32.08	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	39.02	76.32	125.69	183.31	224.66	229.98	218.95	188.07	146.18	90.56	48.65	32.08	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	280.97	317.12	358.09	402.07	429.25	421.25	401.81	374.06	339.4	297.53	271.38	266.93	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.91	0.77	0.6	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=	19.68	19.82	20.07	20.42	20.73	20.92	20.98	20.97	20.82	20.42	19.99	19.66	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.95	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.87	0.68	0.47	0.53	0.83	0.98	1	1	(89)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.73	18.87	19.12	19.47	19.76	19.92	19.95	19.95	19.85	19.48	19.05	18.71	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.17	19.31	19.56	19.91	20.21	20.39	20.43	20.43	20.3	19.92	19.49	19.15	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.17	19.31	19.56	19.91	20.21	20.39	20.43	20.43	20.3	19.92	19.49	19.15	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.99	0.96	0.88	0.72	0.53	0.59	0.85	0.98	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	280.23	315.48	353.39	385.65	378.47	302	213.05	220.52	288.65	290.19	269.99	266.38	(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=	871.2	841.98	761.4	634.07	488.81	328.92	217.79	228.38	354.11	535.29	714.96	867.2	(97)
--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	439.69	353.81	303.56	178.87	82.1	0	0	0	0	182.35	320.38	447.01	(98)
--------	--------	--------	--------	--------	------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2307.76

Space heating requirement in kWh/m²/year

46.81

(99)

TFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	534.32	420.64	431.15	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.85	0.91	0.89	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	454.17	384.86	383.63	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	556.15	532.27	500.93	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	73.43	109.67	87.28	0	0	0	0	
---------	---	---	---	---	---	-------	--------	-------	---	---	---	---	--

Total = Sum(104) = 270.38 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	18.36	27.42	21.82	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 67.59 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 1.37 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 48.18 (109)

Target Fabric Energy Efficiency (TFEE) 55.41 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N6 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	49.3 (1a)	4 (2a)	197.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.3 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	197.2 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.85 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.66 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.84	0.82	0.81	0.73	0.71	0.63	0.63	0.61	0.66	0.71	0.74	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.85 0.84 0.83 0.76 0.75 0.7 0.7 0.69 0.72 0.75 0.78 0.8 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.85 0.84 0.83 0.76 0.75 0.7 0.7 0.69 0.72 0.75 0.78 0.8 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			6.5	$\times 1/[1/(1.6) + 0.04] =$	9.77		(27)
Floor			49.3	$\times$ 0.16	7.888		(28)
Walls	25.24	6.5	18.74	$\times$ 0.19	3.56		(29)
Total area of elements, m²			74.54				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 21.22 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5591.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 11.18 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	55.57	54.67	53.8	49.68	48.91	45.32	45.32	44.66	46.71	48.91	50.47	52.1

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	87.97	87.08	86.2	82.08	81.31	77.73	77.73	77.06	79.11	81.31	82.87	84.5		
Average = Sum(39) _{1...12} /12=													82.08	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.78	1.77	1.75	1.66	1.65	1.58	1.58	1.56	1.6	1.65	1.68	1.71		
Average = Sum(40) _{1...12} /12=													1.66	(40)

DFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.67 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 73.85 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	81.24	78.28	75.33	72.37	69.42	66.47	66.47	69.42	72.37	75.33	78.28	81.24	
Total = Sum(44) _{1...12} =												886.21	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.47	105.36	108.73	94.79	90.95	78.49	72.73	83.46	84.45	98.42	107.44	116.67	
Total = Sum(45) _{1...12} =												1161.96	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) \times (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) \times (51) \times (52) \times (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) \times (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

DFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17	(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=	102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17	
Output from water heater (annual) _{1...12}												987.67	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	25.6	22.39	23.1	20.14	19.33	16.68	15.45	17.73	17.95	20.91	22.83	24.79	(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=	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.09	12.52	10.18	7.71	5.76	4.86	5.26	6.83	9.17	11.64	13.59	14.48	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	145.42	146.92	143.12	135.03	124.81	115.2	108.79	107.28	111.08	119.18	129.4	139	(68)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	-----	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	34.41	33.32	31.05	27.98	25.98	23.16	20.77	23.84	24.93	28.11	31.71	33.32	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	241.96	240.8	232.4	218.75	204.59	191.27	182.86	185.99	193.22	206.97	222.73	234.85	(73)
--------	--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d			Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	6.5	x	19.64	x	0.63	x	0.7	=	39.02	(76)
East	0.9x	0.77	x	6.5	x	38.42	x	0.63	x	0.7	=	76.32	(76)
East	0.9x	0.77	x	6.5	x	63.27	x	0.63	x	0.7	=	125.69	(76)
East	0.9x	0.77	x	6.5	x	92.28	x	0.63	x	0.7	=	183.31	(76)
East	0.9x	0.77	x	6.5	x	113.09	x	0.63	x	0.7	=	224.66	(76)
East	0.9x	0.77	x	6.5	x	115.77	x	0.63	x	0.7	=	229.98	(76)
East	0.9x	0.77	x	6.5	x	110.22	x	0.63	x	0.7	=	218.95	(76)
East	0.9x	0.77	x	6.5	x	94.68	x	0.63	x	0.7	=	188.07	(76)

DFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.5	x	73.59	x	0.63	x	0.7	=	146.18	(76)
East	0.9x	0.77	x	6.5	x	45.59	x	0.63	x	0.7	=	90.56	(76)
East	0.9x	0.77	x	6.5	x	24.49	x	0.63	x	0.7	=	48.65	(76)
East	0.9x	0.77	x	6.5	x	16.15	x	0.63	x	0.7	=	32.08	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	39.02	76.32	125.69	183.31	224.66	229.98	218.95	188.07	146.18	90.56	48.65	32.08	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	280.97	317.12	358.09	402.07	429.25	421.25	401.81	374.06	339.4	297.53	271.38	266.93	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.96	0.94	0.91	0.84	0.74	0.63	0.67	0.82	0.93	0.96	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	17.45	17.73	18.26	19.07	19.78	20.41	20.72	20.67	20.17	19.24	18.27	17.49	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.48	19.49	19.51	19.57	19.58	19.63	19.63	19.64	19.61	19.58	19.55	19.53	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.96	0.93	0.89	0.8	0.66	0.49	0.54	0.76	0.91	0.95	0.97	(89)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	16.32	16.6	17.14	17.97	18.66	19.27	19.51	19.49	19.06	18.16	17.19	16.39	(90)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.84	17.13	17.66	18.48	19.18	19.8	20.07	20.04	19.57	18.66	17.69	16.9	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.84	17.13	17.66	18.48	19.18	19.8	20.07	20.04	19.57	18.66	17.69	16.9	(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=	0.95	0.94	0.91	0.86	0.79	0.67	0.54	0.58	0.76	0.89	0.94	0.96	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	267.88	298.01	327.23	347.67	338.41	282.62	217.9	218.07	258.41	264.32	255.05	255.68	(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=	1103.55	1064.54	962.37	786.24	608.45	404.4	269.9	280.3	432.95	655.3	877.86	1073.02	(97)
--------	---------	---------	--------	--------	--------	-------	-------	-------	--------	-------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	621.74	515.1	472.55	315.77	200.91	0	0	0	0	290.89	448.42	608.1	(98)
--------	--------	-------	--------	--------	--------	---	---	---	---	--------	--------	-------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3473.49

Space heating requirement in kWh/m²/year

70.46

(99)

DFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	730.64	575.19	585.68	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.59	0.66	0.63	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	429.53	378.51	369.55	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	556.15	532.27	500.93	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	91.17	114.4	97.75	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(104) = 303.31 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	22.79	28.6	24.44	0	0	0	0	
---------	---	---	---	---	---	-------	------	-------	---	---	---	---	--

Total = Sum(107) = 75.83 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 1.54 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 71.99 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N6 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	49.3 (1a)	4 (2a)	197.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.3 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	197.2 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.75 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.58 (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

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			6.5	$\times 1/[1/(1.6) + 0.04] =$	9.77		(27)
Floor			49.3	$\times$ 0.16	7.888		(28)
Walls	25.24	6.5	18.74	$\times$ 0.19	3.56		(29)
Total area of elements, m²			74.54				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 21.22 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5591.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 11.18 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.4 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	50.41	49.71	49.03	45.84	45.24	42.46	42.46	41.94	43.53	45.24	46.45	47.72

