Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.9
Printed on 29 October 2020 at 11:23:42

Project Information:

Assessed By: Christopher Goddard (STRO035147) **Building Type:** Mid-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 70.86m²

Site Reference : 3-5 Plough Lane **Plot Reference:** UNIT 4

Address : Unit 3, Plough Lane, TW11 9BN

Client Details:

Name: Union Architecture

Address : Thera House, 45a Commercial Road, Ashley Cross, Poole, BH17 7BX

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)	26.18 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	24.81 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	48.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	41.1 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	**OK**
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	**OK**
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
Mitsubishi ECODAN 8.5kW

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 1.39 kWh/day
Permitted by DBSCG: 1.66 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	Yes	**OK**

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	Cylinderstat	**OK**
	Independent timer for DHW	**OK**
Boiler interlock:	Yes	**OK**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: North	2.08m²
Windows facing: North	2.08m²
Windows facing: North	2.15m²
Windows facing: North	0.63m²
Windows facing: North	0.63m²
Roof windows facing: North	1.5m²
Roof windows facing: North	1.5m²
Ventilation rate:	4.00

10 Key features

Party Walls U-value	0 W/m²K

Thermal Bridge Report

Property Details: UNIT 4

Address:	Unit 3, Plough Lane, TW11 9BN
Located in:	England
Region:	Thames valley

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0729

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.05	7.59	E2	[UD]
Sill	0.04	6.57	E3	[A]
Jamb	0.05	22.71	E4	[A]
Ground floor (normal)	0.16	10.31	E5	[A]
Intermediate floor within a dwelling	0.07	10.31	E6	[A]
Eaves (insulation at rafter level)	0.04	10.31	E11	[A]
Party wall between dwellings	0.06	4.8	E18	[A]

Party Junctions Details:

Ground floor	0.16	13.75	P1	[D]
Intermediate floor within a dwelling	0	13.75	P2	[D]
Roof (insulation at rafter level)	0.08	13.75	P5	[D]

Roof Junctions Details:

Head	0.08	2.5	R1	[D]
Sill	0.06	2.5	R2	[D]
Jamb	0.08	5.04	R3	[D]

Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 England

Assessor and House Details

Assessor Name: Christopher Goddard
Assessor Number: STRO035147
Property Address: Unit 3
Plough Lane
TW11 9BN

Buiding regulation assessment

	kg/m²/year
TER	26.18
DER	24.81

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO_2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2012 DER Worksheet		24.81	*(ZC1)*
TER		26.18	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		24.81	
% improvement DER/TER	5.2		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	24.81	*(ZC1)*
CO2 emissions from appliances, equation (L14)	16.6	*(ZC2)*
CO2 emissions from cooking, equation (L16)	2.45	*(ZC3)*
Net CO2 emissions	43.9	*(ZC8)*

Result:

Credits awarded for ENE 1 = 0.8

Code Level = 3

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 41.14

Credits awarded for ENE 2 = 5.9

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		37.1
Standard DER		18.05
Actual Case CO2 emissions		43.86
Actual DER		24.81
Reduction in CO2 emissions	-18.22	

Credits awarded for ENE 7 = 0

Technologies eligible to contribute to achieving the requirements of this issue must produce energy from renewable sources and meet all other ancillary requirements as defined by Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

The following requirements must also be met:

- Where not provided by accredited external renewables there must be a direct supply of energy produced to the dwelling under assessment.
- Where covered by the Microgeneration Certification Scheme (MCS), technologies under 50kWe or 300kWth must be certified.
- Combined Heat and Power (CHP) schemes above 50kWe must be certified under the CHPQA standard.
- All technologies must be accounted for by SAP.

CHP schemes fuelled by mains gas are eligible to contribute to performance against this issue. Where these schemes are above 50kWe they must be certified under the CHPQA.

It is the responsibly of the Accredited OCDEA and Code Assessor to ensure all technologies use in the calculation are appropriate before awarding credits.

Predicted Energy Assessment

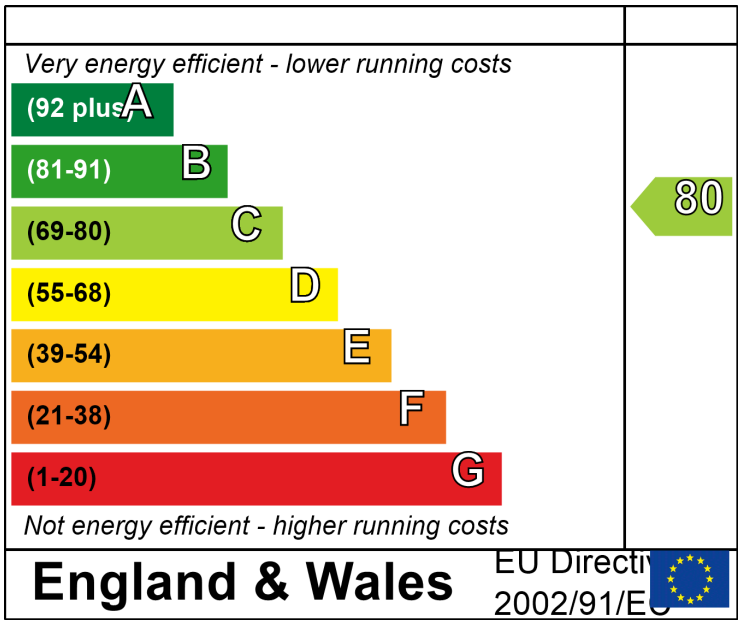
Unit 3
Plough Lane
TW11 9BN

Dwelling type: Mid-terrace House
Date of assessment: 26 October 2020
Produced by: Christopher Goddard
Total floor area: 70.86 m²

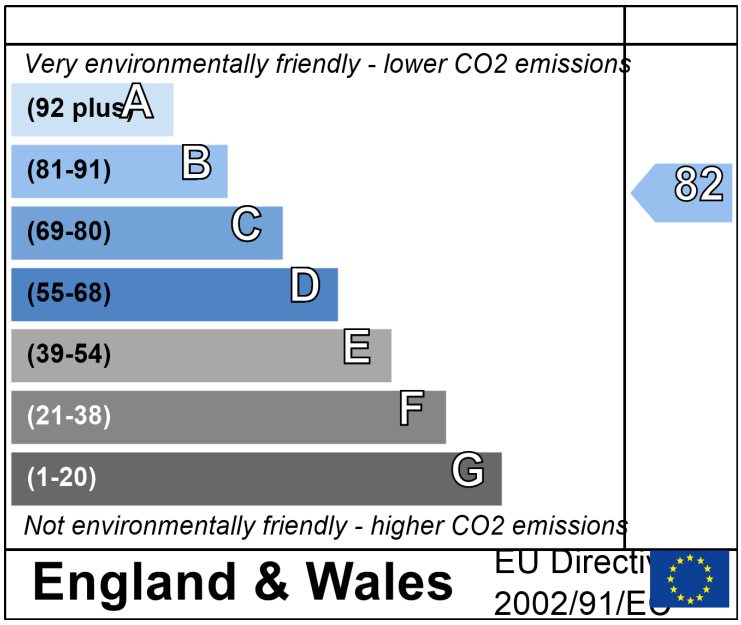
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about 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 (CO_2) 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: UNIT 4

Address:	Unit 3, Plough Lane, TW11 9BN
Located in:	England
Region:	Thames valley
UPRN:	
Date of assessment:	26 October 2020
Date of certificate:	29 October 2020
Assessment type:	New dwelling design stage
Transaction type:	None of the above
Thermal Mass Parameter:	Indicative Value Medium

Comments:

Property description:

Dwelling type:	House
Detachment:	Mid-terrace
Year Completed:	2020
Front of dwelling faces:	North

Comments:

Opening types:

Name:	Type:	Frame Factor:	g-value:	U-Value:	Area:
D1	Half glazed	0.7	0.76	1.2	2.08
W1	Windows	0.7	0.76	1.4	2.08
W2	Windows	0.7	0.76	1.4	2.08
W3	Windows	0.7	0.76	1.4	2.15
W4	Windows	0.7	0.76	1.4	0.63
W5	Windows	0.7	0.76	1.4	0.63
RL1	Roof Windows	0.7	0.76	1.4	1.5
RL2	Roof Windows	0.7	0.76	1.4	1.5

Overshading: Average or unknown

Comments:

Opaque Elements:

Type:	U-Value:		Kappa:
External Elements			
Ext Wall	0.15	Please provide the U-Value calculation to justify the U-Value entered into the assessment.	N/A

Developer Confirmation Report

Materials Used:

Type:	Name:	Thickness:	Conductivity:	R-Value:

Comments:

Roof	0.15	Please provide the U-Value calculation to justify the U-Value entered into the assessment.	N/A
GF	0.15	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)

PW GF	30.25	N/A
PW 1F	35.75	N/A

Comments:

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0729

	Length	Psi-value		
	7.59	0.05	E2	Other lintels (including other steel lintels)
[Approved]	6.57	0.04	E3	Sill
[Approved]	22.71	0.05	E4	Jamb
[Approved]	10.31	0.16	E5	Ground floor (normal)
[Approved]	10.31	0.07	E6	Intermediate floor within a dwelling
[Approved]	10.31	0.04	E11	Eaves (insulation at rafter level)
[Approved]	4.8	0.06	E18	Party wall between dwellings
	13.75	0.16	P1	Ground floor
	13.75	0	P2	Intermediate floor within a dwelling
	13.75	0.08	P5	Roof (insulation at rafter level)
	2.5	0.08	R1	Head
	2.5	0.06	R2	Sill
	5.04	0.08	R3	Jamb

Comments:

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

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Pressure test:	5

Comments:

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

Developer Confirmation Report

Main heating system:

Main heating system:

Heat pumps with radiators or underfloor heating
Electric heat pumps
Fuel: Electricity
Info Source: Boiler Database
Database: (rev 466, product index 100061, SEDBUK 163%):
Brand name: Mitsubishi
Model: ECODAN 8.5kW
Model qualifier: PUHZ-W85VHA(2)-BS - Radiators
(provides DHW all year)
Underfloor heating and radiators, pipes in insulated timber floor
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes

Comments:

Main heating Control:

Main heating Control:

Time and temperature zone control by suitable arrangement of plumbing and electrical services

Comments:

Secondary heating system:

Secondary heating system: None

Comments:

Water heating:

Water heating:

Hot water cylinder
Cylinder volume: 120 litres
Cylinder insulation: Factory 80 mm
Primary pipework insulation: True
Cylinderstat: True
Cylinder in heated space: True

Comments:

Developer Confirmation Report

Waste Water Heat Recovery System:
Total rooms with shower and/or bath: 1
Product index: 080082, RECOUP Pipe+ System C
Number of mixer showers in rooms with a bath: 1
Number of mixer showers in rooms without a bath: 0
Solar panel: False

Others:

Electricity tariff:	Standard 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:	Christopher Goddard	**Stroma Number:**	STRO035147
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.9

Property Address: UNIT 4

Address : Unit 3, Plough Lane, TW11 9BN

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	35.43 (1a)	x	2.2 (2a)	=	77.95	(3a)
First floor	35.43 (1b)	x	2.6 (2b)	=	92.12	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.86 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		170.06	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.43 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.36 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.34	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59

(24d)

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

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.08	x	1.2	=	2.496			(26)
Windows Type 1			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 2			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 3			2.15	x1/[1/(1.4)+ 0.04]		=	2.85			(27)
Windows Type 4			0.63	x1/[1/(1.4)+ 0.04]		=	0.84			(27)
Windows Type 5			0.63	x1/[1/(1.4)+ 0.04]		=	0.84			(27)
Rooflights Type 1			1.5	x1/[1/(1.4) + 0.04]		=	2.1			(27b)
Rooflights Type 2			1.5	x1/[1/(1.4) + 0.04]		=	2.1			(27b)
Floor			35.43	x	0.15	=	5.3145			(28)
Walls	49.99	9.65	40.34	x	0.15	=	6.05			(29)
Roof	36.68	3	33.68	x	0.15	=	5.05			(30)
Total area of elements, m²			122.1							(31)
Party wall			30.25	x	0	=	0			(32)
Party wall			35.75	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12640.77 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 8.9 (36)

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

Total fabric heat loss (33) + (36) = 41.83 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.05	33.82	33.59	32.52	32.32	31.39	31.39	31.21	31.75	32.32	32.73	33.15	(38)

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

(39)m=	75.88	75.65	75.42	74.35	74.15	73.22	73.22	73.04	73.58	74.15	74.56	74.98	

Average = Sum(39)$_{1...12}$ /12= 74.35 (39)

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

(40)m=	1.07	1.07	1.06	1.05	1.05	1.03	1.03	1.03	1.04	1.05	1.05	1.06	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.27 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 88.04 (43)

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

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

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

(44)m=	96.84	93.32	89.8	86.28	82.75	79.23	79.23	82.75	86.28	89.8	93.32	96.84	

Total = Sum(44)$_{1...12}$ = 1056.44 (44)

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

(45)m=	143.61	125.6	129.61	113	108.43	93.56	86.7	99.49	100.68	117.33	128.07	139.08	

Total = Sum(45)$_{1...12}$ = 1385.16 (45)

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

(46)m=	21.54	18.84	19.44	16.95	16.26	14.03	13	14.92	15.1	17.6	19.21	20.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (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) = 120 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.01 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1 (52)

Temperature factor from Table 2b — 0.54 (53)

SAP WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0.75	(54)
Enter (50) or (54) in (55)		0.75	(55)

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

(56)m=	23.2	20.95	23.2	22.45	23.2	22.45	23.2	23.2	22.45	23.2	22.45	23.2	(56)

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

(57)m=	23.2	20.95	23.2	22.45	23.2	22.45	23.2	23.2	22.45	23.2	22.45	23.2	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

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

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

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

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

(62)m=	190.07	167.57	176.07	157.96	154.88	138.52	133.16	145.95	145.64	163.79	173.03	185.54	(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)
WWHRS	-35.49	-31.23	-31.87	-26.24	-24.37	-20.11	-17.03	-20.62	-21.22	-26.21	-30.35	-34.3	(63) (G10)

Output from water heater

(64)m=	154.58	136.34	144.2	131.72	130.51	118.41	116.13	125.33	124.42	137.57	142.69	151.24	

Output from water heater (annual)$_{1...12}$ — 1613.14 — (64)

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

(65)m=	84.92	75.33	80.26	73.54	73.22	67.08	66	70.25	69.44	76.18	78.55	83.41	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.01	136.01	136.01	136.01	136.01	136.01	136.01	136.01	136.01	136.01	136.01	136.01	(66)

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

(67)m=	45.1	40.06	32.58	24.66	18.44	15.56	16.82	21.86	29.34	37.25	43.48	46.35	(67)

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

(68)m=	297.46	300.54	292.76	276.21	255.3	235.66	222.53	219.45	227.22	243.78	264.69	284.33	(68)

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

(69)m=	50.87	50.87	50.87	50.87	50.87	50.87	50.87	50.87	50.87	50.87	50.87	50.87	(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=	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	(71)

Water heating gains (Table 5)

(72)m=	114.14	112.1	107.88	102.14	98.41	93.16	88.7	94.42	96.45	102.39	109.1	112.11	(72)

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

(73)m=	552.9	548.91	529.43	499.21	468.35	440.59	424.26	431.93	449.22	479.63	513.47	539	(73)

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6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.08	x	10.63	x	0.76	x	0.7	=	8.15	(74)
North	0.9x 0.77	x	2.08	x	10.63	x	0.76	x	0.7	=	8.15	(74)
North	0.9x 0.77	x	2.15	x	10.63	x	0.76	x	0.7	=	8.43	(74)
North	0.9x 0.77	x	0.63	x	10.63	x	0.76	x	0.7	=	2.47	(74)
North	0.9x 0.77	x	0.63	x	10.63	x	0.76	x	0.7	=	2.47	(74)
North	0.9x 0.77	x	2.08	x	20.32	x	0.76	x	0.7	=	15.58	(74)
North	0.9x 0.77	x	2.08	x	20.32	x	0.76	x	0.7	=	15.58	(74)
North	0.9x 0.77	x	2.15	x	20.32	x	0.76	x	0.7	=	16.11	(74)
North	0.9x 0.77	x	0.63	x	20.32	x	0.76	x	0.7	=	4.72	(74)
North	0.9x 0.77	x	0.63	x	20.32	x	0.76	x	0.7	=	4.72	(74)
North	0.9x 0.77	x	2.08	x	34.53	x	0.76	x	0.7	=	26.48	(74)
North	0.9x 0.77	x	2.08	x	34.53	x	0.76	x	0.7	=	26.48	(74)
North	0.9x 0.77	x	2.15	x	34.53	x	0.76	x	0.7	=	27.37	(74)
North	0.9x 0.77	x	0.63	x	34.53	x	0.76	x	0.7	=	8.02	(74)
North	0.9x 0.77	x	0.63	x	34.53	x	0.76	x	0.7	=	8.02	(74)
North	0.9x 0.77	x	2.08	x	55.46	x	0.76	x	0.7	=	42.53	(74)
North	0.9x 0.77	x	2.08	x	55.46	x	0.76	x	0.7	=	42.53	(74)
North	0.9x 0.77	x	2.15	x	55.46	x	0.76	x	0.7	=	43.96	(74)
North	0.9x 0.77	x	0.63	x	55.46	x	0.76	x	0.7	=	12.88	(74)
North	0.9x 0.77	x	0.63	x	55.46	x	0.76	x	0.7	=	12.88	(74)
North	0.9x 0.77	x	2.08	x	74.72	x	0.76	x	0.7	=	57.3	(74)
North	0.9x 0.77	x	2.08	x	74.72	x	0.76	x	0.7	=	57.3	(74)
North	0.9x 0.77	x	2.15	x	74.72	x	0.76	x	0.7	=	59.22	(74)
North	0.9x 0.77	x	0.63	x	74.72	x	0.76	x	0.7	=	17.35	(74)
North	0.9x 0.77	x	0.63	x	74.72	x	0.76	x	0.7	=	17.35	(74)
North	0.9x 0.77	x	2.08	x	79.99	x	0.76	x	0.7	=	61.34	(74)
North	0.9x 0.77	x	2.08	x	79.99	x	0.76	x	0.7	=	61.34	(74)
North	0.9x 0.77	x	2.15	x	79.99	x	0.76	x	0.7	=	63.4	(74)
North	0.9x 0.77	x	0.63	x	79.99	x	0.76	x	0.7	=	18.58	(74)
North	0.9x 0.77	x	0.63	x	79.99	x	0.76	x	0.7	=	18.58	(74)
North	0.9x 0.77	x	2.08	x	74.68	x	0.76	x	0.7	=	57.27	(74)
North	0.9x 0.77	x	2.08	x	74.68	x	0.76	x	0.7	=	57.27	(74)
North	0.9x 0.77	x	2.15	x	74.68	x	0.76	x	0.7	=	59.19	(74)
North	0.9x 0.77	x	0.63	x	74.68	x	0.76	x	0.7	=	17.34	(74)
North	0.9x 0.77	x	0.63	x	74.68	x	0.76	x	0.7	=	17.34	(74)
North	0.9x 0.77	x	2.08	x	59.25	x	0.76	x	0.7	=	45.43	(74)

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North	0.9x	0.77	x	2.08	x	59.25	x	0.76	x	0.7	=	45.43	(74)
North	0.9x	0.77	x	2.15	x	59.25	x	0.76	x	0.7	=	46.96	(74)
North	0.9x	0.77	x	0.63	x	59.25	x	0.76	x	0.7	=	13.76	(74)
North	0.9x	0.77	x	0.63	x	59.25	x	0.76	x	0.7	=	13.76	(74)
North	0.9x	0.77	x	2.08	x	41.52	x	0.76	x	0.7	=	31.84	(74)
North	0.9x	0.77	x	2.08	x	41.52	x	0.76	x	0.7	=	31.84	(74)
North	0.9x	0.77	x	2.15	x	41.52	x	0.76	x	0.7	=	32.91	(74)
North	0.9x	0.77	x	0.63	x	41.52	x	0.76	x	0.7	=	9.64	(74)
North	0.9x	0.77	x	0.63	x	41.52	x	0.76	x	0.7	=	9.64	(74)
North	0.9x	0.77	x	2.08	x	24.19	x	0.76	x	0.7	=	18.55	(74)
North	0.9x	0.77	x	2.08	x	24.19	x	0.76	x	0.7	=	18.55	(74)
North	0.9x	0.77	x	2.15	x	24.19	x	0.76	x	0.7	=	19.17	(74)
North	0.9x	0.77	x	0.63	x	24.19	x	0.76	x	0.7	=	5.62	(74)
North	0.9x	0.77	x	0.63	x	24.19	x	0.76	x	0.7	=	5.62	(74)
North	0.9x	0.77	x	2.08	x	13.12	x	0.76	x	0.7	=	10.06	(74)
North	0.9x	0.77	x	2.08	x	13.12	x	0.76	x	0.7	=	10.06	(74)
North	0.9x	0.77	x	2.15	x	13.12	x	0.76	x	0.7	=	10.4	(74)
North	0.9x	0.77	x	0.63	x	13.12	x	0.76	x	0.7	=	3.05	(74)
North	0.9x	0.77	x	0.63	x	13.12	x	0.76	x	0.7	=	3.05	(74)
North	0.9x	0.77	x	2.08	x	8.86	x	0.76	x	0.7	=	6.8	(74)
North	0.9x	0.77	x	2.08	x	8.86	x	0.76	x	0.7	=	6.8	(74)
North	0.9x	0.77	x	2.15	x	8.86	x	0.76	x	0.7	=	7.03	(74)
North	0.9x	0.77	x	0.63	x	8.86	x	0.76	x	0.7	=	2.06	(74)
North	0.9x	0.77	x	0.63	x	8.86	x	0.76	x	0.7	=	2.06	(74)
Rooflights	0.9x	1	x	1.5	x	19.94	x	0.76	x	0.7	=	14.32	(82)
Rooflights	0.9x	1	x	1.5	x	19.94	x	0.76	x	0.7	=	14.32	(82)
Rooflights	0.9x	1	x	1.5	x	39.83	x	0.76	x	0.7	=	28.61	(82)
Rooflights	0.9x	1	x	1.5	x	39.83	x	0.76	x	0.7	=	28.61	(82)
Rooflights	0.9x	1	x	1.5	x	73.56	x	0.76	x	0.7	=	52.83	(82)
Rooflights	0.9x	1	x	1.5	x	73.56	x	0.76	x	0.7	=	52.83	(82)
Rooflights	0.9x	1	x	1.5	x	128.76	x	0.76	x	0.7	=	92.48	(82)
Rooflights	0.9x	1	x	1.5	x	128.76	x	0.76	x	0.7	=	92.48	(82)
Rooflights	0.9x	1	x	1.5	x	182.65	x	0.76	x	0.7	=	131.18	(82)
Rooflights	0.9x	1	x	1.5	x	182.65	x	0.76	x	0.7	=	131.18	(82)
Rooflights	0.9x	1	x	1.5	x	199.33	x	0.76	x	0.7	=	143.16	(82)
Rooflights	0.9x	1	x	1.5	x	199.33	x	0.76	x	0.7	=	143.16	(82)
Rooflights	0.9x	1	x	1.5	x	184.61	x	0.76	x	0.7	=	132.59	(82)
Rooflights	0.9x	1	x	1.5	x	184.61	x	0.76	x	0.7	=	132.59	(82)
Rooflights	0.9x	1	x	1.5	x	140.92	x	0.76	x	0.7	=	101.21	(82)
Rooflights	0.9x	1	x	1.5	x	140.92	x	0.76	x	0.7	=	101.21	(82)
Rooflights	0.9x	1	x	1.5	x	91.75	x	0.76	x	0.7	=	65.89	(82)