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	82.81	82.12	81.44	78.24	77.65	74.86	74.86	74.35	75.94	77.65	78.86	80.12
	Average = Sum(39) _{1...12} /12= 78.24											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.68	1.67	1.65	1.59	1.57	1.52	1.52	1.51	1.54	1.57	1.6	1.63
	Average = Sum(40) _{1...12} /12= 1.59											(40)

DER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.67 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 73.85 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	81.24	78.28	75.33	72.37	69.42	66.47	66.47	69.42	72.37	75.33	78.28	81.24	
Total = Sum(44) _{1...12} =												886.21	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.47	105.36	108.73	94.79	90.95	78.49	72.73	83.46	84.45	98.42	107.44	116.67	
Total = Sum(45) _{1...12} =												1161.96	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

DER WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17	(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=	102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17	
Output from water heater (annual) _{1...12}												987.67	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	25.6	22.39	23.1	20.14	19.33	16.68	15.45	17.73	17.95	20.91	22.83	24.79	(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=	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	14.09	12.52	10.18	7.71	5.76	4.86	5.26	6.83	9.17	11.64	13.59	14.48	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	145.42	146.92	143.12	135.03	124.81	115.2	108.79	107.28	111.08	119.18	129.4	139	(68)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	-----	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	34.41	33.32	31.05	27.98	25.98	23.16	20.77	23.84	24.93	28.11	31.71	33.32	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	241.96	240.8	232.4	218.75	204.59	191.27	182.86	185.99	193.22	206.97	222.73	234.85	(73)
--------	--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	6.5	x	19.64	x	0.63	x	0.7	=	39.02 (76)
East	0.9x	0.77	x	6.5	x	38.42	x	0.63	x	0.7	=	76.32 (76)
East	0.9x	0.77	x	6.5	x	63.27	x	0.63	x	0.7	=	125.69 (76)
East	0.9x	0.77	x	6.5	x	92.28	x	0.63	x	0.7	=	183.31 (76)
East	0.9x	0.77	x	6.5	x	113.09	x	0.63	x	0.7	=	224.66 (76)
East	0.9x	0.77	x	6.5	x	115.77	x	0.63	x	0.7	=	229.98 (76)
East	0.9x	0.77	x	6.5	x	110.22	x	0.63	x	0.7	=	218.95 (76)
East	0.9x	0.77	x	6.5	x	94.68	x	0.63	x	0.7	=	188.07 (76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.5	x	73.59	x	0.63	x	0.7	=	146.18	(76)
East	0.9x	0.77	x	6.5	x	45.59	x	0.63	x	0.7	=	90.56	(76)
East	0.9x	0.77	x	6.5	x	24.49	x	0.63	x	0.7	=	48.65	(76)
East	0.9x	0.77	x	6.5	x	16.15	x	0.63	x	0.7	=	32.08	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	39.02	76.32	125.69	183.31	224.66	229.98	218.95	188.07	146.18	90.56	48.65	32.08	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	280.97	317.12	358.09	402.07	429.25	421.25	401.81	374.06	339.4	297.53	271.38	266.93	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.97	0.96	0.94	0.9	0.84	0.73	0.62	0.66	0.82	0.92	0.96	0.97	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.34	19.45	19.66	19.97	20.25	20.49	20.61	20.59	20.4	20.03	19.66	19.35	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.56	19.57	19.58	19.62	19.63	19.67	19.67	19.68	19.66	19.63	19.61	19.59	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.96	0.93	0.88	0.8	0.65	0.49	0.54	0.76	0.9	0.95	0.97	(89)
--------	------	------	------	------	-----	------	------	------	------	-----	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.34	17.51	17.82	18.3	18.7	19.05	19.19	19.18	18.93	18.4	17.85	17.39	(90)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =

0.46

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.27	18.41	18.67	19.08	19.42	19.72	19.85	19.83	19.61	19.16	18.69	18.3	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.27	18.41	18.67	19.08	19.42	19.72	19.85	19.83	19.61	19.16	18.69	18.3	(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=	0.96	0.95	0.92	0.87	0.79	0.66	0.51	0.55	0.76	0.9	0.95	0.96	(94)
--------	------	------	------	------	------	------	------	------	------	-----	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	269.98	300.7	330.56	350.91	339.07	276.53	203.83	206.46	256.6	266.53	257.18	257.52	(95)
--------	--------	-------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1156.8	1109.32	991.37	796.26	599.24	383.49	243.09	255.3	418.27	664.73	913.78	1129.66	(97)
--------	--------	---------	--------	--------	--------	--------	--------	-------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	659.8	543.4	491.64	320.65	193.57	0	0	0	0	296.26	472.75	648.87	(98)
--------	-------	-------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3626.93

Space heating requirement in kWh/m²/year

73.57

(99)

DER WorkSheet: New dwelling design stage

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		100	(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)

659.8	543.4	491.64	320.65	193.57	0	0	0	0	296.26	472.75	648.87	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
659.8	543.4	491.64	320.65	193.57	0	0	0	0	296.26	472.75	648.87	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												3626.93
												(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1...5,10...12} =												0
												(215)

Water heating

Output from water heater (calculated above)

102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17	
Efficiency of water heater												100
(217)m =	100	100	100	100	100	100	100	100	100	100	100	
												(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	102.4	89.56	92.42	80.57	77.31	66.71	61.82	70.94	71.79	83.66	91.32	99.17		
Total = Sum(219a) _{1...12} =													987.67	(219)

Annual totals

		kWh/year	kWh/year
Space heating fuel used, main system 1		3626.93	
Water heating fuel used		987.67	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		248.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4863.47	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.519	= 1882.38
Space heating (secondary)	(215) x	0.519	= 0
Water heating	(219) x	0.519	= 512.6
Space and water heating	(261) + (262) + (263) + (264) =		2394.97
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 0

DER WorkSheet: New dwelling design stage

Electricity for lighting	(232) x	0.519	=	129.17	(268)
Total CO2, kg/year		sum of (265)...(271) =		2524.14	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		51.2	(273)
EI rating (section 14)				64	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N6 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	49.3 (1a)	4 (2a)	197.2 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	49.3 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	197.2 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.1 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.35 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.27 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.35	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	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) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.56 0.56 0.56 0.54 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 0.54 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
Windows			6.5	$\times 1/[1/(1.4) + 0.04] =$	8.62		(27)
Floor			49.3	$\times$ 0.13	6.408999		(28)
Walls	25.24	6.5	18.74	$\times$ 0.18	3.37		(29)
Total area of elements, m²			74.54				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 18.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 5591.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.73 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 22.13 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	36.46	36.31	36.16	35.46	35.33	34.72	34.72	34.6	34.95	35.33	35.59	35.87

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	58.59	58.44	58.29	57.58	57.45	56.84	56.84	56.73	57.08	57.45	57.72	58
	Average = Sum(39) _{1...12} /12= 57.58											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.19	1.18	1.17	1.17	1.15	1.15	1.15	1.16	1.17	1.17	1.18
	Average = Sum(40) _{1...12} /12= 1.17											(40)

TER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 1.67 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 73.85 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	81.24	78.28	75.33	72.37	69.42	66.47	66.47	69.42	72.37	75.33	78.28	81.24	
Total = Sum(44) _{1...12} =												886.21	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	120.47	105.36	108.73	94.79	90.95	78.49	72.73	83.46	84.45	98.42	107.44	116.67	
Total = Sum(45) _{1...12} =												1161.96	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.07	15.8	16.31	14.22	13.64	11.77	10.91	12.52	12.67	14.76	16.12	17.5	(46)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

TER WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=

167.07	147.45	155.32	139.88	137.55	123.58	119.32	130.05	129.55	145.02	152.53	163.26
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

167.07	147.45	155.32	139.88	137.55	123.58	119.32	130.05	129.55	145.02	152.53	163.26
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

1710.58

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

77.33	68.7	73.43	67.59	67.52	62.17	61.46	65.03	64.15	70	71.8	76.07
-------	------	-------	-------	-------	-------	-------	-------	-------	----	------	-------

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48	83.48

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

14.09	12.52	10.18	7.71	5.76	4.86	5.26	6.83	9.17	11.64	13.59	14.48
-------	-------	-------	------	------	------	------	------	------	-------	-------	-------

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

145.42	146.92	143.12	135.03	124.81	115.2	108.79	107.28	111.08	119.18	129.4	139
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	-----

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35	31.35
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78	-66.78
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

103.94	102.24	98.69	93.88	90.75	86.35	82.61	87.4	89.1	94.09	99.72	102.24
--------	--------	-------	-------	-------	-------	-------	------	------	-------	-------	--------

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

314.49	312.72	303.04	287.65	272.36	257.46	247.69	252.55	260.4	275.95	293.74	306.77
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 (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)							
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>19.64</td></tr></table>	19.64	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>39.02</td></tr></table>	39.02	(76)
0.77																			
6.5																			
19.64																			
0.63																			
0.7																			
39.02																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>38.42</td></tr></table>	38.42	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>76.32</td></tr></table>	76.32	(76)
0.77																			
6.5																			
38.42																			
0.63																			
0.7																			
76.32																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>63.27</td></tr></table>	63.27	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>125.69</td></tr></table>	125.69	(76)
0.77																			
6.5																			
63.27																			
0.63																			
0.7																			
125.69																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>92.28</td></tr></table>	92.28	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>183.31</td></tr></table>	183.31	(76)
0.77																			
6.5																			
92.28																			
0.63																			
0.7																			
183.31																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>113.09</td></tr></table>	113.09	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>224.66</td></tr></table>	224.66	(76)
0.77																			
6.5																			
113.09																			
0.63																			
0.7																			
224.66																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>115.77</td></tr></table>	115.77	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>229.98</td></tr></table>	229.98	(76)
0.77																			
6.5																			
115.77																			
0.63																			
0.7																			
229.98																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>110.22</td></tr></table>	110.22	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>218.95</td></tr></table>	218.95	(76)
0.77																			
6.5																			
110.22																			
0.63																			
0.7																			
218.95																			
East	0.9x	<table><tr><td>0.77</td></tr></table>	0.77	x	<table><tr><td>6.5</td></tr></table>	6.5	x	<table><tr><td>94.68</td></tr></table>	94.68	x	<table><tr><td>0.63</td></tr></table>	0.63	x	<table><tr><td>0.7</td></tr></table>	0.7	=	<table><tr><td>188.07</td></tr></table>	188.07	(76)
0.77																			
6.5																			
94.68																			
0.63																			
0.7																			
188.07																			

TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.5	x	73.59	x	0.63	x	0.7	=	146.18	(76)
East	0.9x	0.77	x	6.5	x	45.59	x	0.63	x	0.7	=	90.56	(76)
East	0.9x	0.77	x	6.5	x	24.49	x	0.63	x	0.7	=	48.65	(76)
East	0.9x	0.77	x	6.5	x	16.15	x	0.63	x	0.7	=	32.08	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	39.02	76.32	125.69	183.31	224.66	229.98	218.95	188.07	146.18	90.56	48.65	32.08	(83)
--------	-------	-------	--------	--------	--------	--------	--------	--------	--------	-------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	353.51	389.04	428.73	470.97	497.02	487.43	466.64	440.62	406.58	366.51	342.39	338.85	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.69	0.52	0.57	0.82	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	19.95	20.2	20.53	20.8	20.95	20.99	20.98	20.88	20.54	20.12	19.79	(87)
--------	-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.93	19.95	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.93	0.81	0.6	0.41	0.45	0.74	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=	18.37	18.56	18.92	19.39	19.75	19.93	19.95	19.95	19.86	19.42	18.82	18.34	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.46

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.04	19.21	19.51	19.92	20.24	20.4	20.44	20.43	20.34	19.94	19.43	19.02	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.04	19.21	19.51	19.92	20.24	20.4	20.44	20.43	20.34	19.94	19.43	19.02	(93)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.93	0.83	0.64	0.46	0.51	0.77	0.95	0.99	0.99	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	350.86	384.11	417.05	437.71	411.07	313.19	215.44	224.61	314.54	347.05	337.59	336.77	(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=	863.54	836.1	758.59	634.59	490.56	329.82	218.03	228.78	356.08	536.52	711.49	859.25	(97)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	381.44	303.74	254.1	141.76	59.14	0	0	0	0	140.96	269.21	388.73	(98)
--------	--------	--------	-------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

1939.07

Space heating requirement in kWh/m²/year

39.33

(99)

TER WorkSheet: New dwelling design stage

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

381.44	303.74	254.1	141.76	59.14	0	0	0	0	140.96	269.21	388.73	
(211)m = {[[(98)m x (204)] } x 100 ÷ (206)												(211)
407.95	324.85	271.77	151.61	63.25	0	0	0	0	150.76	287.92	415.76	
Total (kWh/year) =Sum(211) _{1...5,10...12} =												2073.87 (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	
Total (kWh/year) =Sum(215) _{1...5,10...12} =												0 (215)

Water heating

Output from water heater (calculated above)

167.07	147.45	155.32	139.88	137.55	123.58	119.32	130.05	129.55	145.02	152.53	163.26	
Efficiency of water heater												79.8 (216)
(217)m=	86.95	86.7	86.12	84.85	82.74	79.8	79.8	79.8	79.8	84.74	86.31	87.05 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	192.14	170.07	180.36	164.86	166.24	154.86	149.53	162.97	162.34	171.14	176.71	187.56		
Total = Sum(219a) _{1...12} =													2038.77	(219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		2073.87
Water heating fuel used		2038.77

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		248.88 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4436.52 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 447.96 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 440.37 (264)

TER WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			888.33	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	129.17	(268)
Total CO2, kg/year	sum of (265)...(271) =			1056.42	(272)
TER	=			31.34	(273)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 30 October 2024 at 11:19:48

Project Information:

Assessed By: John Ashe (STRO031268)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 66.48m²

Site Reference : Victoria Mill, Stockport

Plot Reference: N7 Victoria Mill, Stockport

Address :

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

32.18 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

56.54 kg/m²

Fail

Excess emissions = 24.36 kg/m² (75.7 %)

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

66.0 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

81.5 kWh/m²

Fail

Excess energy = 15.48 kg/m² (23.4 %)

2 Fabric U-values

Element

Average

Highest

External wall

0.19 (max. 0.30)

0.19 (max. 0.70)

OK

Floor

0.16 (max. 0.25)

0.16 (max. 0.70)

OK

Roof

(no roof)

Openings

1.60 (max. 2.00)

1.60 (max. 3.30)

OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

3 Air permeability

Air permeability at 50 pascals

15.00

OK

4 Heating efficiency

Main Heating system:

Electric storage systems - electric
Modern (slimline) storage heaters with Celect-type control

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

No cylinder

6 Controls

Space heating controls

Controls for high heat retention storage heaters

OK

Hot water controls:

No cylinder thermostat
No cylinder

Regulations Compliance Report

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (West Pennines):	Not assessed	?
-----------------------------------	--------------	---

10 Key features

None

Thermal Bridge Report

Property Details: N7 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Predicted Energy Assessment

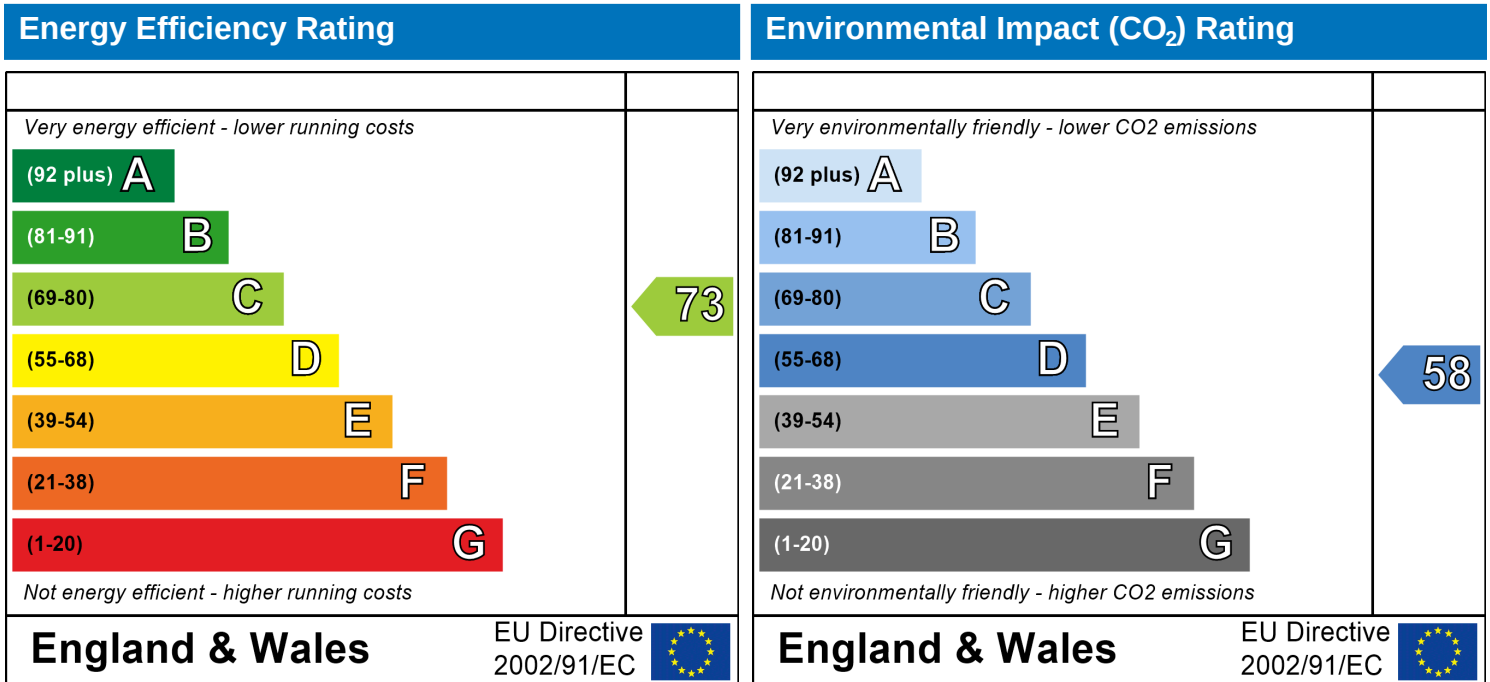


Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Ground floor Flat
30 October 2024
John Ashe
66.48 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Developer Confirmation Report