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Rooflights 0.9x	1	x	1.5	x	91.75	x	0.76	x	0.7	=	65.89	(82)
Rooflights 0.9x	1	x	1.5	x	48.83	x	0.76	x	0.7	=	35.07	(82)
Rooflights 0.9x	1	x	1.5	x	48.83	x	0.76	x	0.7	=	35.07	(82)
Rooflights 0.9x	1	x	1.5	x	24.87	x	0.76	x	0.7	=	17.86	(82)
Rooflights 0.9x	1	x	1.5	x	24.87	x	0.76	x	0.7	=	17.86	(82)
Rooflights 0.9x	1	x	1.5	x	16.47	x	0.76	x	0.7	=	11.83	(82)
Rooflights 0.9x	1	x	1.5	x	16.47	x	0.76	x	0.7	=	11.83	(82)

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

(83)m=	58.32	113.93	202.04	339.75	470.89	509.55	473.58	367.77	247.65	137.65	72.33	48.4	(83)

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

(84)m=	611.21	662.84	731.46	838.96	939.24	950.14	897.84	799.7	696.87	617.28	585.8	587.4	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.87	0.69	0.49	0.36	0.42	0.69	0.92	0.98	0.99	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	20.02	20.03	20.03	20.04	20.04	20.06	20.06	20.06	20.05	20.04	20.04	20.04	(88)

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

(89)m=	0.99	0.98	0.95	0.84	0.63	0.42	0.28	0.33	0.61	0.89	0.97	0.99	(89)

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

(90)m=	20.02	20.03	20.03	20.04	20.04	20.06	20.06	20.06	20.05	20.04	20.04	20.04	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

(92)m=	20.45	20.45	20.45	20.46	20.46	20.47	20.47	20.47	20.47	20.46	20.46	20.46	(92)

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

(93)m=	20.45	20.45	20.45	20.46	20.46	20.47	20.47	20.47	20.47	20.46	20.46	20.46	(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	0.85	0.66	0.45	0.32	0.37	0.64	0.91	0.98	0.99	(94)

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

(95)m=	603.57	648.93	696.1	716.57	619.81	426.64	282.91	296.47	449.4	559.44	571.6	581.33	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	1225.6	1176.57	1052.46	859.59	649.75	429.7	283.26	297.29	468.42	731.32	996.06	1218.96	(97)

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

(98)m=	462.79	354.57	265.13	102.98	22.28	0	0	0	0	127.88	305.61	474.4	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2115.64	(98)
Space heating requirement in kWh/m²/year	29.86	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	162.95	(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)	462.79	354.57	265.13	102.98	22.28	0	0	0	0	127.88	305.61	474.4	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	284.01	217.6	162.71	63.2	13.67	0	0	0	0	78.48	187.55	291.13	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1298.35 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	154.58	136.34	144.2	131.72	130.51	118.41	116.13	125.33	124.42	137.57	142.69	151.24

Efficiency of water heater	119.34	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	119.34	119.34	119.34	119.34	119.34	119.34	119.34	119.34	119.34	119.34	119.34	119.34	(217)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	129.53	114.25	120.83	110.37	109.36	99.22	97.31	105.02	104.26	115.28	119.56	126.73

Total = Sum(219a)$_{1...12}$ = 1351.72 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1298.35
Water heating fuel used		1351.72
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year sum of (230a)…(230g) =		0 (231)
Electricity for lighting		318.59 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	171.25 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)

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Water heating cost (other fuel)	(219)	13.19	x 0.01 =	178.29	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	0	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	13.19	x 0.01 =	42.02	(250)
Additional standing charges (Table 12)				0	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)…(254) =			391.57	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.42	(257)
SAP rating (Section 12)		80.2	(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	=	673.84	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	701.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =					1375.39	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	0	(267)
Electricity for lighting	(232)	x		0.519	=	165.35	(268)
Total CO2, kg/year			sum of (265)…(271) =			1540.73	(272)
CO2 emissions per m²			(272) ÷ (4) =			21.74	(273)
EI rating (section 14)						82	(274)

13a. Primary Energy

		Energy kWh/year		**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211)	x		3.07	=	3985.94	(261)
Space heating (secondary)	(215)	x		3.07	=	0	(263)
Energy for water heating	(219)	x		3.07	=	4149.78	(264)
Space and water heating	(261) + (262) + (263) + (264) =					8135.72	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		3.07	=	0	(267)
Electricity for lighting	(232)	x		0	=	978.07	(268)
'Total Primary Energy			sum of (265)…(271) =			9113.79	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =			128.62	(273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Christopher Goddard	**Stroma Number:**	STRO035147
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.9

Property Address: UNIT 4

Address : Unit 3, Plough Lane, TW11 9BN

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	35.43 (1a)	x	2.2 (2a)	=	77.95	(3a)
First floor	35.43 (1b)	x	2.6 (2b)	=	92.12	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.86 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		170.06	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.43	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.36	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.34	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59

(24d)

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

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.08	x	1.2	=	2.496			(26)
Windows Type 1			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 2			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 3			2.15	x1/[1/(1.4)+ 0.04]		=	2.85			(27)
Windows Type 4			0.63	x1/[1/(1.4)+ 0.04]		=	0.84			(27)
Windows Type 5			0.63	x1/[1/(1.4)+ 0.04]		=	0.84			(27)
Rooflights Type 1			1.5	x1/[1/(1.7) + 0.04]		=	2.55			(27b)
Rooflights Type 2			1.5	x1/[1/(1.7) + 0.04]		=	2.55			(27b)
Floor			35.43	x	0.13	=	4.6059			(28)
Walls	49.99	9.65	40.34	x	0.18	=	7.26			(29)
Roof	36.68	3	33.68	x	0.13	=	4.38			(30)
Total area of elements, m²			122.1							(31)
Party wall			30.25	x	0	=	0			(32)
Party wall			35.75	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.55 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12640.77 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 7.15 (36)

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

Total fabric heat loss (33) + (36) = 40.7 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.05	33.82	33.59	32.52	32.32	31.39	31.39	31.21	31.75	32.32	32.73	33.15	(38)

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

(39)m=	74.75	74.52	74.29	73.22	73.02	72.09	72.09	71.91	72.45	73.02	73.43	73.85	

Average = Sum(39)$_{1...12}$ /12= 73.22 (39)

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

(40)m=	1.05	1.05	1.05	1.03	1.03	1.02	1.02	1.01	1.02	1.03	1.04	1.04	

Average = Sum(40)$_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.27 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 88.04 (43)

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

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

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

(44)m=	96.84	93.32	89.8	86.28	82.75	79.23	79.23	82.75	86.28	89.8	93.32	96.84	

Total = Sum(44)$_{1...12}$ = 1056.44 (44)

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

(45)m=	143.61	125.6	129.61	113	108.43	93.56	86.7	99.49	100.68	117.33	128.07	139.08	

Total = Sum(45)$_{1...12}$ = 1385.16 (45)

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

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

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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

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

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

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

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

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

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

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

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

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

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

(62)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.57	85.58	99.73	108.86	118.22	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.57	85.58	99.73	108.86	118.22	

Output from water heater (annual)$_{1...12}$	1177.39	(64)

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

(65)m=	30.52	26.69	27.54	24.01	23.04	19.88	18.42	21.14	21.39	24.93	27.22	29.55	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	(66)

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

(67)m=	18.04	16.02	13.03	9.87	7.37	6.23	6.73	8.74	11.74	14.9	17.39	18.54	(67)

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

(68)m=	199.3	201.36	196.15	185.06	171.05	157.89	149.1	147.03	152.24	163.33	177.34	190.5	(68)

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

(69)m=	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	(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=	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	(71)

Water heating gains (Table 5)

(72)m=	41.02	39.72	37.02	33.35	30.97	27.61	24.76	28.42	29.71	33.51	37.8	39.72	(72)

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

(73)m=	315.36	314.11	303.2	285.28	266.4	248.73	237.59	241.19	250.69	268.75	289.53	305.77	(73)

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6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.08	x	10.63	x	0.63	x	0.7	=	6.76	(74)
North	0.9x	0.77	x	2.08	x	10.63	x	0.63	x	0.7	=	6.76	(74)
North	0.9x	0.77	x	2.15	x	10.63	x	0.63	x	0.7	=	6.99	(74)
North	0.9x	0.77	x	0.63	x	10.63	x	0.63	x	0.7	=	2.05	(74)
North	0.9x	0.77	x	0.63	x	10.63	x	0.63	x	0.7	=	2.05	(74)
North	0.9x	0.77	x	2.08	x	20.32	x	0.63	x	0.7	=	12.92	(74)
North	0.9x	0.77	x	2.08	x	20.32	x	0.63	x	0.7	=	12.92	(74)
North	0.9x	0.77	x	2.15	x	20.32	x	0.63	x	0.7	=	13.35	(74)
North	0.9x	0.77	x	0.63	x	20.32	x	0.63	x	0.7	=	3.91	(74)
North	0.9x	0.77	x	0.63	x	20.32	x	0.63	x	0.7	=	3.91	(74)
North	0.9x	0.77	x	2.08	x	34.53	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	2.08	x	34.53	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	2.15	x	34.53	x	0.63	x	0.7	=	22.69	(74)
North	0.9x	0.77	x	0.63	x	34.53	x	0.63	x	0.7	=	6.65	(74)
North	0.9x	0.77	x	0.63	x	34.53	x	0.63	x	0.7	=	6.65	(74)
North	0.9x	0.77	x	2.08	x	55.46	x	0.63	x	0.7	=	35.26	(74)
North	0.9x	0.77	x	2.08	x	55.46	x	0.63	x	0.7	=	35.26	(74)
North	0.9x	0.77	x	2.15	x	55.46	x	0.63	x	0.7	=	36.44	(74)
North	0.9x	0.77	x	0.63	x	55.46	x	0.63	x	0.7	=	10.68	(74)
North	0.9x	0.77	x	0.63	x	55.46	x	0.63	x	0.7	=	10.68	(74)
North	0.9x	0.77	x	2.08	x	74.72	x	0.63	x	0.7	=	47.49	(74)
North	0.9x	0.77	x	2.08	x	74.72	x	0.63	x	0.7	=	47.49	(74)
North	0.9x	0.77	x	2.15	x	74.72	x	0.63	x	0.7	=	49.09	(74)
North	0.9x	0.77	x	0.63	x	74.72	x	0.63	x	0.7	=	14.39	(74)
North	0.9x	0.77	x	0.63	x	74.72	x	0.63	x	0.7	=	14.39	(74)
North	0.9x	0.77	x	2.08	x	79.99	x	0.63	x	0.7	=	50.84	(74)
North	0.9x	0.77	x	2.08	x	79.99	x	0.63	x	0.7	=	50.84	(74)
North	0.9x	0.77	x	2.15	x	79.99	x	0.63	x	0.7	=	52.56	(74)
North	0.9x	0.77	x	0.63	x	79.99	x	0.63	x	0.7	=	15.4	(74)
North	0.9x	0.77	x	0.63	x	79.99	x	0.63	x	0.7	=	15.4	(74)
North	0.9x	0.77	x	2.08	x	74.68	x	0.63	x	0.7	=	47.47	(74)
North	0.9x	0.77	x	2.08	x	74.68	x	0.63	x	0.7	=	47.47	(74)
North	0.9x	0.77	x	2.15	x	74.68	x	0.63	x	0.7	=	49.07	(74)
North	0.9x	0.77	x	0.63	x	74.68	x	0.63	x	0.7	=	14.38	(74)
North	0.9x	0.77	x	0.63	x	74.68	x	0.63	x	0.7	=	14.38	(74)
North	0.9x	0.77	x	2.08	x	59.25	x	0.63	x	0.7	=	37.66	(74)