Property Details: N7 Victoria Mill, Stockport

Address:
Located in: England
Region: West Pennines
UPRN:
Date of assessment: 30 October 2024
Date of certificate: 30 October 2024
Assessment type: New dwelling design stage
Transaction type: New dwelling
Thermal Mass Parameter: Indicative Value Low
Comments:

Property description:

Dwelling type: Flat
Detachment:
Year Completed: 2024
Front of dwelling faces: North
Comments:

Opening types:

Name:	Type:	Frame Factor:	g-value:	U-Value:	Area:
Windows	Windows	0.7	0.63	1.6	9.14

Overshading: Average or unknown
Comments:

Opaque Elements:

Type:	U-Value:	Kappa:
<u>External Elements</u>		
Walls	0.19 Please provide the U-Value calculation to justify the U-Value entered into the assessment.	N/A

Materials Used:	Name:	Thickness:	Conductivity:	R-Value:
Type:				
Walls	Internal Surface Resistance	0	0	0.13
Walls	Plaster (Lightweight) (0 mm)	3	0.18	0.02
Walls	Plasterboard Standard (0 mm)	12.5	0.21	0.06

Developer Confirmation Report

Walls	Thermawall TW50 (100 mm)	100	0.022	4.55
Walls	Plaster Dabs Cavity (15 mm)	15	0	0.17
Walls	Brickwork Outer Leaf - BRE (102.5 mm)	300	0.77	0.39
Walls	External Surface Resistance	0	0	0.04

Comments:

GF 0.16 Please provide the U-Value calculation to justify the U-Value entered into the assessment. N/A

Internal Elements (Area, Kappa)

Party Elements (Area, Kappa)

Thermal bridges:

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Comments:

If specific construction details have been adopted then please provide the associated checklists; signed and dated.

Ventilation:

Pressure test: No (Assumed)
Ventilation: Natural ventilation (extract fans)
Pressure test: 15

Comments:

Please provide the pressure test certificate, or certificates if the result is based on an average; signed and dated.

Main heating system:

Main heating system: Electric storage systems
Off-peak tariffs
Fuel: Electricity
Info Source: SAP Tables
SAP Table: 405
Modern (slimline) storage heaters with Celect-type control
Systems with radiators

Comments:

Main heating Control:

Developer Confirmation Report

Main heating Control:

Controls for high heat retention storage heaters

Comments:

Secondary heating system:

Secondary heating system:

None

Comments:

Water heating:

Water heating:

No hot water cylinder

Comments:

Solar panel: False

Others:

Electricity tariff:

7-Hour Tariff

Low energy lights:

100%

Terrain type:

Low rise urban / suburban

Wind turbine:

No

Photovoltaics:

None

Comments:

Please provide the MCS certificate or data sheet equivalent confirming the size of the array on the roof. This should include any calculations to support a proportioned amount included in the assessment.

Declaration :

I confirm that the property has been built to the above specification.

Signed:

.....

Date:

.....

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N7 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	66.48 (1a)	4 (2a)	265.92 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	66.48 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	265.92 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.75 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.58 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			9.14	$\times 1/[1/(1.6) + 0.04] =$	13.74		(27)
Floor			66.48	$\times$ 0.16	10.6368		(28)
Walls	74.22	9.14	65.08	$\times$ 0.19	12.37		(29)
Total area of elements, m²			140.7				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.75 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 7898.52 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 21.11 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	67.97	67.04	66.12	61.81	61.01	57.26	57.26	56.56	58.7	61.01	62.64	64.34

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	125.83	124.89	123.97	119.67	118.86	115.11	115.11	114.41	116.55	118.86	120.49	122.19
Average = Sum(39) _{1...12} /12=											119.66	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.89	1.88	1.86	1.8	1.79	1.73	1.73	1.72	1.75	1.79	1.81	1.84
Average = Sum(40) _{1...12} /12=											1.8	(40)

SAP WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.16 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 85.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	93.99	90.57	87.16	83.74	80.32	76.9	76.9	80.32	83.74	87.16	90.57	93.99	
Total = Sum(44) _{1...12} =												1025.35	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	139.39	121.91	125.8	109.67	105.23	90.81	84.15	96.56	97.71	113.88	124.31	134.99	
Total = Sum(45) _{1...12} =												1344.4	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) \times (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) \times (51) \times (52) \times (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) \times (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

SAP WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74	(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=	118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74	
Output from water heater (annual) _{1...12}												1142.74	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	29.62	25.91	26.73	23.31	22.36	19.3	17.88	20.52	20.76	24.2	26.41	28.68	(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=	129.46	129.46	129.46	129.46	129.46	129.46	129.46	129.46	129.46	129.46	129.46	129.46	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	45.36	40.29	32.76	24.8	18.54	15.65	16.91	21.98	29.51	37.47	43.73	46.62	(67)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	282.01	284.94	277.56	261.86	242.04	223.42	210.98	208.05	215.42	231.12	250.94	269.57	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	(69)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	39.81	38.55	35.93	32.37	30.06	26.8	24.03	27.58	28.84	32.53	36.69	38.55	(72)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	460.44	457.03	439.51	412.29	383.9	359.13	345.18	350.87	367.03	394.38	424.62	448	(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	9.14	x	19.64	x	0.63	x	0.7	=	54.86	(76)
East	0.9x	0.77	x	9.14	x	38.42	x	0.63	x	0.7	=	107.32	(76)
East	0.9x	0.77	x	9.14	x	63.27	x	0.63	x	0.7	=	176.74	(76)
East	0.9x	0.77	x	9.14	x	92.28	x	0.63	x	0.7	=	257.77	(76)
East	0.9x	0.77	x	9.14	x	113.09	x	0.63	x	0.7	=	315.9	(76)
East	0.9x	0.77	x	9.14	x	115.77	x	0.63	x	0.7	=	323.38	(76)
East	0.9x	0.77	x	9.14	x	110.22	x	0.63	x	0.7	=	307.87	(76)
East	0.9x	0.77	x	9.14	x	94.68	x	0.63	x	0.7	=	264.46	(76)

SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	9.14	x	73.59	x	0.63	x	0.7	=	205.56	(76)
East	0.9x	0.77	x	9.14	x	45.59	x	0.63	x	0.7	=	127.34	(76)
East	0.9x	0.77	x	9.14	x	24.49	x	0.63	x	0.7	=	68.41	(76)
East	0.9x	0.77	x	9.14	x	16.15	x	0.63	x	0.7	=	45.12	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	54.86	107.32	176.74	257.77	315.9	323.38	307.87	264.46	205.56	127.34	68.41	45.12	(83)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	515.3	564.35	616.25	670.06	699.8	682.51	653.06	615.33	572.59	521.72	493.02	493.11	(84)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.95	0.94	0.92	0.88	0.81	0.7	0.59	0.62	0.78	0.89	0.94	0.96	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.3	19.41	19.62	19.93	20.21	20.46	20.58	20.56	20.37	20.01	19.62	19.31	(87)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.41	19.42	19.42	19.47	19.48	19.52	19.52	19.53	19.5	19.48	19.46	19.44	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.94	0.93	0.9	0.85	0.76	0.61	0.44	0.48	0.7	0.86	0.93	0.95	(89)
--------	------	------	-----	------	------	------	------	------	-----	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.19	17.35	17.66	18.13	18.52	18.87	19.01	19	18.76	18.25	17.69	17.23	(90)
--------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.23	18.36	18.62	19.01	19.35	19.65	19.78	19.77	19.55	19.11	18.64	18.25	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.23	18.36	18.62	19.01	19.35	19.65	19.78	19.77	19.55	19.11	18.64	18.25	(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=	0.94	0.92	0.89	0.84	0.75	0.62	0.47	0.51	0.71	0.85	0.92	0.94	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	482.13	519.72	550.13	561.83	527.24	422.38	307.49	313.75	404.78	445.95	452.13	463.69	(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=	1752.26	1681.08	1502.44	1209.83	909.07	581.38	365.84	385.08	635.03	1011.67	1390.45	1716.63	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	---------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	944.98	780.43	708.52	466.56	284.08	0	0	0	0	420.9	675.59	932.19	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

5213.24

(98)

Space heating requirement in kWh/m²/year

78.42

(99)

SAP WorkSheet: New dwelling design stage

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		100	(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)

944.98	780.43	708.52	466.56	284.08	0	0	0	0	420.9	675.59	932.19
--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------

(211)m = {[[(98)m x (204)] } x 100 ÷ (206) (211)

944.98	780.43	708.52	466.56	284.08	0	0	0	0	420.9	675.59	932.19
--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}=

5213.24 (211)

Space heating fuel (secondary), kWh/month

= {[[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---

Total (kWh/year) =Sum(215)_{1...5,10...12}=

0 (215)

Water heating

Output from water heater (calculated above)

118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74
--------	--------	--------	-------	-------	-------	-------	-------	-------	------	--------	--------

Efficiency of water heater 100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74
---------	--------	--------	--------	-------	-------	-------	-------	-------	-------	------	--------	--------

Total = Sum(219a)_{1...12} =

1142.74 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	5213.24	
Water heating fuel used	1142.74	

Electricity for pumps, fans and electric keep-hot

Total electricity for the above, kWh/year sum of (230a)...(230g) = 0 (231)

Electricity for lighting 320.41 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 6676.39 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	5.5	x 0.01 = 286.73 (240)
Space heating - main system 2	(213) x	0	x 0.01 = 0 (241)
Space heating - secondary	(215) x	15.29	x 0.01 = 0 (242)
Water heating cost (other fuel)	(219)	14.31	x 0.01 = 163.54 (247)
Pumps, fans and electric keep-hot	(231)	0	x 0.01 = 0 (249)

SAP WorkSheet: New dwelling design stage

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting (232) 14.31 x 0.01 = 45.85 (250)

Additional standing charges (Table 12) 24 (251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)...(254) = 520.12 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12) 0.42 (256)

Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] = 1.96 (257)

SAP rating (Section 12) 72.66 (258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1) (211) x	0.519	=	2705.67 (261)
Space heating (secondary) (215) x	0.519	=	0 (263)
Water heating (219) x	0.519	=	593.08 (264)
Space and water heating (261) + (262) + (263) + (264) =			3298.75 (265)
Electricity for pumps, fans and electric keep-hot (231) x	0.519	=	0 (267)
Electricity for lighting (232) x	0.519	=	166.29 (268)
Total CO2, kg/year		sum of (265)...(271) =	3465.05 (272)
CO2 emissions per m²		(272) ÷ (4) =	52.12 (273)
El rating (section 14)			58 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1) (211) x	3.07	=	16004.65 (261)
Space heating (secondary) (215) x	3.07	=	0 (263)
Energy for water heating (219) x	3.07	=	3508.21 (264)
Space and water heating (261) + (262) + (263) + (264) =			19512.86 (265)
Electricity for pumps, fans and electric keep-hot (231) x	3.07	=	0 (267)
Electricity for lighting (232) x	0	=	983.66 (268)
'Total Primary Energy		sum of (265)...(271) =	20496.52 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	308.31 (273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N7 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	66.48	(1a) x	4	(2a) =	265.92
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	66.48	(4)			
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			265.92

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0
Number of open flues	0	+	0	+	0	=	0	x 20 =	0
Number of intermittent fans							2	x 10 =	20
Number of passive vents							0	x 10 =	0
Number of flueless gas fires							0	x 40 =	0

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.08
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0
Additional infiltration		[(9)-1]x0.1 =	0
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0
If no draught lobby, enter 0.05, else enter 0			0
Percentage of windows and doors draught stripped			0
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.33
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.25

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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.32	0.32	0.31	0.28	0.27	0.24	0.24	0.23	0.25	0.27	0.28	0.3
------	------	------	------	------	------	------	------	------	------	------	-----

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.55 0.55 0.55 0.54 0.54 0.53 0.53 0.53 0.53 0.54 0.54 0.54 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.55 0.55 0.55 0.54 0.54 0.53 0.53 0.53 0.53 0.54 0.54 0.54 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			9.14	$\times 1/[1/(1.4) + 0.04] =$	12.12		(27)
Floor			66.48	$\times$ 0.13	8.6424		(28)
Walls	74.22	9.14	65.08	$\times$ 0.18	11.71		(29)
Total area of elements, m²			140.7				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 32.47 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 7898.52 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.04 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 39.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	48.41	48.23	48.06	47.25	47.1	46.39	46.39	46.26	46.66	47.1	47.4	47.72

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	87.92	87.74	87.57	86.76	86.61	85.9	85.9	85.77	86.17	86.61	86.91	87.23
	Average = Sum(39) _{1...12} /12= 86.76											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.32	1.32	1.32	1.31	1.3	1.29	1.29	1.29	1.3	1.3	1.31	1.31
	Average = Sum(40) _{1...12} /12= 1.31											(40)

TFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.16 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 85.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	93.99	90.57	87.16	83.74	80.32	76.9	76.9	80.32	83.74	87.16	90.57	93.99	
Total = Sum(44) _{1...12} =												1025.35	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	139.39	121.91	125.8	109.67	105.23	90.81	84.15	96.56	97.71	113.88	124.31	134.99	
Total = Sum(45) _{1...12} =												1344.4	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

TFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74	(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=	118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74	
Output from water heater (annual) _{1...12}												1142.74	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	29.62	25.91	26.73	23.31	22.36	19.3	17.88	20.52	20.76	24.2	26.41	28.68	(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=	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.14	16.11	13.11	9.92	7.42	6.26	6.77	8.79	11.8	14.99	17.49	18.65	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	188.95	190.91	185.97	175.45	162.17	149.69	141.35	139.39	144.33	154.85	168.13	180.61	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	39.81	38.55	35.93	32.37	30.06	26.8	24.03	27.58	28.84	32.53	36.69	38.55	(72)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	302.27	300.94	290.37	273.1	255.01	238.12	227.52	231.13	240.34	257.73	277.68	293.18	(73)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d			Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	9.14	x	19.64	x	0.63	x	0.7	=	54.86	(76)
East	0.9x	0.77	x	9.14	x	38.42	x	0.63	x	0.7	=	107.32	(76)
East	0.9x	0.77	x	9.14	x	63.27	x	0.63	x	0.7	=	176.74	(76)
East	0.9x	0.77	x	9.14	x	92.28	x	0.63	x	0.7	=	257.77	(76)
East	0.9x	0.77	x	9.14	x	113.09	x	0.63	x	0.7	=	315.9	(76)
East	0.9x	0.77	x	9.14	x	115.77	x	0.63	x	0.7	=	323.38	(76)
East	0.9x	0.77	x	9.14	x	110.22	x	0.63	x	0.7	=	307.87	(76)
East	0.9x	0.77	x	9.14	x	94.68	x	0.63	x	0.7	=	264.46	(76)

TFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	9.14	x	73.59	x	0.63	x	0.7	=	205.56	(76)
East	0.9x	0.77	x	9.14	x	45.59	x	0.63	x	0.7	=	127.34	(76)
East	0.9x	0.77	x	9.14	x	24.49	x	0.63	x	0.7	=	68.41	(76)
East	0.9x	0.77	x	9.14	x	16.15	x	0.63	x	0.7	=	45.12	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	54.86	107.32	176.74	257.77	315.9	323.38	307.87	264.46	205.56	127.34	68.41	45.12	(83)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	357.13	408.26	467.11	530.87	570.91	561.5	535.39	495.59	445.9	385.08	346.08	338.29	(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	0.72	0.92	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.48	19.62	19.9	20.27	20.62	20.87	20.96	20.95	20.74	20.28	19.82	19.45	(87)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.82	19.83	19.83	19.84	19.84	19.85	19.85	19.85	19.84	19.84	19.84	19.83	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.89	0.72	0.51	0.57	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=	18.44	18.59	18.86	19.24	19.57	19.78	19.84	19.83	19.69	19.26	18.79	18.42	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.95	19.1	19.37	19.74	20.09	20.32	20.39	20.38	20.21	19.76	19.29	18.93	(92)
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.95	19.1	19.37	19.74	20.09	20.32	20.39	20.38	20.21	19.76	19.29	18.93	(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	1	0.99	0.97	0.9	0.76	0.58	0.64	0.88	0.98	1	1	(94)
--------	---	---	------	------	-----	------	------	------	------	------	---	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	356.32	406.46	461.94	512.98	515.57	427.81	311.62	319.32	392.94	377.57	344.63	337.7	(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=	1287.97	1245.5	1126.86	940.85	726.33	491.07	325.53	341.21	526.26	793.45	1059.63	1284.8	(97)
--------	---------	--------	---------	--------	--------	--------	--------	--------	--------	--------	---------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	693.14	563.83	494.7	308.07	156.81	0	0	0	0	309.41	514.8	704.64	(98)
--------	--------	--------	-------	--------	--------	---	---	---	---	--------	-------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3745.41