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North	0.9x	0.77	x	2.08	x	59.25	x	0.63	x	0.7	=	37.66	(74)
North	0.9x	0.77	x	2.15	x	59.25	x	0.63	x	0.7	=	38.93	(74)
North	0.9x	0.77	x	0.63	x	59.25	x	0.63	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	0.63	x	59.25	x	0.63	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	2.08	x	41.52	x	0.63	x	0.7	=	26.39	(74)
North	0.9x	0.77	x	2.08	x	41.52	x	0.63	x	0.7	=	26.39	(74)
North	0.9x	0.77	x	2.15	x	41.52	x	0.63	x	0.7	=	27.28	(74)
North	0.9x	0.77	x	0.63	x	41.52	x	0.63	x	0.7	=	7.99	(74)
North	0.9x	0.77	x	0.63	x	41.52	x	0.63	x	0.7	=	7.99	(74)
North	0.9x	0.77	x	2.08	x	24.19	x	0.63	x	0.7	=	15.38	(74)
North	0.9x	0.77	x	2.08	x	24.19	x	0.63	x	0.7	=	15.38	(74)
North	0.9x	0.77	x	2.15	x	24.19	x	0.63	x	0.7	=	15.89	(74)
North	0.9x	0.77	x	0.63	x	24.19	x	0.63	x	0.7	=	4.66	(74)
North	0.9x	0.77	x	0.63	x	24.19	x	0.63	x	0.7	=	4.66	(74)
North	0.9x	0.77	x	2.08	x	13.12	x	0.63	x	0.7	=	8.34	(74)
North	0.9x	0.77	x	2.08	x	13.12	x	0.63	x	0.7	=	8.34	(74)
North	0.9x	0.77	x	2.15	x	13.12	x	0.63	x	0.7	=	8.62	(74)
North	0.9x	0.77	x	0.63	x	13.12	x	0.63	x	0.7	=	2.53	(74)
North	0.9x	0.77	x	0.63	x	13.12	x	0.63	x	0.7	=	2.53	(74)
North	0.9x	0.77	x	2.08	x	8.86	x	0.63	x	0.7	=	5.63	(74)
North	0.9x	0.77	x	2.08	x	8.86	x	0.63	x	0.7	=	5.63	(74)
North	0.9x	0.77	x	2.15	x	8.86	x	0.63	x	0.7	=	5.82	(74)
North	0.9x	0.77	x	0.63	x	8.86	x	0.63	x	0.7	=	1.71	(74)
North	0.9x	0.77	x	0.63	x	8.86	x	0.63	x	0.7	=	1.71	(74)
Rooflights	0.9x	1	x	1.5	x	19.94	x	0.63	x	0.7	=	11.87	(82)
Rooflights	0.9x	1	x	1.5	x	19.94	x	0.63	x	0.7	=	11.87	(82)
Rooflights	0.9x	1	x	1.5	x	39.83	x	0.63	x	0.7	=	23.71	(82)
Rooflights	0.9x	1	x	1.5	x	39.83	x	0.63	x	0.7	=	23.71	(82)
Rooflights	0.9x	1	x	1.5	x	73.56	x	0.63	x	0.7	=	43.8	(82)
Rooflights	0.9x	1	x	1.5	x	73.56	x	0.63	x	0.7	=	43.8	(82)
Rooflights	0.9x	1	x	1.5	x	128.76	x	0.63	x	0.7	=	76.66	(82)
Rooflights	0.9x	1	x	1.5	x	128.76	x	0.63	x	0.7	=	76.66	(82)
Rooflights	0.9x	1	x	1.5	x	182.65	x	0.63	x	0.7	=	108.74	(82)
Rooflights	0.9x	1	x	1.5	x	182.65	x	0.63	x	0.7	=	108.74	(82)
Rooflights	0.9x	1	x	1.5	x	199.33	x	0.63	x	0.7	=	118.67	(82)
Rooflights	0.9x	1	x	1.5	x	199.33	x	0.63	x	0.7	=	118.67	(82)
Rooflights	0.9x	1	x	1.5	x	184.61	x	0.63	x	0.7	=	109.91	(82)
Rooflights	0.9x	1	x	1.5	x	184.61	x	0.63	x	0.7	=	109.91	(82)
Rooflights	0.9x	1	x	1.5	x	140.92	x	0.63	x	0.7	=	83.9	(82)
Rooflights	0.9x	1	x	1.5	x	140.92	x	0.63	x	0.7	=	83.9	(82)
Rooflights	0.9x	1	x	1.5	x	91.75	x	0.63	x	0.7	=	54.62	(82)

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Rooflights 0.9x	1	x	1.5	x	91.75	x	0.63	x	0.7	=	54.62	(82)
Rooflights 0.9x	1	x	1.5	x	48.83	x	0.63	x	0.7	=	29.07	(82)
Rooflights 0.9x	1	x	1.5	x	48.83	x	0.63	x	0.7	=	29.07	(82)
Rooflights 0.9x	1	x	1.5	x	24.87	x	0.63	x	0.7	=	14.8	(82)
Rooflights 0.9x	1	x	1.5	x	24.87	x	0.63	x	0.7	=	14.8	(82)
Rooflights 0.9x	1	x	1.5	x	16.47	x	0.63	x	0.7	=	9.81	(82)
Rooflights 0.9x	1	x	1.5	x	16.47	x	0.63	x	0.7	=	9.81	(82)

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

(83)m=	48.34	94.44	167.48	281.63	390.34	422.39	392.58	304.87	205.29	114.1	59.96	40.12	(83)

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

(84)m=	363.7	408.55	470.68	566.91	656.74	671.12	630.16	546.06	455.99	382.85	349.49	345.89	(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	0.86	0.66	0.5	0.59	0.88	0.99	1	1	(86)

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

(87)m=	19.81	19.93	20.18	20.54	20.84	20.97	21	20.99	20.87	20.48	20.09	19.79	(87)

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

(88)m=	20.04	20.04	20.04	20.06	20.06	20.07	20.07	20.07	20.06	20.06	20.05	20.05	(88)

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

(89)m=	1	1	0.99	0.95	0.81	0.57	0.4	0.48	0.82	0.98	1	1	(89)

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

(90)m=	18.94	19.07	19.31	19.68	19.95	20.06	20.07	20.07	19.99	19.63	19.24	18.93	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

(92)m=	19.32	19.45	19.69	20.06	20.34	20.46	20.47	20.47	20.37	20	19.61	19.31	(92)

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

(93)m=	19.32	19.45	19.69	20.06	20.34	20.46	20.47	20.47	20.37	20	19.61	19.31	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.95	0.83	0.61	0.44	0.53	0.85	0.98	1	1	(94)

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

(95)m=	363.13	407.24	466.03	541.07	544.25	409.71	277.52	288.42	385.48	375.85	348.39	345.48	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	1122.75	1083.92	980.04	817.04	631.2	422.27	279.23	292.73	454.44	686.72	918.62	1115.72	(97)

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

(98)m=	565.16	454.73	382.42	198.7	64.69	0	0	0	0	231.28	410.57	573.06	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2880.6	(98)
Space heating requirement in kWh/m²/year	40.65	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	677.62	533.44	546.55	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.92	0.96	0.93	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	622.43	511.36	507.66	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	828.67	782.06	693.93	0	0	0	0	(103)

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

(104)m=	0	0	0	0	0	148.5	201.4	138.58	0	0	0	0	
Total = Sum(104)$_{5,8}$ =													488.48 (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)$_{5,8}$ =													0 (106)
Space cooling requirement for month = (104)m × (105) × (106)m													
(107)m=	0	0	0	0	0	37.12	50.35	34.65	0	0	0	0	
Total = Sum(107)$_{5,8}$ =													122.12 (107)
Space cooling requirement in kWh/m²/year									(107) ÷ (4) =				1.72 (108)

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

Fabric Energy Efficiency	(99) + (108) = 42.38	(109)
Target Fabric Energy Efficiency (TFEE)	48.73	(109)

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User Details:

Assessor Name:	Christopher Goddard	**Stroma Number:**	STRO035147
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.9

Property Address: UNIT 4

Address : Unit 3, Plough Lane, TW11 9BN

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	35.43 (1a)	x	2.2 (2a)	=	77.95	(3a)
First floor	35.43 (1b)	x	2.6 (2b)	=	92.12	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.86 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		170.06	(5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.31 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57

(24d)

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

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.08	x	1.2	=	2.496			(26)
Windows Type 1			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 2			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 3			2.15	x1/[1/(1.4)+ 0.04]		=	2.85			(27)
Windows Type 4			0.63	x1/[1/(1.4)+ 0.04]		=	0.84			(27)
Windows Type 5			0.63	x1/[1/(1.4)+ 0.04]		=	0.84			(27)
Rooflights Type 1			1.5	x1/[1/(1.4) + 0.04]		=	2.1			(27b)
Rooflights Type 2			1.5	x1/[1/(1.4) + 0.04]		=	2.1			(27b)
Floor			35.43	x	0.15	=	5.3145			(28)
Walls	49.99	9.65	40.34	x	0.15	=	6.05			(29)
Roof	36.68	3	33.68	x	0.15	=	5.05			(30)
Total area of elements, m²			122.1							(31)
Party wall			30.25	x	0	=	0			(32)
Party wall			35.75	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12640.77 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 8.9 (36)

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

Total fabric heat loss (33) + (36) = 41.83 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.51	32.34	32.17	31.38	31.23	30.53	30.53	30.4	30.8	31.23	31.53	31.84	(38)

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

(39)m=	74.34	74.17	74	73.2	73.06	72.36	72.36	72.23	72.63	73.06	73.36	73.67	

Average = Sum(39)$_{1...12}$ /12= 73.2 (39)

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

(40)m=	1.05	1.05	1.04	1.03	1.03	1.02	1.02	1.02	1.02	1.03	1.04	1.04	

Average = Sum(40)$_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.27 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 88.04 (43)

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

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

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

(44)m=	96.84	93.32	89.8	86.28	82.75	79.23	79.23	82.75	86.28	89.8	93.32	96.84	

Total = Sum(44)$_{1...12}$ = 1056.44 (44)

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

(45)m=	143.61	125.6	129.61	113	108.43	93.56	86.7	99.49	100.68	117.33	128.07	139.08	

Total = Sum(45)$_{1...12}$ = 1385.16 (45)

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

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

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

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

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

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

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

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

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

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

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

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

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

(62)m=	122.07	106.76	110.17	96.05	92.16	79.53	73.69	84.57	85.58	99.73	108.86	118.22	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
WWHRS	-35.49	-31.23	-31.87	-26.24	-24.37	-20.11	-17.03	-20.62	-21.22	-26.21	-30.35	-34.3	(63) (G10)

Output from water heater

(64)m=	86.58	75.54	78.3	69.81	67.79	59.42	56.66	63.95	64.36	73.52	78.51	83.92	

Output from water heater (annual)$_{1...12}$	858.35	(64)

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

(65)m=	30.52	26.69	27.54	24.01	23.04	19.88	18.42	21.14	21.39	24.93	27.22	29.55	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	(66)

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

(67)m=	18.04	16.02	13.03	9.87	7.37	6.23	6.73	8.74	11.74	14.9	17.39	18.54	(67)