Space heating requirement in kWh/m²/year

56.34

(99)

TFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	807.47	635.67	651.86	0	0	0	0	(100)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.78	0.86	0.83	0	0	0	0	(101)
---------	---	---	---	---	---	------	------	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	631.09	547.06	538.5	0	0	0	0	(102)
---------	---	---	---	---	---	--------	--------	-------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	737.11	705.03	659.98	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	76.34	117.53	90.38	0	0	0	0	
---------	---	---	---	---	---	-------	--------	-------	---	---	---	---	--

Total = Sum(104) = 284.25 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	19.08	29.38	22.6	0	0	0	0	
---------	---	---	---	---	---	-------	-------	------	---	---	---	---	--

Total = Sum(107) = 71.06 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 1.07 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 57.41 (109)

Target Fabric Energy Efficiency (TFEE) 66.02 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N7 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	66.48 (1a) x	4 (2a) =	265.92 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	66.48 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	265.92 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.08 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.83 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.64 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DFEE WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.82	0.8	0.78	0.7	0.69	0.61	0.61	0.59	0.64	0.69	0.72	0.75
------	-----	------	-----	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.83 0.82 0.81 0.75 0.74 0.68 0.68 0.67 0.7 0.74 0.76 0.78 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.83 0.82 0.81 0.75 0.74 0.68 0.68 0.67 0.7 0.74 0.76 0.78 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			9.14	$\times 1/[1/(1.6) + 0.04] =$	13.74		(27)
Floor			66.48	$\times$ 0.16	10.6368		(28)
Walls	74.22	9.14	65.08	$\times$ 0.19	12.37		(29)
Total area of elements, m²			140.7				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.75 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 7898.52 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 21.11 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	73.05	71.92	70.81	65.59	64.62	60.07	60.07	59.23	61.82	64.62	66.59	68.65

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	130.9	129.77	128.66	123.44	122.47	117.92	117.92	117.08	119.67	122.47	124.44	126.5
	Average = Sum(39) _{1...12} /12= 123.44											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.97	1.95	1.94	1.86	1.84	1.77	1.77	1.76	1.8	1.84	1.87	1.9
	Average = Sum(40) _{1...12} /12= 1.86											(40)

DFEE WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.16 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 85.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	93.99	90.57	87.16	83.74	80.32	76.9	76.9	80.32	83.74	87.16	90.57	93.99	
Total = Sum(44) _{1...12} =												1025.35	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	139.39	121.91	125.8	109.67	105.23	90.81	84.15	96.56	97.71	113.88	124.31	134.99	
Total = Sum(45) _{1...12} =												1344.4	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

DFEE WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74	(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=	118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74	
Output from water heater (annual) _{1...12}												1142.74	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	29.62	25.91	26.73	23.31	22.36	19.3	17.88	20.52	20.76	24.2	26.41	28.68	(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=	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.14	16.11	13.11	9.92	7.42	6.26	6.77	8.79	11.8	14.99	17.49	18.65	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	188.95	190.91	185.97	175.45	162.17	149.69	141.35	139.39	144.33	154.85	168.13	180.61	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	39.81	38.55	35.93	32.37	30.06	26.8	24.03	27.58	28.84	32.53	36.69	38.55	(72)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	302.27	300.94	290.37	273.1	255.01	238.12	227.52	231.13	240.34	257.73	277.68	293.18	(73)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d			Area m²			Flux Table 6a			g_ Table 6b			FF Table 6c			Gains (W)		
East	0.9x	0.77	x	9.14	x	19.64	x	0.63	x	0.7	=	54.86	(76)						
East	0.9x	0.77	x	9.14	x	38.42	x	0.63	x	0.7	=	107.32	(76)						
East	0.9x	0.77	x	9.14	x	63.27	x	0.63	x	0.7	=	176.74	(76)						
East	0.9x	0.77	x	9.14	x	92.28	x	0.63	x	0.7	=	257.77	(76)						
East	0.9x	0.77	x	9.14	x	113.09	x	0.63	x	0.7	=	315.9	(76)						
East	0.9x	0.77	x	9.14	x	115.77	x	0.63	x	0.7	=	323.38	(76)						
East	0.9x	0.77	x	9.14	x	110.22	x	0.63	x	0.7	=	307.87	(76)						
East	0.9x	0.77	x	9.14	x	94.68	x	0.63	x	0.7	=	264.46	(76)						

DFEE WorkSheet: New dwelling design stage

East	0.9x	0.77	x	9.14	x	73.59	x	0.63	x	0.7	=	205.56	(76)
East	0.9x	0.77	x	9.14	x	45.59	x	0.63	x	0.7	=	127.34	(76)
East	0.9x	0.77	x	9.14	x	24.49	x	0.63	x	0.7	=	68.41	(76)
East	0.9x	0.77	x	9.14	x	16.15	x	0.63	x	0.7	=	45.12	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	54.86	107.32	176.74	257.77	315.9	323.38	307.87	264.46	205.56	127.34	68.41	45.12	(83)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	357.13	408.26	467.11	530.87	570.91	561.5	535.39	495.59	445.9	385.08	346.08	338.29	(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=	0.98	0.97	0.95	0.91	0.86	0.76	0.66	0.7	0.84	0.93	0.97	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	17.16	17.44	18	18.83	19.59	20.28	20.64	20.57	20.01	19.02	18	17.18	(87)
--------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	----	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.35	19.37	19.38	19.43	19.44	19.49	19.49	19.5	19.47	19.44	19.42	19.4	(88)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.96	0.94	0.89	0.82	0.68	0.51	0.56	0.78	0.92	0.96	0.97	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	15.96	16.25	16.81	17.65	18.4	19.06	19.34	19.31	18.83	17.86	16.84	16.01	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	16.55	16.83	17.39	18.23	18.98	19.66	19.98	19.93	19.41	18.43	17.41	16.58	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	16.55	16.83	17.39	18.23	18.98	19.66	19.98	19.93	19.41	18.43	17.41	16.58	(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=	0.96	0.94	0.92	0.87	0.8	0.69	0.57	0.61	0.78	0.9	0.95	0.96	(94)
--------	------	------	------	------	-----	------	------	------	------	-----	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	341.89	385.44	429.37	463.27	457.16	388.29	304.38	302.21	347.34	345.53	327.06	325.27	(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=	1603.53	1548.62	1401.39	1151.23	891.91	596.43	398.18	413.44	635.28	958.7	1283.07	1566.35	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	-------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	938.66	781.66	723.18	495.33	323.45	0	0	0	0	456.2	688.33	923.37	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

5330.19

Space heating requirement in kWh/m²/year

80.18

(99)

DFEE WorkSheet: New dwelling design stage

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m=	0	0	0	0	0	1108.49	872.64	889.83	0	0	0	0	(100)
---------	---	---	---	---	---	---------	--------	--------	---	---	---	---	-------

Utilisation factor for loss hm

(101)m=	0	0	0	0	0	0.53	0.6	0.57	0	0	0	0	(101)
---------	---	---	---	---	---	------	-----	------	---	---	---	---	-------

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m=	0	0	0	0	0	586.3	521.66	505.61	0	0	0	0	(102)
---------	---	---	---	---	---	-------	--------	--------	---	---	---	---	-------

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m=	0	0	0	0	0	737.11	705.03	659.98	0	0	0	0	(103)
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	-------

Space cooling requirement for month, whole dwelling, continuous (kWh) = $0.024 \times [(103)m - (102)m] \times (41)m$
set (104)m to zero if (104)m < 3 x (98)m

(104)m=	0	0	0	0	0	108.59	136.43	114.85	0	0	0	0	
---------	---	---	---	---	---	--------	--------	--------	---	---	---	---	--