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

(68)m=	199.3	201.36	196.15	185.06	171.05	157.89	149.1	147.03	152.24	163.33	177.34	190.5	(68)

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

(69)m=	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	(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=	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	(71)

Water heating gains (Table 5)

(72)m=	41.02	39.72	37.02	33.35	30.97	27.61	24.76	28.42	29.71	33.51	37.8	39.72	(72)

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

(73)m=	315.36	314.11	303.2	285.28	266.4	248.73	237.59	241.19	250.69	268.75	289.53	305.77	(73)

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6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.08	x	10.63	x	0.76	x	0.7	=	8.15	(74)
North	0.9x 0.77	x	2.08	x	10.63	x	0.76	x	0.7	=	8.15	(74)
North	0.9x 0.77	x	2.15	x	10.63	x	0.76	x	0.7	=	8.43	(74)
North	0.9x 0.77	x	0.63	x	10.63	x	0.76	x	0.7	=	2.47	(74)
North	0.9x 0.77	x	0.63	x	10.63	x	0.76	x	0.7	=	2.47	(74)
North	0.9x 0.77	x	2.08	x	20.32	x	0.76	x	0.7	=	15.58	(74)
North	0.9x 0.77	x	2.08	x	20.32	x	0.76	x	0.7	=	15.58	(74)
North	0.9x 0.77	x	2.15	x	20.32	x	0.76	x	0.7	=	16.11	(74)
North	0.9x 0.77	x	0.63	x	20.32	x	0.76	x	0.7	=	4.72	(74)
North	0.9x 0.77	x	0.63	x	20.32	x	0.76	x	0.7	=	4.72	(74)
North	0.9x 0.77	x	2.08	x	34.53	x	0.76	x	0.7	=	26.48	(74)
North	0.9x 0.77	x	2.08	x	34.53	x	0.76	x	0.7	=	26.48	(74)
North	0.9x 0.77	x	2.15	x	34.53	x	0.76	x	0.7	=	27.37	(74)
North	0.9x 0.77	x	0.63	x	34.53	x	0.76	x	0.7	=	8.02	(74)
North	0.9x 0.77	x	0.63	x	34.53	x	0.76	x	0.7	=	8.02	(74)
North	0.9x 0.77	x	2.08	x	55.46	x	0.76	x	0.7	=	42.53	(74)
North	0.9x 0.77	x	2.08	x	55.46	x	0.76	x	0.7	=	42.53	(74)
North	0.9x 0.77	x	2.15	x	55.46	x	0.76	x	0.7	=	43.96	(74)
North	0.9x 0.77	x	0.63	x	55.46	x	0.76	x	0.7	=	12.88	(74)
North	0.9x 0.77	x	0.63	x	55.46	x	0.76	x	0.7	=	12.88	(74)
North	0.9x 0.77	x	2.08	x	74.72	x	0.76	x	0.7	=	57.3	(74)
North	0.9x 0.77	x	2.08	x	74.72	x	0.76	x	0.7	=	57.3	(74)
North	0.9x 0.77	x	2.15	x	74.72	x	0.76	x	0.7	=	59.22	(74)
North	0.9x 0.77	x	0.63	x	74.72	x	0.76	x	0.7	=	17.35	(74)
North	0.9x 0.77	x	0.63	x	74.72	x	0.76	x	0.7	=	17.35	(74)
North	0.9x 0.77	x	2.08	x	79.99	x	0.76	x	0.7	=	61.34	(74)
North	0.9x 0.77	x	2.08	x	79.99	x	0.76	x	0.7	=	61.34	(74)
North	0.9x 0.77	x	2.15	x	79.99	x	0.76	x	0.7	=	63.4	(74)
North	0.9x 0.77	x	0.63	x	79.99	x	0.76	x	0.7	=	18.58	(74)
North	0.9x 0.77	x	0.63	x	79.99	x	0.76	x	0.7	=	18.58	(74)
North	0.9x 0.77	x	2.08	x	74.68	x	0.76	x	0.7	=	57.27	(74)
North	0.9x 0.77	x	2.08	x	74.68	x	0.76	x	0.7	=	57.27	(74)
North	0.9x 0.77	x	2.15	x	74.68	x	0.76	x	0.7	=	59.19	(74)
North	0.9x 0.77	x	0.63	x	74.68	x	0.76	x	0.7	=	17.34	(74)
North	0.9x 0.77	x	0.63	x	74.68	x	0.76	x	0.7	=	17.34	(74)
North	0.9x 0.77	x	2.08	x	59.25	x	0.76	x	0.7	=	45.43	(74)

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North	0.9x	0.77	x	2.08	x	59.25	x	0.76	x	0.7	=	45.43	(74)
North	0.9x	0.77	x	2.15	x	59.25	x	0.76	x	0.7	=	46.96	(74)
North	0.9x	0.77	x	0.63	x	59.25	x	0.76	x	0.7	=	13.76	(74)
North	0.9x	0.77	x	0.63	x	59.25	x	0.76	x	0.7	=	13.76	(74)
North	0.9x	0.77	x	2.08	x	41.52	x	0.76	x	0.7	=	31.84	(74)
North	0.9x	0.77	x	2.08	x	41.52	x	0.76	x	0.7	=	31.84	(74)
North	0.9x	0.77	x	2.15	x	41.52	x	0.76	x	0.7	=	32.91	(74)
North	0.9x	0.77	x	0.63	x	41.52	x	0.76	x	0.7	=	9.64	(74)
North	0.9x	0.77	x	0.63	x	41.52	x	0.76	x	0.7	=	9.64	(74)
North	0.9x	0.77	x	2.08	x	24.19	x	0.76	x	0.7	=	18.55	(74)
North	0.9x	0.77	x	2.08	x	24.19	x	0.76	x	0.7	=	18.55	(74)
North	0.9x	0.77	x	2.15	x	24.19	x	0.76	x	0.7	=	19.17	(74)
North	0.9x	0.77	x	0.63	x	24.19	x	0.76	x	0.7	=	5.62	(74)
North	0.9x	0.77	x	0.63	x	24.19	x	0.76	x	0.7	=	5.62	(74)
North	0.9x	0.77	x	2.08	x	13.12	x	0.76	x	0.7	=	10.06	(74)
North	0.9x	0.77	x	2.08	x	13.12	x	0.76	x	0.7	=	10.06	(74)
North	0.9x	0.77	x	2.15	x	13.12	x	0.76	x	0.7	=	10.4	(74)
North	0.9x	0.77	x	0.63	x	13.12	x	0.76	x	0.7	=	3.05	(74)
North	0.9x	0.77	x	0.63	x	13.12	x	0.76	x	0.7	=	3.05	(74)
North	0.9x	0.77	x	2.08	x	8.86	x	0.76	x	0.7	=	6.8	(74)
North	0.9x	0.77	x	2.08	x	8.86	x	0.76	x	0.7	=	6.8	(74)
North	0.9x	0.77	x	2.15	x	8.86	x	0.76	x	0.7	=	7.03	(74)
North	0.9x	0.77	x	0.63	x	8.86	x	0.76	x	0.7	=	2.06	(74)
North	0.9x	0.77	x	0.63	x	8.86	x	0.76	x	0.7	=	2.06	(74)
Rooflights	0.9x	1	x	1.5	x	19.94	x	0.76	x	0.7	=	14.32	(82)
Rooflights	0.9x	1	x	1.5	x	19.94	x	0.76	x	0.7	=	14.32	(82)
Rooflights	0.9x	1	x	1.5	x	39.83	x	0.76	x	0.7	=	28.61	(82)
Rooflights	0.9x	1	x	1.5	x	39.83	x	0.76	x	0.7	=	28.61	(82)
Rooflights	0.9x	1	x	1.5	x	73.56	x	0.76	x	0.7	=	52.83	(82)
Rooflights	0.9x	1	x	1.5	x	73.56	x	0.76	x	0.7	=	52.83	(82)
Rooflights	0.9x	1	x	1.5	x	128.76	x	0.76	x	0.7	=	92.48	(82)
Rooflights	0.9x	1	x	1.5	x	128.76	x	0.76	x	0.7	=	92.48	(82)
Rooflights	0.9x	1	x	1.5	x	182.65	x	0.76	x	0.7	=	131.18	(82)
Rooflights	0.9x	1	x	1.5	x	182.65	x	0.76	x	0.7	=	131.18	(82)
Rooflights	0.9x	1	x	1.5	x	199.33	x	0.76	x	0.7	=	143.16	(82)
Rooflights	0.9x	1	x	1.5	x	199.33	x	0.76	x	0.7	=	143.16	(82)
Rooflights	0.9x	1	x	1.5	x	184.61	x	0.76	x	0.7	=	132.59	(82)
Rooflights	0.9x	1	x	1.5	x	184.61	x	0.76	x	0.7	=	132.59	(82)
Rooflights	0.9x	1	x	1.5	x	140.92	x	0.76	x	0.7	=	101.21	(82)
Rooflights	0.9x	1	x	1.5	x	140.92	x	0.76	x	0.7	=	101.21	(82)
Rooflights	0.9x	1	x	1.5	x	91.75	x	0.76	x	0.7	=	65.89	(82)

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Rooflights 0.9x	1	x	1.5	x	91.75	x	0.76	x	0.7	=	65.89	(82)
Rooflights 0.9x	1	x	1.5	x	48.83	x	0.76	x	0.7	=	35.07	(82)
Rooflights 0.9x	1	x	1.5	x	48.83	x	0.76	x	0.7	=	35.07	(82)
Rooflights 0.9x	1	x	1.5	x	24.87	x	0.76	x	0.7	=	17.86	(82)
Rooflights 0.9x	1	x	1.5	x	24.87	x	0.76	x	0.7	=	17.86	(82)
Rooflights 0.9x	1	x	1.5	x	16.47	x	0.76	x	0.7	=	11.83	(82)
Rooflights 0.9x	1	x	1.5	x	16.47	x	0.76	x	0.7	=	11.83	(82)

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

(83)m=	58.32	113.93	202.04	339.75	470.89	509.55	473.58	367.77	247.65	137.65	72.33	48.4	(83)

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

(84)m=	373.67	428.04	505.24	625.02	737.29	758.28	711.17	608.96	498.35	406.4	361.86	354.17	(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	1	0.99	0.95	0.81	0.59	0.44	0.54	0.85	0.98	1	1	(86)

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

(87)m=	19.83	19.96	20.23	20.61	20.89	20.98	21	20.99	20.89	20.51	20.11	19.8	(87)

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

(88)m=	20.04	20.04	20.05	20.06	20.06	20.07	20.07	20.07	20.06	20.06	20.05	20.05	(88)

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

(89)m=	1	1	0.99	0.93	0.76	0.51	0.35	0.43	0.78	0.98	1	1	(89)

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

(90)m=	18.97	19.1	19.37	19.74	19.99	20.06	20.07	20.07	20	19.66	19.26	18.95	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

(92)m=	19.34	19.48	19.74	20.12	20.38	20.46	20.47	20.47	20.39	20.03	19.63	19.32	(92)

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

(93)m=	19.34	19.48	19.74	20.12	20.38	20.46	20.47	20.47	20.39	20.03	19.63	19.32	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.94	0.78	0.55	0.39	0.48	0.81	0.98	1	1	(94)

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

(95)m=	373.01	426.33	498.45	584.73	572.01	416.58	279.26	291.35	402.52	396.91	360.52	353.7	(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=	1118.36	1081.4	979.98	821.29	634.17	424.27	280.25	294.06	457.06	689.12	919.09	1114.19	(97)

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

(98)m=	554.54	440.2	358.25	170.33	46.25	0	0	0	0	217.4	402.17	565.8	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2754.95	(98)
Space heating requirement in kWh/m²/year	38.88	(99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	680.21	535.48	548.98	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.94	0.97	0.95	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	641.84	520.76	520.68	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	922.28	869.09	761.62	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	201.92	259.15	179.26	0	0	0	0	

Total = Sum(104)$_{5,8}$ =	640.33	(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)$_{5,8}$ =	0	(106)

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

(107)m=	0	0	0	0	0	50.48	64.79	44.81	0	0	0	0	

Total = Sum(107)$_{5,8}$ =	160.08	(107)
Space cooling requirement in kWh/m²/year — (107) ÷ (4) =	2.26	(108)

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

Fabric Energy Efficiency — (99) + (108) =	41.14	(109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Christopher Goddard	**Stroma Number:**	STRO035147
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.9

Property Address: UNIT 4

Address : Unit 3, Plough Lane, TW11 9BN

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	35.43 (1a)	x	2.2 (2a)	=	77.95	(3a)
First floor	35.43 (1b)	x	2.6 (2b)	=	92.12	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.86 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		170.06	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.43 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.36 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.34	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59

(24d)

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

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.08	x	1.2	=	2.496			(26)
Windows Type 1			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 2			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 3			2.15	x1/[1/(1.4)+ 0.04]		=	2.85			(27)
Windows Type 4			0.63	x1/[1/(1.4)+ 0.04]		=	0.84			(27)
Windows Type 5			0.63	x1/[1/(1.4)+ 0.04]		=	0.84			(27)
Rooflights Type 1			1.5	x1/[1/(1.4) + 0.04]		=	2.1			(27b)
Rooflights Type 2			1.5	x1/[1/(1.4) + 0.04]		=	2.1			(27b)
Floor			35.43	x	0.15	=	5.3145			(28)
Walls	49.99	9.65	40.34	x	0.15	=	6.05			(29)
Roof	36.68	3	33.68	x	0.15	=	5.05			(30)
Total area of elements, m²			122.1							(31)
Party wall			30.25	x	0	=	0			(32)
Party wall			35.75	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.93 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12640.77 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 8.9 (36)

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

Total fabric heat loss (33) + (36) = 41.83 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.05	33.82	33.59	32.52	32.32	31.39	31.39	31.21	31.75	32.32	32.73	33.15	(38)

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

(39)m=	75.88	75.65	75.42	74.35	74.15	73.22	73.22	73.04	73.58	74.15	74.56	74.98	

Average = Sum(39)$_{1...12}$ /12= 74.35 (39)

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

(40)m=	1.07	1.07	1.06	1.05	1.05	1.03	1.03	1.03	1.04	1.05	1.05	1.06	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.27 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 88.04 (43)

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

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

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

(44)m=	96.84	93.32	89.8	86.28	82.75	79.23	79.23	82.75	86.28	89.8	93.32	96.84	

Total = Sum(44)$_{1...12}$ = 1056.44 (44)

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

(45)m=	143.61	125.6	129.61	113	108.43	93.56	86.7	99.49	100.68	117.33	128.07	139.08	

Total = Sum(45)$_{1...12}$ = 1385.16 (45)

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

(46)m=	21.54	18.84	19.44	16.95	16.26	14.03	13	14.92	15.1	17.6	19.21	20.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 120 (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) = 120 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.01 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1 (52)

Temperature factor from Table 2b — 0.54 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0.75	(54)
Enter (50) or (54) in (55)		0.75	(55)

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

(56)m=	23.2	20.95	23.2	22.45	23.2	22.45	23.2	23.2	22.45	23.2	22.45	23.2	(56)

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

(57)m=	23.2	20.95	23.2	22.45	23.2	22.45	23.2	23.2	22.45	23.2	22.45	23.2	(57)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

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

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

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

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

(62)m=	190.07	167.57	176.07	157.96	154.88	138.52	133.16	145.95	145.64	163.79	173.03	185.54	(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)
WWHRS	-35.49	-31.23	-31.87	-26.24	-24.37	-20.11	-17.03	-20.62	-21.22	-26.21	-30.35	-34.3	(63) (G10)

Output from water heater

(64)m=	154.58	136.34	144.2	131.72	130.51	118.41	116.13	125.33	124.42	137.57	142.69	151.24	

Output from water heater (annual)$_{1...12}$	1613.14	(64)

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

(65)m=	84.92	75.33	80.26	73.54	73.22	67.08	66	70.25	69.44	76.18	78.55	83.41	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	(66)

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

(67)m=	18.04	16.02	13.03	9.87	7.37	6.23	6.73	8.74	11.74	14.9	17.39	18.54	(67)

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

(68)m=	199.3	201.36	196.15	185.06	171.05	157.89	149.1	147.03	152.24	163.33	177.34	190.5	(68)

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

(69)m=	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	(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=	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	(71)

Water heating gains (Table 5)

(72)m=	114.14	112.1	107.88	102.14	98.41	93.16	88.7	94.42	96.45	102.39	109.1	112.11	(72)

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

(73)m=	388.48	386.49	374.07	354.06	333.84	314.28	301.53	307.19	317.43	337.63	360.84	378.16	(73)

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6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.08	x	10.63	x	0.76	x	0.7	=	8.15	(74)
North	0.9x 0.77	x	2.08	x	10.63	x	0.76	x	0.7	=	8.15	(74)
North	0.9x 0.77	x	2.15	x	10.63	x	0.76	x	0.7	=	8.43	(74)
North	0.9x 0.77	x	0.63	x	10.63	x	0.76	x	0.7	=	2.47	(74)
North	0.9x 0.77	x	0.63	x	10.63	x	0.76	x	0.7	=	2.47	(74)
North	0.9x 0.77	x	2.08	x	20.32	x	0.76	x	0.7	=	15.58	(74)
North	0.9x 0.77	x	2.08	x	20.32	x	0.76	x	0.7	=	15.58	(74)
North	0.9x 0.77	x	2.15	x	20.32	x	0.76	x	0.7	=	16.11	(74)
North	0.9x 0.77	x	0.63	x	20.32	x	0.76	x	0.7	=	4.72	(74)
North	0.9x 0.77	x	0.63	x	20.32	x	0.76	x	0.7	=	4.72	(74)
North	0.9x 0.77	x	2.08	x	34.53	x	0.76	x	0.7	=	26.48	(74)
North	0.9x 0.77	x	2.08	x	34.53	x	0.76	x	0.7	=	26.48	(74)
North	0.9x 0.77	x	2.15	x	34.53	x	0.76	x	0.7	=	27.37	(74)
North	0.9x 0.77	x	0.63	x	34.53	x	0.76	x	0.7	=	8.02	(74)
North	0.9x 0.77	x	0.63	x	34.53	x	0.76	x	0.7	=	8.02	(74)
North	0.9x 0.77	x	2.08	x	55.46	x	0.76	x	0.7	=	42.53	(74)
North	0.9x 0.77	x	2.08	x	55.46	x	0.76	x	0.7	=	42.53	(74)
North	0.9x 0.77	x	2.15	x	55.46	x	0.76	x	0.7	=	43.96	(74)
North	0.9x 0.77	x	0.63	x	55.46	x	0.76	x	0.7	=	12.88	(74)
North	0.9x 0.77	x	0.63	x	55.46	x	0.76	x	0.7	=	12.88	(74)
North	0.9x 0.77	x	2.08	x	74.72	x	0.76	x	0.7	=	57.3	(74)
North	0.9x 0.77	x	2.08	x	74.72	x	0.76	x	0.7	=	57.3	(74)
North	0.9x 0.77	x	2.15	x	74.72	x	0.76	x	0.7	=	59.22	(74)
North	0.9x 0.77	x	0.63	x	74.72	x	0.76	x	0.7	=	17.35	(74)
North	0.9x 0.77	x	0.63	x	74.72	x	0.76	x	0.7	=	17.35	(74)
North	0.9x 0.77	x	2.08	x	79.99	x	0.76	x	0.7	=	61.34	(74)
North	0.9x 0.77	x	2.08	x	79.99	x	0.76	x	0.7	=	61.34	(74)
North	0.9x 0.77	x	2.15	x	79.99	x	0.76	x	0.7	=	63.4	(74)
North	0.9x 0.77	x	0.63	x	79.99	x	0.76	x	0.7	=	18.58	(74)
North	0.9x 0.77	x	0.63	x	79.99	x	0.76	x	0.7	=	18.58	(74)
North	0.9x 0.77	x	2.08	x	74.68	x	0.76	x	0.7	=	57.27	(74)
North	0.9x 0.77	x	2.08	x	74.68	x	0.76	x	0.7	=	57.27	(74)
North	0.9x 0.77	x	2.15	x	74.68	x	0.76	x	0.7	=	59.19	(74)
North	0.9x 0.77	x	0.63	x	74.68	x	0.76	x	0.7	=	17.34	(74)
North	0.9x 0.77	x	0.63	x	74.68	x	0.76	x	0.7	=	17.34	(74)
North	0.9x 0.77	x	2.08	x	59.25	x	0.76	x	0.7	=	45.43	(74)

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North	0.9x	0.77	x	2.08	x	59.25	x	0.76	x	0.7	=	45.43	(74)
North	0.9x	0.77	x	2.15	x	59.25	x	0.76	x	0.7	=	46.96	(74)
North	0.9x	0.77	x	0.63	x	59.25	x	0.76	x	0.7	=	13.76	(74)
North	0.9x	0.77	x	0.63	x	59.25	x	0.76	x	0.7	=	13.76	(74)
North	0.9x	0.77	x	2.08	x	41.52	x	0.76	x	0.7	=	31.84	(74)
North	0.9x	0.77	x	2.08	x	41.52	x	0.76	x	0.7	=	31.84	(74)
North	0.9x	0.77	x	2.15	x	41.52	x	0.76	x	0.7	=	32.91	(74)
North	0.9x	0.77	x	0.63	x	41.52	x	0.76	x	0.7	=	9.64	(74)
North	0.9x	0.77	x	0.63	x	41.52	x	0.76	x	0.7	=	9.64	(74)
North	0.9x	0.77	x	2.08	x	24.19	x	0.76	x	0.7	=	18.55	(74)
North	0.9x	0.77	x	2.08	x	24.19	x	0.76	x	0.7	=	18.55	(74)
North	0.9x	0.77	x	2.15	x	24.19	x	0.76	x	0.7	=	19.17	(74)
North	0.9x	0.77	x	0.63	x	24.19	x	0.76	x	0.7	=	5.62	(74)
North	0.9x	0.77	x	0.63	x	24.19	x	0.76	x	0.7	=	5.62	(74)
North	0.9x	0.77	x	2.08	x	13.12	x	0.76	x	0.7	=	10.06	(74)
North	0.9x	0.77	x	2.08	x	13.12	x	0.76	x	0.7	=	10.06	(74)
North	0.9x	0.77	x	2.15	x	13.12	x	0.76	x	0.7	=	10.4	(74)
North	0.9x	0.77	x	0.63	x	13.12	x	0.76	x	0.7	=	3.05	(74)
North	0.9x	0.77	x	0.63	x	13.12	x	0.76	x	0.7	=	3.05	(74)
North	0.9x	0.77	x	2.08	x	8.86	x	0.76	x	0.7	=	6.8	(74)
North	0.9x	0.77	x	2.08	x	8.86	x	0.76	x	0.7	=	6.8	(74)
North	0.9x	0.77	x	2.15	x	8.86	x	0.76	x	0.7	=	7.03	(74)
North	0.9x	0.77	x	0.63	x	8.86	x	0.76	x	0.7	=	2.06	(74)
North	0.9x	0.77	x	0.63	x	8.86	x	0.76	x	0.7	=	2.06	(74)
Rooflights	0.9x	1	x	1.5	x	19.94	x	0.76	x	0.7	=	14.32	(82)
Rooflights	0.9x	1	x	1.5	x	19.94	x	0.76	x	0.7	=	14.32	(82)
Rooflights	0.9x	1	x	1.5	x	39.83	x	0.76	x	0.7	=	28.61	(82)
Rooflights	0.9x	1	x	1.5	x	39.83	x	0.76	x	0.7	=	28.61	(82)
Rooflights	0.9x	1	x	1.5	x	73.56	x	0.76	x	0.7	=	52.83	(82)
Rooflights	0.9x	1	x	1.5	x	73.56	x	0.76	x	0.7	=	52.83	(82)
Rooflights	0.9x	1	x	1.5	x	128.76	x	0.76	x	0.7	=	92.48	(82)
Rooflights	0.9x	1	x	1.5	x	128.76	x	0.76	x	0.7	=	92.48	(82)
Rooflights	0.9x	1	x	1.5	x	182.65	x	0.76	x	0.7	=	131.18	(82)
Rooflights	0.9x	1	x	1.5	x	182.65	x	0.76	x	0.7	=	131.18	(82)
Rooflights	0.9x	1	x	1.5	x	199.33	x	0.76	x	0.7	=	143.16	(82)
Rooflights	0.9x	1	x	1.5	x	199.33	x	0.76	x	0.7	=	143.16	(82)
Rooflights	0.9x	1	x	1.5	x	184.61	x	0.76	x	0.7	=	132.59	(82)
Rooflights	0.9x	1	x	1.5	x	184.61	x	0.76	x	0.7	=	132.59	(82)
Rooflights	0.9x	1	x	1.5	x	140.92	x	0.76	x	0.7	=	101.21	(82)
Rooflights	0.9x	1	x	1.5	x	140.92	x	0.76	x	0.7	=	101.21	(82)
Rooflights	0.9x	1	x	1.5	x	91.75	x	0.76	x	0.7	=	65.89	(82)