Total = Sum(104) = 359.87 (104)

Cooled fraction

f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0	
---------	---	---	---	---	---	------	------	------	---	---	---	---	--

Total = Sum(104) = 0 (106)

Space cooling requirement for month = (104)m x (105) x (106)m

(107)m=	0	0	0	0	0	27.15	34.11	28.71	0	0	0	0	
---------	---	---	---	---	---	-------	-------	-------	---	---	---	---	--

Total = Sum(107) = 89.97 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 1.35 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 81.53 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N7 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	<input type="text" value="66.48"/> (1a)	<input type="text" value="4"/> (2a)	<input type="text" value="265.92"/> (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	<input type="text" value="66.48"/> (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	<input type="text" value="265.92"/> (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (6a)
Number of open flues	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/> x 20 =	<input type="text" value="0"/> (6b)
Number of intermittent fans				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7a)
Number of passive vents				<input type="text" value="0"/> x 10 =	<input type="text" value="0"/> (7b)
Number of flueless gas fires				<input type="text" value="0"/> x 40 =	<input type="text" value="0"/> (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	<input type="text" value="0"/>	÷ (5) =	<input type="text" value="0"/> (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			<input type="text" value="0"/> (9)
Additional infiltration		[(9)-1]x0.1 =	<input type="text" value="0"/> (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			<input type="text" value="0"/> (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			<input type="text" value="0"/> (12)
If no draught lobby, enter 0.05, else enter 0			<input type="text" value="0"/> (13)
Percentage of windows and doors draught stripped			<input type="text" value="0"/> (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		<input type="text" value="0"/> (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		<input type="text" value="0"/> (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			<input type="text" value="15"/> (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			<input type="text" value="0.75"/> (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			<input type="text" value="3"/> (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		<input type="text" value="0.78"/> (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		<input type="text" value="0.58"/> (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

0.74	0.73	0.71	0.64	0.62	0.55	0.55	0.54	0.58	0.62	0.65	0.68
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.77 0.76 0.75 0.7 0.7 0.65 0.65 0.64 0.67 0.7 0.71 0.73 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			9.14	$\times 1/[1/(1.6) + 0.04] =$	13.74		(27)
Floor			66.48	$\times$ 0.16	10.6368		(28)
Walls	74.22	9.14	65.08	$\times$ 0.19	12.37		(29)
Total area of elements, m²			140.7				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 36.75 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 7898.52 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 21.11 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.85 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	67.97	67.04	66.12	61.81	61.01	57.26	57.26	56.56	58.7	61.01	62.64	64.34

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	125.83	124.89	123.97	119.67	118.86	115.11	115.11	114.41	116.55	118.86	120.49	122.19
	Average = Sum(39) _{1...12} /12= 119.66											(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.89	1.88	1.86	1.8	1.79	1.73	1.73	1.72	1.75	1.79	1.81	1.84
	Average = Sum(40) _{1...12} /12= 1.8											(40)

DER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.16 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 85.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m}$ = factor from Table 1c x (43)													
(44)m=	93.99	90.57	87.16	83.74	80.32	76.9	76.9	80.32	83.74	87.16	90.57	93.99	
Total = Sum(44) _{1...12} =												1025.35	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times nm \times DTm / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	139.39	121.91	125.8	109.67	105.23	90.81	84.15	96.56	97.71	113.88	124.31	134.99	
Total = Sum(45) _{1...12} =												1344.4	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

DER WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74	(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=	118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74	
Output from water heater (annual) _{1...12}												1142.74	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	29.62	25.91	26.73	23.31	22.36	19.3	17.88	20.52	20.76	24.2	26.41	28.68	(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=	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.14	16.11	13.11	9.92	7.42	6.26	6.77	8.79	11.8	14.99	17.49	18.65	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	188.95	190.91	185.97	175.45	162.17	149.69	141.35	139.39	144.33	154.85	168.13	180.61	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	39.81	38.55	35.93	32.37	30.06	26.8	24.03	27.58	28.84	32.53	36.69	38.55	(72)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	302.27	300.94	290.37	273.1	255.01	238.12	227.52	231.13	240.34	257.73	277.68	293.18	(73)
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
East	0.9x	0.77	x	9.14	x	19.64	x	0.63	x	0.7	=	54.86	(76)
East	0.9x	0.77	x	9.14	x	38.42	x	0.63	x	0.7	=	107.32	(76)
East	0.9x	0.77	x	9.14	x	63.27	x	0.63	x	0.7	=	176.74	(76)
East	0.9x	0.77	x	9.14	x	92.28	x	0.63	x	0.7	=	257.77	(76)
East	0.9x	0.77	x	9.14	x	113.09	x	0.63	x	0.7	=	315.9	(76)
East	0.9x	0.77	x	9.14	x	115.77	x	0.63	x	0.7	=	323.38	(76)
East	0.9x	0.77	x	9.14	x	110.22	x	0.63	x	0.7	=	307.87	(76)
East	0.9x	0.77	x	9.14	x	94.68	x	0.63	x	0.7	=	264.46	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	9.14	x	73.59	x	0.63	x	0.7	=	205.56	(76)
East	0.9x	0.77	x	9.14	x	45.59	x	0.63	x	0.7	=	127.34	(76)
East	0.9x	0.77	x	9.14	x	24.49	x	0.63	x	0.7	=	68.41	(76)
East	0.9x	0.77	x	9.14	x	16.15	x	0.63	x	0.7	=	45.12	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	54.86	107.32	176.74	257.77	315.9	323.38	307.87	264.46	205.56	127.34	68.41	45.12	(83)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	357.13	408.26	467.11	530.87	570.91	561.5	535.39	495.59	445.9	385.08	346.08	338.29	(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=	0.97	0.97	0.95	0.91	0.85	0.76	0.66	0.69	0.84	0.93	0.97	0.98	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.18	19.29	19.51	19.84	20.14	20.41	20.55	20.53	20.31	19.91	19.51	19.19	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.41	19.42	19.42	19.47	19.48	19.52	19.52	19.53	19.5	19.48	19.46	19.44	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.97	0.96	0.94	0.89	0.81	0.68	0.51	0.56	0.78	0.91	0.96	0.97	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.02	17.19	17.51	18.01	18.43	18.83	18.99	18.97	18.69	18.12	17.54	17.05	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.08	18.22	18.49	18.91	19.27	19.6	19.75	19.74	19.48	19	18.5	18.1	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	----	------	------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.08	18.22	18.49	18.91	19.27	19.6	19.75	19.74	19.48	19	18.5	18.1	(93)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	----	------	------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.96	0.95	0.93	0.88	0.81	0.68	0.54	0.58	0.78	0.91	0.95	0.97	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	344.56	389.03	434.2	468.84	460.55	383.41	287.97	289.29	347.2	349.08	329.89	327.59	(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=	1733.66	1663.38	1486.67	1197.25	899.98	576.09	363.08	381.66	627.19	998.62	1374.13	1698.48	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1033.49	856.36	783.04	524.46	326.94	0	0	0	0	483.26	751.85	1019.94	(98)
--------	---------	--------	--------	--------	--------	---	---	---	---	--------	--------	---------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

5779.33

Space heating requirement in kWh/m²/year

86.93

(99)

DER WorkSheet: New dwelling design stage

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		100	(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)

1033.49	856.36	783.04	524.46	326.94	0	0	0	0	483.26	751.85	1019.94	
(211)m = {[(98)m × (204)] } × 100 ÷ (206)												(211)
1033.49	856.36	783.04	524.46	326.94	0	0	0	0	483.26	751.85	1019.94	
Total (kWh/year) = Sum(211) _{1...5,10...12} =												5779.33
												(211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

(215)m =	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) = Sum(215) _{1...5,10...12} =												0
												(215)

Water heating

Output from water heater (calculated above)

118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74	
Efficiency of water heater												100
(217)m =	100	100	100	100	100	100	100	100	100	100	100	
												(217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m=	118.48	103.62	106.93	93.22	89.45	77.19	71.53	82.08	83.06	96.8	105.66	114.74		
Total = Sum(219a) _{1...12} =													1142.74	(219)

Annual totals

		kWh/year	kWh/year
Space heating fuel used, main system 1		5779.33	
Water heating fuel used		1142.74	
Electricity for pumps, fans and electric keep-hot			
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	0	(231)
Electricity for lighting		320.41	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		7242.48	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.519	= 2999.47
Space heating (secondary)	(215) ×	0.519	= 0
Water heating	(219) ×	0.519	= 593.08
Space and water heating	(261) + (262) + (263) + (264) =		3592.56
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	= 0

DER WorkSheet: New dwelling design stage

Electricity for lighting	(232) x	0.519	=	166.29	(268)
Total CO2, kg/year		sum of (265)...(271) =			3758.85 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			56.54 (273)
EI rating (section 14)				55	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: John Ashe **Stroma Number:** STRO031268
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.60

Property Address: N7 Victoria Mill, Stockport

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	66.48 (1a)	4 (2a)	265.92 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	66.48 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	265.92 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.08 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.33 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.25 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.32	0.32	0.31	0.28	0.27	0.24	0.24	0.23	0.25	0.27	0.28	0.3
------	------	------	------	------	------	------	------	------	------	------	-----

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.55 0.55 0.55 0.54 0.54 0.53 0.53 0.53 0.53 0.54 0.54 0.54 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.55 0.55 0.55 0.54 0.54 0.53 0.53 0.53 0.53 0.54 0.54 0.54 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows			9.14	$\times 1/[1/(1.4) + 0.04] =$	12.12		(27)
Floor			66.48	$\times$ 0.13	8.6424		(28)
Walls	74.22	9.14	65.08	$\times$ 0.18	11.71		(29)
Total area of elements, m²			140.7				(31)

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 32.47 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 7898.52 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.04 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 39.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	48.41	48.23	48.06	47.25	47.1	46.39	46.39	46.26	46.66	47.1	47.4	47.72

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	87.92	87.74	87.57	86.76	86.61	85.9	85.9	85.77	86.17	86.61	86.91	87.23		
Average = Sum(39) _{1...12} /12=													86.76	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.32	1.32	1.32	1.31	1.3	1.29	1.29	1.29	1.3	1.3	1.31	1.31		
Average = Sum(40) _{1...12} /12=													1.31	(40)

TER WorkSheet: New dwelling design stage

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N 2.16 (42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 85.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	93.99	90.57	87.16	83.74	80.32	76.9	76.9	80.32	83.74	87.16	90.57	93.99	
Total = Sum(44) _{1...12} =												1025.35	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	139.39	121.91	125.8	109.67	105.23	90.81	84.15	96.56	97.71	113.88	124.31	134.99	
Total = Sum(45) _{1...12} =												1344.4	(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.91	18.29	18.87	16.45	15.79	13.62	12.62	14.48	14.66	17.08	18.65	20.25	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

If cylinder contains dedicated solar storage, $(57)m = (56)m \times [(50) - (H11)] \div (50)$, else $(57)m = (56)m$ where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

TER WorkSheet: New dwelling design stage

Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	185.98	163.99	172.39	154.77	151.83	135.9	130.74	143.16	142.81	160.47	169.4	181.58	(62)
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	185.98	163.99	172.39	154.77	151.83	135.9	130.74	143.16	142.81	160.47	169.4	181.58	
Output from water heater (annual) _{1...12}												1893.02	(64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=	83.62	74.2	79.1	72.54	72.27	66.27	65.26	69.38	68.56	75.14	77.4	82.16	(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=	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	107.89	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.14	16.11	13.11	9.92	7.42	6.26	6.77	8.79	11.8	14.99	17.49	18.65	(67)
--------	-------	-------	-------	------	------	------	------	------	------	-------	-------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	188.95	190.91	185.97	175.45	162.17	149.69	141.35	139.39	144.33	154.85	168.13	180.61	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	33.79	(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=	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	-86.31	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	112.39	110.42	106.32	100.75	97.13	92.04	87.71	93.26	95.23	100.99	107.51	110.43	(72)
--------	--------	--------	--------	--------	-------	-------	-------	-------	-------	--------	--------	--------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	377.85	375.81	363.76	344.49	325.08	306.36	294.19	299.81	309.73	329.2	351.5	368.05	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	-------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)		
East	0.9x	0.77	x	9.14	x	19.64	x	0.63	x	0.7	=	54.86	(76)
East	0.9x	0.77	x	9.14	x	38.42	x	0.63	x	0.7	=	107.32	(76)
East	0.9x	0.77	x	9.14	x	63.27	x	0.63	x	0.7	=	176.74	(76)
East	0.9x	0.77	x	9.14	x	92.28	x	0.63	x	0.7	=	257.77	(76)
East	0.9x	0.77	x	9.14	x	113.09	x	0.63	x	0.7	=	315.9	(76)
East	0.9x	0.77	x	9.14	x	115.77	x	0.63	x	0.7	=	323.38	(76)
East	0.9x	0.77	x	9.14	x	110.22	x	0.63	x	0.7	=	307.87	(76)
East	0.9x	0.77	x	9.14	x	94.68	x	0.63	x	0.7	=	264.46	(76)

TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	9.14	x	73.59	x	0.63	x	0.7	=	205.56	(76)
East	0.9x	0.77	x	9.14	x	45.59	x	0.63	x	0.7	=	127.34	(76)
East	0.9x	0.77	x	9.14	x	24.49	x	0.63	x	0.7	=	68.41	(76)
East	0.9x	0.77	x	9.14	x	16.15	x	0.63	x	0.7	=	45.12	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	54.86	107.32	176.74	257.77	315.9	323.38	307.87	264.46	205.56	127.34	68.41	45.12	(83)
--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------	-------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	432.71	483.13	540.5	602.25	640.99	629.74	602.07	564.27	515.29	456.54	419.9	413.17	(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	0.96	0.9	0.76	0.6	0.65	0.87	0.98	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.58	19.72	19.99	20.36	20.69	20.9	20.98	20.96	20.8	20.38	19.91	19.55	(87)
--------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.82	19.83	19.83	19.84	19.84	19.85	19.85	19.85	19.84	19.84	19.84	19.83	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.95	0.86	0.66	0.46	0.51	0.8	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=	17.95	18.16	18.55	19.08	19.53	19.78	19.84	19.83	19.68	19.11	18.45	17.92	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.75	18.93	19.26	19.7	20.09	20.33	20.4	20.39	20.23	19.73	19.17	18.72	(92)
--------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.75	18.93	19.26	19.7	20.09	20.33	20.4	20.39	20.23	19.73	19.17	18.72	(93)
--------	-------	-------	-------	------	-------	-------	------	-------	-------	-------	-------	-------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.98	0.95	0.87	0.71	0.53	0.58	0.83	0.96	0.99	1	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	430.47	478.77	529.78	570.75	556.02	445.77	316.74	327.58	427.98	439.96	415.93	411.42	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1270.32	1230.66	1117.11	937.39	726.97	492.3	326.04	342	528.26	790.96	1048.72	1266.7	(97)
--------	---------	---------	---------	--------	--------	-------	--------	-----	--------	--------	---------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	624.85	505.27	436.97	263.98	127.19	0	0	0	0	261.14	455.61	636.33	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

3311.35

Space heating requirement in kWh/m²/year

49.81

(99)

TER WorkSheet: New dwelling design stage

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

624.85	505.27	436.97	263.98	127.19	0	0	0	0	261.14	455.61	636.33
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m × (204)] } × 100 ÷ (206) (211)

668.29	540.4	467.35	282.33	136.03	0	0	0	0	279.3	487.28	680.56
--------	-------	--------	--------	--------	---	---	---	---	-------	--------	--------

Total (kWh/year) = Sum(211)_{1...5,10...12} = 3541.55 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

(215)m =	0	0	0	0	0	0	0	0	0	0	0	Total (kWh/year) = Sum(215) _{1...5,10...12} = 0 (215)
----------	---	---	---	---	---	---	---	---	---	---	---	--

Water heating

Output from water heater (calculated above)

185.98	163.99	172.39	154.77	151.83	135.9	130.74	143.16	142.81	160.47	169.4	181.58
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------

Efficiency of water heater 79.8 (216)

(217)m =	87.8	87.62	87.19	86.23	84.35	79.8	79.8	79.8	79.8	86.11	87.33	87.88	(217)
----------	------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m =	211.82	187.16	197.71	179.49	180.01	170.3	163.84	179.39	178.96	186.37	193.98	206.62	Total = Sum(219a) _{1...12} = 2235.65 (219)
----------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	---

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1		3541.55
Water heating fuel used		2235.65

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 320.41 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 6172.6 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) ×	0.216	= 764.97 (261)
Space heating (secondary)	(215) ×	0.519	= 0 (263)
Water heating	(219) ×	0.216	= 482.9 (264)

TER WorkSheet: New dwelling design stage

Space and water heating	(261) + (262) + (263) + (264) =			1247.87	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	166.29	(268)
Total CO2, kg/year	sum of (265)...(271) =			1453.09	(272)
TER	=			32.18	(273)