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Rooflights 0.9x	1	x	1.5	x	91.75	x	0.76	x	0.7	=	65.89	(82)
Rooflights 0.9x	1	x	1.5	x	48.83	x	0.76	x	0.7	=	35.07	(82)
Rooflights 0.9x	1	x	1.5	x	48.83	x	0.76	x	0.7	=	35.07	(82)
Rooflights 0.9x	1	x	1.5	x	24.87	x	0.76	x	0.7	=	17.86	(82)
Rooflights 0.9x	1	x	1.5	x	24.87	x	0.76	x	0.7	=	17.86	(82)
Rooflights 0.9x	1	x	1.5	x	16.47	x	0.76	x	0.7	=	11.83	(82)
Rooflights 0.9x	1	x	1.5	x	16.47	x	0.76	x	0.7	=	11.83	(82)

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

(83)m=	58.32	113.93	202.04	339.75	470.89	509.55	473.58	367.77	247.65	137.65	72.33	48.4	(83)

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

(84)m=	446.79	500.42	576.1	693.81	804.73	823.83	775.11	674.97	565.08	475.28	433.16	426.56	(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	0.77	0.56	0.41	0.49	0.8	0.97	0.99	1	(86)

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

(87)m=	21	21	21	21	21	21	21	21	21	21	21	21	(87)

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

(88)m=	20.02	20.03	20.03	20.04	20.04	20.06	20.06	20.06	20.05	20.04	20.04	20.04	(88)

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

(89)m=	1	0.99	0.98	0.91	0.72	0.48	0.33	0.39	0.72	0.96	0.99	1	(89)

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

(90)m=	20.02	20.03	20.03	20.04	20.04	20.06	20.06	20.06	20.05	20.04	20.04	20.04	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

(92)m=	20.45	20.45	20.45	20.46	20.46	20.47	20.47	20.47	20.47	20.46	20.46	20.46	(92)

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

(93)m=	20.45	20.45	20.45	20.46	20.46	20.47	20.47	20.47	20.47	20.46	20.46	20.46	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.92	0.74	0.51	0.36	0.44	0.76	0.96	0.99	1	(94)

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

(95)m=	445.47	497.41	565.49	637.63	597.25	423.81	282.54	295.43	427.45	458.13	430.42	425.57	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	1225.6	1176.57	1052.46	859.59	649.75	429.7	283.26	297.29	468.42	731.32	996.06	1218.96	(97)

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

(98)m=	580.42	456.4	362.31	159.81	39.06	0	0	0	0	203.25	407.26	590.28	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2798.78	(98)
Space heating requirement in kWh/m²/year	39.5	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	162.95	(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)	580.42	456.4	362.31	159.81	39.06	0	0	0	0	203.25	407.26	590.28	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	356.2	280.09	222.34	98.08	23.97	0	0	0	0	124.73	249.93	362.25	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1717.59 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	154.58	136.34	144.2	131.72	130.51	118.41	116.13	125.33	124.42	137.57	142.69	151.24

Efficiency of water heater 119.34 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	119.34	119.34	119.34	119.34	119.34	119.34	119.34	119.34	119.34	119.34	119.34	119.34

(217)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	129.53	114.25	120.83	110.37	109.36	99.22	97.31	105.02	104.26	115.28	119.56	126.73

Total = Sum(219a)$_{1...12}$ = 1351.72 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1717.59
Water heating fuel used		1351.72
Electricity for pumps, fans and electric keep-hot		
Total electricity for the above, kWh/year sum of (230a)…(230g) =		0 (231)
Electricity for lighting		318.59 (232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	891.43	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	701.54	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			1592.97	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	0	(267)
Electricity for lighting	(232) x	0.519	=	165.35	(268)
Total CO2, kg/year	sum of (265)…(271) =			1758.32	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			24.81	(273)
EI rating (section 14)				80	(274)

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User Details:

Assessor Name:	Christopher Goddard	**Stroma Number:**	STRO035147
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.9

Property Address: UNIT 4

Address : Unit 3, Plough Lane, TW11 9BN

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	35.43 (1a)	x	2.2 (2a)	=	77.95	(3a)
First floor	35.43 (1b)	x	2.6 (2b)	=	92.12	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.86 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		170.06	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.43 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.36 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.34	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59

(24d)

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

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.08	x	1.2	=	2.496			(26)
Windows Type 1			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 2			2.08	x1/[1/(1.4)+ 0.04]		=	2.76			(27)
Windows Type 3			2.15	x1/[1/(1.4)+ 0.04]		=	2.85			(27)
Windows Type 4			0.63	x1/[1/(1.4)+ 0.04]		=	0.84			(27)
Windows Type 5			0.63	x1/[1/(1.4)+ 0.04]		=	0.84			(27)
Rooflights Type 1			1.5	x1/[1/(1.7) + 0.04]		=	2.55			(27b)
Rooflights Type 2			1.5	x1/[1/(1.7) + 0.04]		=	2.55			(27b)
Floor			35.43	x	0.13	=	4.6059			(28)
Walls	49.99	9.65	40.34	x	0.18	=	7.26			(29)
Roof	36.68	3	33.68	x	0.13	=	4.38			(30)
Total area of elements, m²			122.1							(31)
Party wall			30.25	x	0	=	0			(32)
Party wall			35.75	x	0	=	0			(32)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.55 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12640.77 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 7.15 (36)

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

Total fabric heat loss (33) + (36) = 40.7 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.05	33.82	33.59	32.52	32.32	31.39	31.39	31.21	31.75	32.32	32.73	33.15	(38)

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

(39)m=	74.75	74.52	74.29	73.22	73.02	72.09	72.09	71.91	72.45	73.02	73.43	73.85	

Average = Sum(39)$_{1...12}$ /12= 73.22 (39)

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

(40)m=	1.05	1.05	1.05	1.03	1.03	1.02	1.02	1.01	1.02	1.03	1.04	1.04	

Average = Sum(40)$_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.27 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 88.04 (43)

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

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

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

(44)m=	96.84	93.32	89.8	86.28	82.75	79.23	79.23	82.75	86.28	89.8	93.32	96.84	

Total = Sum(44)$_{1...12}$ = 1056.44 (44)

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

(45)m=	143.61	125.6	129.61	113	108.43	93.56	86.7	99.49	100.68	117.33	128.07	139.08	

Total = Sum(45)$_{1...12}$ = 1385.16 (45)

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

(46)m=	21.54	18.84	19.44	16.95	16.26	14.03	13	14.92	15.1	17.6	19.21	20.86	(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): — 1.22 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.66 (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.66	(55)

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

(56)m=	20.5	18.52	20.5	19.84	20.5	19.84	20.5	20.5	19.84	20.5	19.84	20.5	(56)

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

(57)m=	20.5	18.52	20.5	19.84	20.5	19.84	20.5	20.5	19.84	20.5	19.84	20.5	(57)

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

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

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

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

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

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

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

(62)m=	187.38	165.13	173.38	155.35	152.19	135.91	130.46	143.25	143.03	161.09	170.43	182.84	(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)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	187.38	165.13	173.38	155.35	152.19	135.91	130.46	143.25	143.03	161.09	170.43	182.84	

Output from water heater (annual)$_{1...12}$ 1900.44 (64)

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

(65)m=	82.76	73.39	78.11	71.45	71.06	64.99	63.84	68.09	67.36	74.02	76.47	81.25	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	(66)

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

(67)m=	18.04	16.02	13.03	9.87	7.37	6.23	6.73	8.74	11.74	14.9	17.39	18.54	(67)

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

(68)m=	199.3	201.36	196.15	185.06	171.05	157.89	149.1	147.03	152.24	163.33	177.34	190.5	(68)

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

(69)m=	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	(71)

Water heating gains (Table 5)

(72)m=	111.24	109.2	104.98	99.24	95.51	90.26	85.8	91.52	93.55	99.49	106.2	109.21	(72)

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

(73)m=	388.58	386.59	374.17	354.17	333.94	314.38	301.63	307.29	317.53	337.73	360.94	378.26	(73)

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6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.08	x	10.63	x	0.63	x	0.7	=	6.76	(74)
North	0.9x	0.77	x	2.08	x	10.63	x	0.63	x	0.7	=	6.76	(74)
North	0.9x	0.77	x	2.15	x	10.63	x	0.63	x	0.7	=	6.99	(74)
North	0.9x	0.77	x	0.63	x	10.63	x	0.63	x	0.7	=	2.05	(74)
North	0.9x	0.77	x	0.63	x	10.63	x	0.63	x	0.7	=	2.05	(74)
North	0.9x	0.77	x	2.08	x	20.32	x	0.63	x	0.7	=	12.92	(74)
North	0.9x	0.77	x	2.08	x	20.32	x	0.63	x	0.7	=	12.92	(74)
North	0.9x	0.77	x	2.15	x	20.32	x	0.63	x	0.7	=	13.35	(74)
North	0.9x	0.77	x	0.63	x	20.32	x	0.63	x	0.7	=	3.91	(74)
North	0.9x	0.77	x	0.63	x	20.32	x	0.63	x	0.7	=	3.91	(74)
North	0.9x	0.77	x	2.08	x	34.53	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	2.08	x	34.53	x	0.63	x	0.7	=	21.95	(74)
North	0.9x	0.77	x	2.15	x	34.53	x	0.63	x	0.7	=	22.69	(74)
North	0.9x	0.77	x	0.63	x	34.53	x	0.63	x	0.7	=	6.65	(74)
North	0.9x	0.77	x	0.63	x	34.53	x	0.63	x	0.7	=	6.65	(74)
North	0.9x	0.77	x	2.08	x	55.46	x	0.63	x	0.7	=	35.26	(74)
North	0.9x	0.77	x	2.08	x	55.46	x	0.63	x	0.7	=	35.26	(74)
North	0.9x	0.77	x	2.15	x	55.46	x	0.63	x	0.7	=	36.44	(74)
North	0.9x	0.77	x	0.63	x	55.46	x	0.63	x	0.7	=	10.68	(74)
North	0.9x	0.77	x	0.63	x	55.46	x	0.63	x	0.7	=	10.68	(74)
North	0.9x	0.77	x	2.08	x	74.72	x	0.63	x	0.7	=	47.49	(74)
North	0.9x	0.77	x	2.08	x	74.72	x	0.63	x	0.7	=	47.49	(74)
North	0.9x	0.77	x	2.15	x	74.72	x	0.63	x	0.7	=	49.09	(74)
North	0.9x	0.77	x	0.63	x	74.72	x	0.63	x	0.7	=	14.39	(74)
North	0.9x	0.77	x	0.63	x	74.72	x	0.63	x	0.7	=	14.39	(74)
North	0.9x	0.77	x	2.08	x	79.99	x	0.63	x	0.7	=	50.84	(74)
North	0.9x	0.77	x	2.08	x	79.99	x	0.63	x	0.7	=	50.84	(74)
North	0.9x	0.77	x	2.15	x	79.99	x	0.63	x	0.7	=	52.56	(74)
North	0.9x	0.77	x	0.63	x	79.99	x	0.63	x	0.7	=	15.4	(74)
North	0.9x	0.77	x	0.63	x	79.99	x	0.63	x	0.7	=	15.4	(74)
North	0.9x	0.77	x	2.08	x	74.68	x	0.63	x	0.7	=	47.47	(74)
North	0.9x	0.77	x	2.08	x	74.68	x	0.63	x	0.7	=	47.47	(74)
North	0.9x	0.77	x	2.15	x	74.68	x	0.63	x	0.7	=	49.07	(74)
North	0.9x	0.77	x	0.63	x	74.68	x	0.63	x	0.7	=	14.38	(74)
North	0.9x	0.77	x	0.63	x	74.68	x	0.63	x	0.7	=	14.38	(74)
North	0.9x	0.77	x	2.08	x	59.25	x	0.63	x	0.7	=	37.66	(74)

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North	0.9x	0.77	x	2.08	x	59.25	x	0.63	x	0.7	=	37.66	(74)
North	0.9x	0.77	x	2.15	x	59.25	x	0.63	x	0.7	=	38.93	(74)
North	0.9x	0.77	x	0.63	x	59.25	x	0.63	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	0.63	x	59.25	x	0.63	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	2.08	x	41.52	x	0.63	x	0.7	=	26.39	(74)
North	0.9x	0.77	x	2.08	x	41.52	x	0.63	x	0.7	=	26.39	(74)
North	0.9x	0.77	x	2.15	x	41.52	x	0.63	x	0.7	=	27.28	(74)
North	0.9x	0.77	x	0.63	x	41.52	x	0.63	x	0.7	=	7.99	(74)
North	0.9x	0.77	x	0.63	x	41.52	x	0.63	x	0.7	=	7.99	(74)
North	0.9x	0.77	x	2.08	x	24.19	x	0.63	x	0.7	=	15.38	(74)
North	0.9x	0.77	x	2.08	x	24.19	x	0.63	x	0.7	=	15.38	(74)
North	0.9x	0.77	x	2.15	x	24.19	x	0.63	x	0.7	=	15.89	(74)
North	0.9x	0.77	x	0.63	x	24.19	x	0.63	x	0.7	=	4.66	(74)
North	0.9x	0.77	x	0.63	x	24.19	x	0.63	x	0.7	=	4.66	(74)
North	0.9x	0.77	x	2.08	x	13.12	x	0.63	x	0.7	=	8.34	(74)
North	0.9x	0.77	x	2.08	x	13.12	x	0.63	x	0.7	=	8.34	(74)
North	0.9x	0.77	x	2.15	x	13.12	x	0.63	x	0.7	=	8.62	(74)
North	0.9x	0.77	x	0.63	x	13.12	x	0.63	x	0.7	=	2.53	(74)
North	0.9x	0.77	x	0.63	x	13.12	x	0.63	x	0.7	=	2.53	(74)
North	0.9x	0.77	x	2.08	x	8.86	x	0.63	x	0.7	=	5.63	(74)
North	0.9x	0.77	x	2.08	x	8.86	x	0.63	x	0.7	=	5.63	(74)
North	0.9x	0.77	x	2.15	x	8.86	x	0.63	x	0.7	=	5.82	(74)
North	0.9x	0.77	x	0.63	x	8.86	x	0.63	x	0.7	=	1.71	(74)
North	0.9x	0.77	x	0.63	x	8.86	x	0.63	x	0.7	=	1.71	(74)
Rooflights	0.9x	1	x	1.5	x	19.94	x	0.63	x	0.7	=	11.87	(82)
Rooflights	0.9x	1	x	1.5	x	19.94	x	0.63	x	0.7	=	11.87	(82)
Rooflights	0.9x	1	x	1.5	x	39.83	x	0.63	x	0.7	=	23.71	(82)
Rooflights	0.9x	1	x	1.5	x	39.83	x	0.63	x	0.7	=	23.71	(82)
Rooflights	0.9x	1	x	1.5	x	73.56	x	0.63	x	0.7	=	43.8	(82)
Rooflights	0.9x	1	x	1.5	x	73.56	x	0.63	x	0.7	=	43.8	(82)
Rooflights	0.9x	1	x	1.5	x	128.76	x	0.63	x	0.7	=	76.66	(82)
Rooflights	0.9x	1	x	1.5	x	128.76	x	0.63	x	0.7	=	76.66	(82)
Rooflights	0.9x	1	x	1.5	x	182.65	x	0.63	x	0.7	=	108.74	(82)
Rooflights	0.9x	1	x	1.5	x	182.65	x	0.63	x	0.7	=	108.74	(82)
Rooflights	0.9x	1	x	1.5	x	199.33	x	0.63	x	0.7	=	118.67	(82)
Rooflights	0.9x	1	x	1.5	x	199.33	x	0.63	x	0.7	=	118.67	(82)
Rooflights	0.9x	1	x	1.5	x	184.61	x	0.63	x	0.7	=	109.91	(82)
Rooflights	0.9x	1	x	1.5	x	184.61	x	0.63	x	0.7	=	109.91	(82)
Rooflights	0.9x	1	x	1.5	x	140.92	x	0.63	x	0.7	=	83.9	(82)
Rooflights	0.9x	1	x	1.5	x	140.92	x	0.63	x	0.7	=	83.9	(82)
Rooflights	0.9x	1	x	1.5	x	91.75	x	0.63	x	0.7	=	54.62	(82)

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Rooflights 0.9x	1	x	1.5	x	91.75	x	0.63	x	0.7	=	54.62	(82)
Rooflights 0.9x	1	x	1.5	x	48.83	x	0.63	x	0.7	=	29.07	(82)
Rooflights 0.9x	1	x	1.5	x	48.83	x	0.63	x	0.7	=	29.07	(82)
Rooflights 0.9x	1	x	1.5	x	24.87	x	0.63	x	0.7	=	14.8	(82)
Rooflights 0.9x	1	x	1.5	x	24.87	x	0.63	x	0.7	=	14.8	(82)
Rooflights 0.9x	1	x	1.5	x	16.47	x	0.63	x	0.7	=	9.81	(82)
Rooflights 0.9x	1	x	1.5	x	16.47	x	0.63	x	0.7	=	9.81	(82)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	48.34	94.44	167.48	281.63	390.34	422.39	392.58	304.87	205.29	114.1	59.96	40.12	(83)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	436.92	481.04	541.64	635.8	724.28	736.77	694.21	612.16	522.82	451.83	420.89	418.38	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.82	0.61	0.45	0.53	0.83	0.98	1	1	(86)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.9	20.03	20.27	20.62	20.88	20.98	21	20.99	20.91	20.57	20.19	19.89	(87)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.04	20.04	20.04	20.06	20.06	20.07	20.07	20.07	20.06	20.06	20.05	20.05	(88)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	1	0.99	0.98	0.93	0.77	0.53	0.36	0.43	0.76	0.96	0.99	1	(89)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.57	18.76	19.11	19.61	19.95	20.06	20.07	20.07	19.99	19.55	19	18.56	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	19.16	19.31	19.61	20.05	20.36	20.46	20.47	20.47	20.39	20	19.52	19.14	(92)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	19.16	19.31	19.61	20.05	20.36	20.46	20.47	20.47	20.39	20	19.52	19.14	(93)

8. Space heating requirement

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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	1	0.99	0.98	0.93	0.78	0.56	0.4	0.47	0.78	0.96	0.99	1	(94)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	435.17	477.55	531.4	591.25	567.18	414.1	278.22	290.34	409.59	435.18	417.56	417.05	(95)

Monthly average external temperature from Table 8

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	1110.53	1073.98	974.32	816.37	632.07	422.56	279.29	292.89	455.89	686.14	911.72	1103.25	(97)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	502.47	400.8	329.53	162.09	48.28	0	0	0	0	186.72	355.79	510.53	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2496.2	(98)
Space heating requirement in kWh/m²/year	35.23	(99)

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

Space heating:

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	502.47	400.8	329.53	162.09	48.28	0	0	0	0	186.72	355.79	510.53	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	537.4	428.66	352.44	173.36	51.64	0	0	0	0	199.7	380.53	546.02	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2669.74 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	187.38	165.13	173.38	155.35	152.19	135.91	130.46	143.25	143.03	161.09	170.43	182.84

Efficiency of water heater 79.8 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	87.32	87.09	86.5	84.93	82.14	79.8	79.8	79.8	79.8	85.21	86.73	87.41

(217)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	214.58	189.61	200.43	182.92	185.28	170.32	163.49	179.51	179.23	189.06	196.49	209.18

Total = Sum(219a)$_{1...12}$ = 2260.11 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2669.74
Water heating fuel used		2260.11
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		318.59 (232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	576.66 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	488.18	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1064.85	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	165.35	(268)
Total CO2, kg/year	sum of (265)…(271) =			1269.12	(272)

TER = 26.18 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 29 October 2020

Property Details: UNIT 4

Dwelling type:	Mid-terrace House
Located in:	England
Region:	Thames valley
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	224.48	**(P1)**
Transmission heat loss coefficient:	41.8	
Summer heat loss coefficient:	266.31	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North (W1)	0	1
North (W2)	0	1
North (W3)	0	1
North (W4)	0	1
North (W5)	0	1
North (RL1)	0	1
North (RL2)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North (W1)	1	0.9	1	0.9	**(P8)**
North (W2)	1	0.9	1	0.9	**(P8)**
North (W3)	1	0.9	1	0.9	**(P8)**
North (W4)	1	0.9	1	0.9	**(P8)**
North (W5)	1	0.9	1	0.9	**(P8)**
North (RL1)	1	1	1	1	**(P8)**
North (RL2)	1	1	1	1	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North (W1)	0.9 x	2.08	81.19	0.76	0.7	0.9	72.77	
North (W2)	0.9 x	2.08	81.19	0.76	0.7	0.9	72.77	
North (W3)	0.9 x	2.15	81.19	0.76	0.7	0.9	75.22	
North (W4)	0.9 x	0.63	81.19	0.76	0.7	0.9	22.04	
North (W5)	0.9 x	0.63	81.19	0.76	0.7	0.9	22.04	
	1 x	1.5	202.32	0.76	0.7	1	145.31	
	1 x	1.5	202.32	0.76	0.7	1	145.31	
						Total	555.45	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	440.59	424.26	431.93	
Total summer gains	1043.85	979.71	875.24	**(P5)**

SAP 2012 Overheating Assessment

Summer gain/loss ratio	3.92	3.68	3.29	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	20.17	21.83	21.34	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight