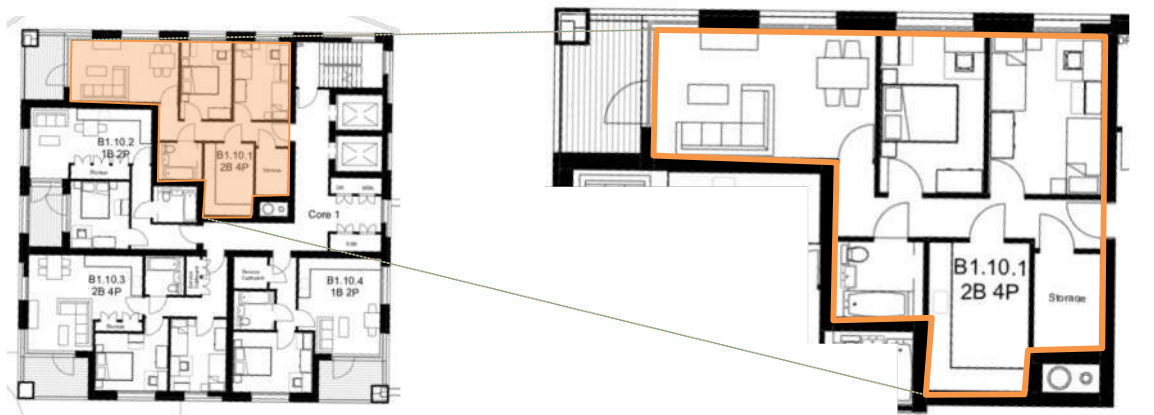


Block B – Apartment 1 (B1.10.1)

UNIT MODELLED

- 2 bedroom
- Block B
- 10th Floor



SPECIFIC ASSUMPTIONS

VENTILATION RATES ASSUMED

Infiltration rate

3 m³/h/m² at 50 Pa

approximately
equivalent to

0.25 ACH

Mechanical ventilation

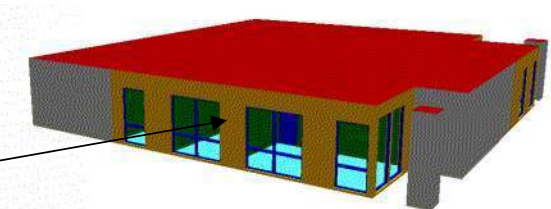
MVHR
Ventilation
Rate

50 l/s

Window opening schedule

Windows

Top pane of all windows
assumed to be 80%
openable free area
24/7



Patio Doors

Patio windows assumed
to be 100% openable
free area
24/7

A reduction factor is applied to the openable area when blinds are assumed in the calculations

TM59 ASSESSMENT OF OVERHEATING IN HOMES – RESULTS

CURRENT CLIMATE WEATHER DATA – TM59 LHR FUTURE WEATHER

Block B: Apt 1 - CIBSE TM59 Criteria**			
	Criterion 1 (without blinds)	Criterion 1 (with blinds)	Compliance Achieved*
TM 59 LHR 1989 Weather Data – Moderately Warm Summer (DSY 1)			
Living Room	53 / 55	29 / 55	PASS
Bedroom 1	16 / 110	9 / 110	PASS
Bedroom 2	43 / 110	21 / 110	PASS
TM 59 LHR 2003 Weather Data – Intense Warm Spell (DSY 2)			
Living Room	109 / 55	86 / 55	FAIL
Bedroom 1	57 / 110	31 / 110	PASS
Bedroom 2	100 / 110	64 / 110	PASS
TM 59 LHR 1976 Weather Data – Sustained Warm Period (DSY 3)			
Living Room	164 / 55	132 / 55	FAIL
Bedroom 1	89 / 110	51 / 110	PASS
Bedroom 2	150 / 110	107 / 110	PASS

**Note the kitchen has been omitted from the analysis as it is not located on a perimeter wall.

CIBSE TM59 Overheating Results – 1989 (London DSY)



Bedroom Comfort During Sleeping Hours			
	Number of hours above 26 °C	Percentage of hours above 26 °C	Compliance Achieved
TM 59 LHR 1989 Weather Data – Moderately Warm Summer*			
Bedroom 1	10 / 3285	0.30%	PASS
Bedroom 2	5 / 3285	0.15%	PASS

*These results reflect the design with blinds incorporated.

Best Practice

The overheating results shown on this page demonstrate how the scheme is likely to perform considering the impacts of Climate Change.

Compliance with the DSY 1 future weather file is seen as achieving good practice design using the current overheating methodology. The other two weather files, DSY 2 and DSY 3, show how the development is likely to perform considering more extreme conditions, but it is not required for the development to comply under these conditions.

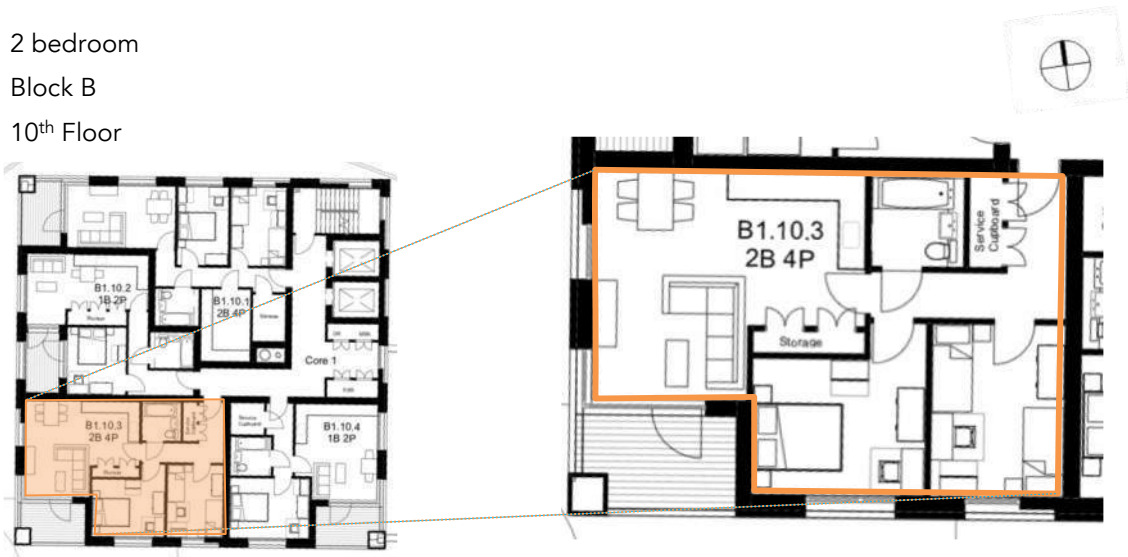
Key

- Passes without blinds
- Passes with blinds
- Fails with or without blinds

Block B – Apartment 2 (B1.10.3)

UNIT MODELLED

- 2 bedroom
- Block B
- 10th Floor



SPECIFIC ASSUMPTIONS

VENTILATION RATES ASSUMED

Infiltration rate

3 m³/h/m² at 50 Pa

approximately
equivalent to

0.25 ACH

Mechanical ventilation

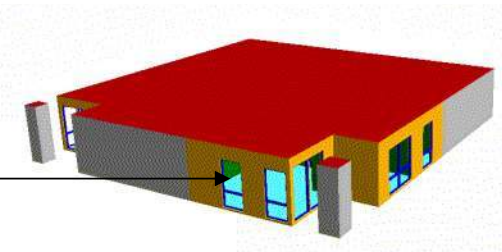
MVHR
Ventilation
Rate

50 l/s

Window opening schedule

Windows

Top pane of all windows
assumed to be 80%
openable free area
24/7



Patio Doors

Patio windows assumed
to be 100% openable
free area
24/7

TM59 ASSESSMENT OF OVERHEATING IN HOMES – RESULTS

CURRENT CLIMATE WEATHER DATA – TM59 LHR FUTURE WEATHER

Block B: Apt 2 - CIBSE TM59 Criteria			
	Criterion 1 (without blinds)	Criterion 1 (with blinds)	Compliance Achieved*
TM 59 LHR 1989 Weather Data – Moderately Warm Summer (DSY 1)			
Kitchen / Living Room	33 / 55	17 / 55	PASS
Bedroom 1	103 / 110	41 / 110	PASS
Bedroom 2	37 / 110	14 / 110	PASS
TM 59 LHR 2003 Weather Data – Intense Warm Spell (DSY 2)			
Kitchen / Living Room	71 / 55	51 / 55	FAIL
Bedroom 1	162 / 110	101 / 110	PASS
Bedroom 2	107 / 110	61 / 110	PASS
TM 59 LHR 1976 Weather Data – Sustained Warm Period (DSY 3)			
Kitchen / Living Room	110 / 55	87 / 55	FAIL
Bedroom 1	228 / 110	155 / 110	FAIL
Bedroom 2	170 / 110	99 / 110	PASS

Bedroom Comfort During Sleeping Hours			
	Number of hours above 26 °C	Percentage of hours above 26 °C	Compliance Achieved
TM 59 LHR 1989 Weather Data – Moderately Warm Summer*			
Bedroom 1	10 / 3285	0.30%	PASS
Bedroom 2	13 / 3285	0.40%	PASS

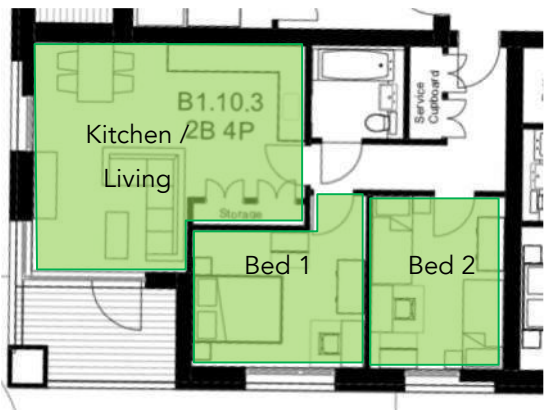
*These results reflect the design with blinds incorporated.

Best Practice

The overheating results shown on this page demonstrate how the scheme is likely to perform considering the impacts of Climate Change.

Compliance with the DSY 1 future weather file is seen as achieving good practice design using the current overheating methodology. The other two weather files, DSY 2 and DSY 3, show how the development is likely to perform considering more extreme conditions, but it is not required for the development to comply under these conditions.

CIBSE TM59 Overheating Results – 1989 (London DSY)



Key

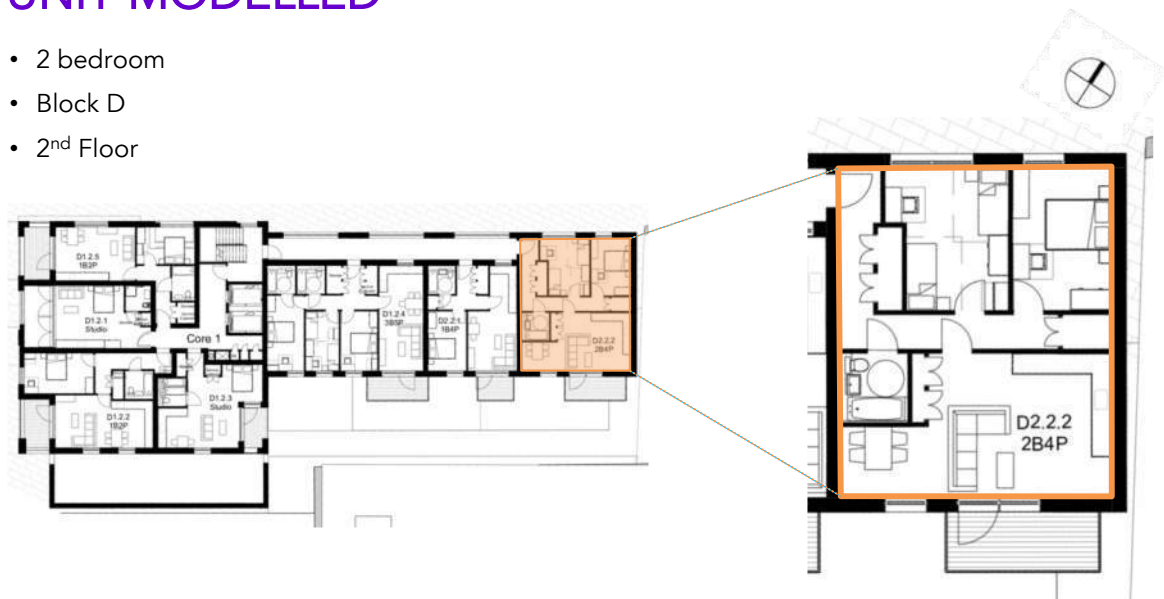
Green box	Passes without blinds
Yellow box	Passes with blinds
Red box	Fails with or without blinds

A reduction factor is applied to the openable area when blinds are assumed in the calculations

Block D – Apartment 3 (D2.2.2)

UNIT MODELLED

- 2 bedroom
- Block D
- 2nd Floor



SPECIFIC ASSUMPTIONS

VENTILATION RATES ASSUMED

Infiltration rate

3 m³/h/m² at 50 Pa

approximately
equivalent to

0.25 ACH

Mechanical ventilation

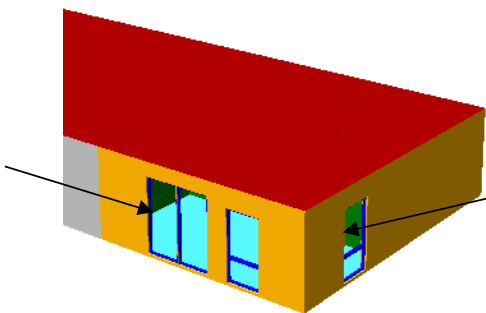
MVHR
Ventilation
Rate

50 l/s

Window opening schedule

Patio Doors

Patio windows assumed
to be 100% openable
free area
24/7



Windows

Top pane of all windows
assumed to be 80%
openable free area
24/7

TM59 ASSESSMENT OF OVERHEATING IN HOMES – RESULTS

CURRENT CLIMATE WEATHER DATA – TM59 LHR FUTURE WEATHER

Block D: Apt 3 - CIBSE TM59 Criteria			
	Criterion 1 (without blinds)	Criterion 1 (with blinds)	Compliance Achieved*
TM 59 LHR 1989 Weather Data – Moderately Warm Summer (DSY 1)			
Kitchen / Living Room	28 / 55	14 / 55	PASS
Bedroom 1	25 / 110	12 / 110	PASS
Bedroom 2	7 / 110	0 / 110	PASS
TM 59 LHR 2003 Weather Data – Intense Warm Spell (DSY 2)			
Kitchen / Living Room	96 / 55	48 / 55	FAIL
Bedroom 1	69 / 110	33 / 110	PASS
Bedroom 2	28 / 110	6 / 110	PASS
TM 59 LHR 1976 Weather Data – Sustained Warm Period (DSY 3)			
Kitchen / Living Room	141 / 55	76 / 55	FAIL
Bedroom 1	103 / 110	50 / 110	PASS
Bedroom 2	35 / 110	12 / 110	PASS

Bedroom Comfort During Sleeping Hours

	Number of hours above 26 °C	Percentage of hours above 26 °C	Compliance Achieved
TM 59 LHR 1989 Weather Data – Moderately Warm Summer*			
Bedroom 1	4 / 3285	0.12%	PASS
Bedroom 2	4 / 3285	0.12%	PASS

*These results reflect the design with blinds incorporated.

Best Practice

The overheating results shown on this page demonstrate how the scheme is likely to perform considering the impacts of Climate Change.

Compliance with the DSY 1 future weather file is seen as achieving good practice design using the current overheating methodology. The other two weather files, DSY 2 and DSY 3, show how the development is likely to perform considering more extreme conditions, but it is not required for the development to comply under these conditions.

CIBSE TM59 Overheating Results – 1989 (London DSY)



Key

	Passes without blinds
	Passes with blinds
	Fails with or without blinds

A reduction factor is applied to the openable area when blinds are assumed in the calculations

Block E – Apartment 4 (E2.5.10)

UNIT MODELLED

- 2 bedroom
- Block E
- 5th Floor



SPECIFIC ASSUMPTIONS

VENTILATION RATES ASSUMED

Infiltration rate

3 m³/h/m² at 50 Pa

approximately
equivalent to

0.25 ACH

Mechanical ventilation

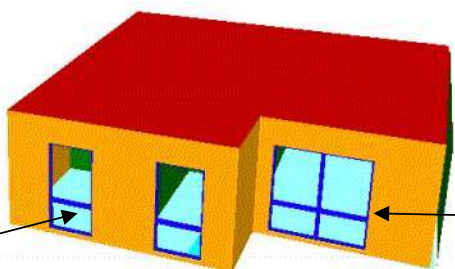
MVHR
Ventilation
Rate

50 l/s

Window opening schedule

Windows

Top pane of all windows
assumed to be 80%
openable free area
24/7



Patio Doors

Patio windows assumed
to be 100% openable
free area
24/7

A reduction factor is applied to the openable area when blinds are assumed in the calculations

TM59 ASSESSMENT OF OVERHEATING IN HOMES – RESULTS

CURRENT CLIMATE WEATHER DATA – TM59 LHR FUTURE WEATHER

Block E: Apt 4 - CIBSE TM59 Criteria			
	Criterion 1 (without blinds)	Criterion 1 (with blinds)	Compliance Achieved*
TM 59 LHR 1989 Weather Data – Moderately Warm Summer (DSY 1)			
Kitchen / Living Room	77 / 55	39 / 55	PASS
Bedroom 1	60 / 110	13 / 110	PASS
Bedroom 2	141 / 110	30 / 110	PASS
TM 59 LHR 2003 Weather Data – Intense Warm Spell (DSY 2)			
Kitchen / Living Room	148 / 55	97 / 55	FAIL
Bedroom 1	121 / 110	87 / 110	PASS
Bedroom 2	184 / 110	127 / 110	FAIL
TM 59 LHR 1976 Weather Data – Sustained Warm Period (DSY 3)			
Kitchen / Living Room	199 / 55	134 / 55	FAIL
Bedroom 1	164 / 110	116 / 110	FAIL
Bedroom 2	233 / 110	169 / 110	FAIL

Bedroom Comfort During Sleeping Hours			
	Number of hours above 26 °C	Percentage of hours above 26 °C	Compliance Achieved*
TM 59 LHR 1989 Weather Data – Moderately Warm Summer*			
Bedroom 1	24 / 3285	0.73%	PASS
Bedroom 2	20 / 3285	0.61%	PASS

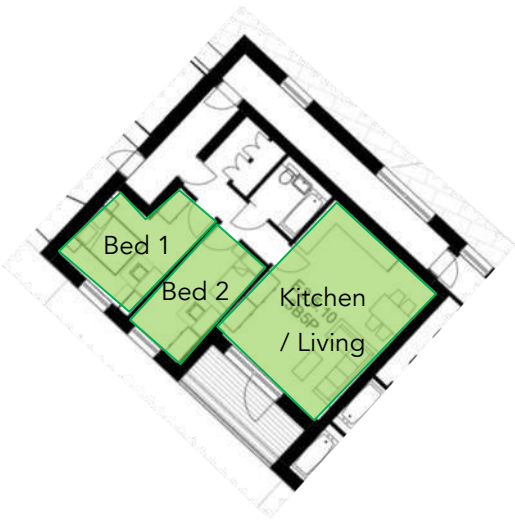
*These results reflect the design with blinds incorporated.

Best Practice

The overheating results shown on this page demonstrate how the scheme is likely to perform considering the impacts of Climate Change.

Compliance with the DSY 1 future weather file is seen as achieving good practice design using the current overheating methodology. The other two weather files, DSY 2 and DSY 3, show how the development is likely to perform considering more extreme conditions, but it is not required for the development to comply under these conditions.

CIBSE TM59 Overheating Results – 1989 (London DSY)



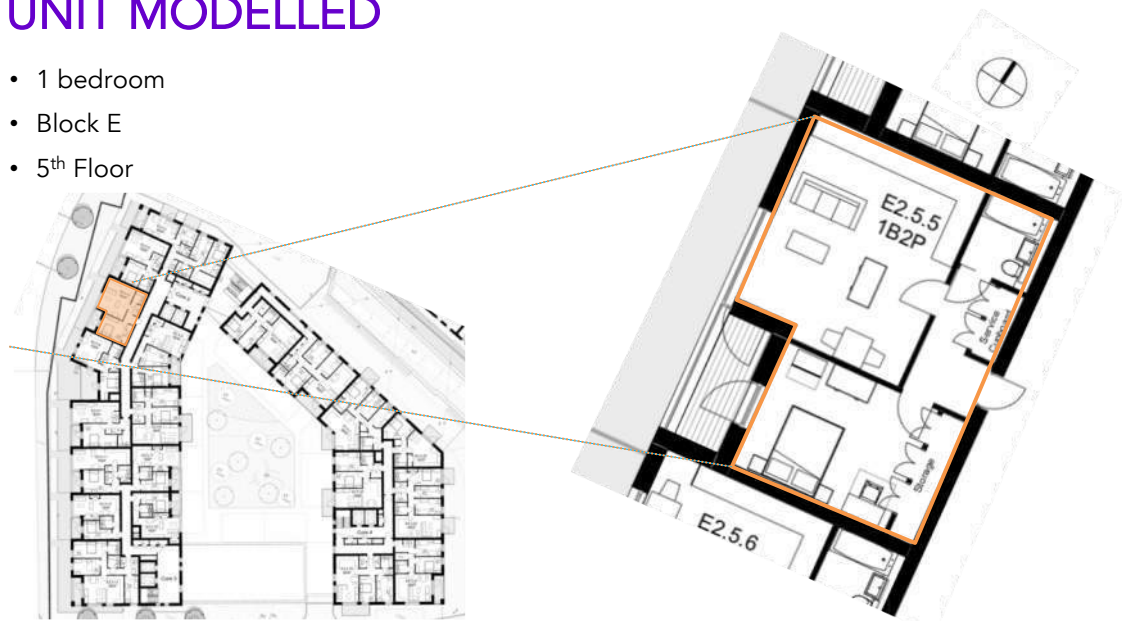
Key

Green box	Passes without blinds
Yellow box	Passes with blinds
Red box	Fails with or without blinds

Block E – Apartment 5 (E2.5.5)

UNIT MODELLED

- 1 bedroom
- Block E
- 5th Floor



SPECIFIC ASSUMPTIONS

VENTILATION RATES ASSUMED

Infiltration rate

3 m³/h/m² at 50 Pa

approximately
equivalent to

0.25 ACH

Mechanical ventilation

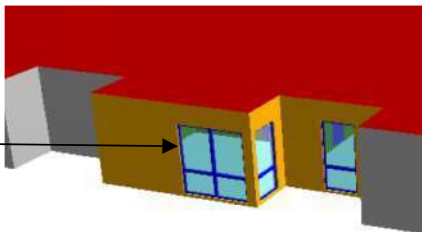
MVHR
Ventilation
Rate

50 l/s

Window opening schedule

Windows

Top pane of all windows
assumed to be 80%
openable free area
24/7



Patio Doors

Patio windows assumed
to be 100% openable
free area
24/7

A reduction factor is applied to the openable area when blinds are assumed in the calculations

TM59 ASSESSMENT OF OVERHEATING IN HOMES – RESULTS

CURRENT CLIMATE WEATHER DATA – TM59 LHR FUTURE WEATHER

Block E: Apt 5 - CIBSE TM59 Criteria			
	Criterion 1 (without blinds)	Criterion 1 (with blinds)	Compliance Achieved*
TM 59 LHR 1989 Weather Data – Moderately Warm Summer (DSY 1)			
Kitchen / Living Room	32 / 55	17 / 55	PASS
Bedroom 1	13 / 110	3 / 110	PASS
TM 59 LHR 2003 Weather Data – Intense Warm Spell (DSY 2)			
Kitchen / Living Room	92 / 55	17 / 55	PASS
Bedroom 1	39 / 110	54 / 110	PASS
TM 59 LHR 1976 Weather Data – Sustained Warm Period (DSY 3)			
Kitchen / Living Room	150 / 55	100 / 55	FAIL
Bedroom 1	81 / 110	31 / 110	PASS

Bedroom Comfort During Sleeping Hours			
	Number of hours above 26 °C	Percentage of hours above 26 °C	Compliance Achieved
TM 59 LHR 1989 Weather Data – Moderately Warm Summer*			
Bedroom 1	10 / 3285	0.30%	PASS

*These results reflect the design with blinds incorporated.

Best Practice

The overheating results shown on this page demonstrate how the scheme is likely to perform considering the impacts of Climate Change.

Compliance with the DSY 1 future weather file is seen as achieving good practice design using the current overheating methodology. The other two weather files, DSY 2 and DSY 3, show how the development is likely to perform considering more extreme conditions, but it is not required for the development to comply under these conditions.

CIBSE TM59 Overheating Results – 1989 (London DSY)



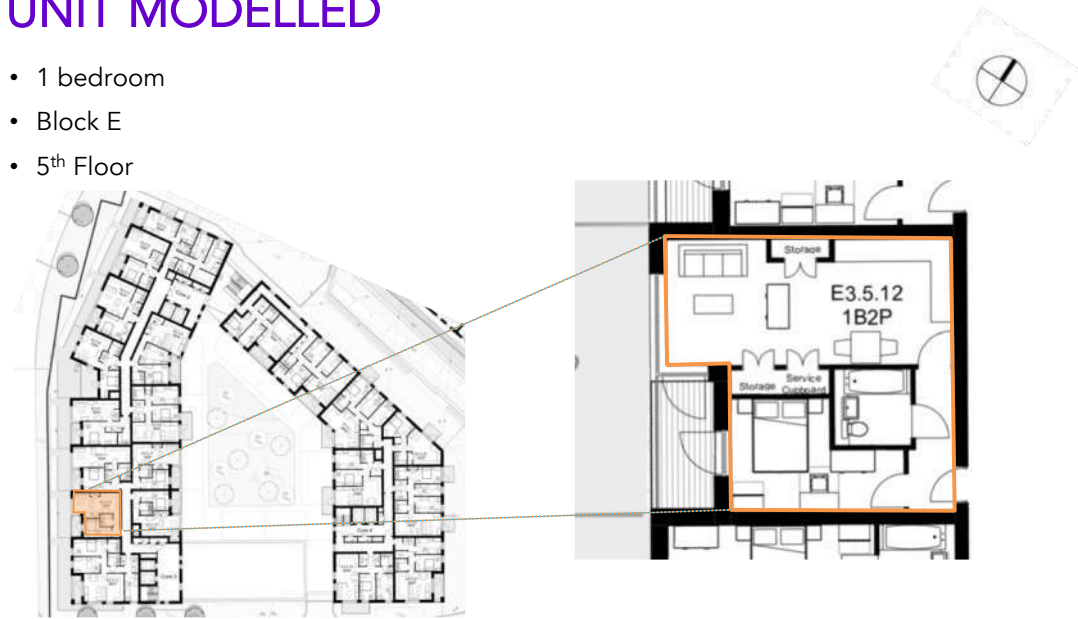
Key

Green box	Passes without blinds
Yellow box	Passes with blinds
Red box	Fails with or without blinds

Block E – Apartment 6 (E3.5.12)

UNIT MODELLED

- 1 bedroom
- Block E
- 5th Floor



SPECIFIC ASSUMPTIONS

VENTILATION RATES ASSUMED

Infiltration rate

3 m³/h/m² at 50 Pa

approximately
equivalent to

0.25 ACH

Mechanical ventilation

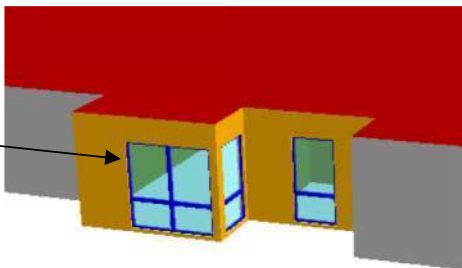
MVHR
Ventilation
Rate

50 l/s

Window opening schedule

Windows

Top pane of all windows
assumed to be 80%
openable free area
24/7



Patio Doors

Patio windows assumed
to be 100% openable
free area
24/7

TM59 ASSESSMENT OF OVERHEATING IN HOMES – RESULTS

CURRENT CLIMATE WEATHER DATA – TM59 LHR FUTURE WEATHER

Block E: Apt 6 - CIBSE TM59 Criteria			
	Criterion 1 (without blinds)	Criterion 1 (with blinds)	Compliance Achieved*
TM 59 LHR 1989 Weather Data – Moderately Warm Summer (DSY 1)			
Kitchen / Living Room	35 / 55	17 / 55	PASS
Bedroom 1	33 / 110	14 / 110	PASS
TM 59 LHR 2003 Weather Data – Intense Warm Spell (DSY 2)			
Kitchen / Living Room	91 / 55	52 / 55	PASS
Bedroom 1	84 / 110	44 / 110	PASS
TM 59 LHR 1976 Weather Data – Sustained Warm Period (DSY 3)			
Kitchen / Living Room	138 / 55	89 / 55	FAIL
Bedroom 1	136 / 110	74 / 110	PASS

Bedroom Comfort During Sleeping Hours			
	Number of hours above 26 °C	Percentage of hours above 26 °C	Compliance Achieved
TM 59 LHR 1989 Weather Data – Moderately Warm Summer*			
Bedroom 1	11 / 3285	0.33%	PASS

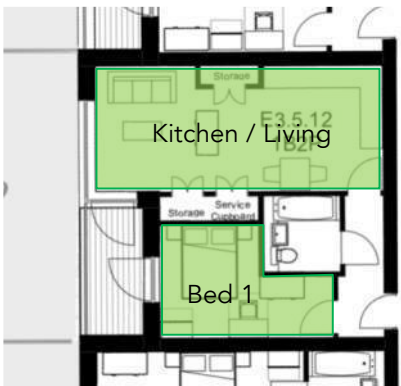
*These results reflect the design with blinds incorporated.

Best Practice

The overheating results shown on this page demonstrate how the scheme is likely to perform considering the impacts of Climate Change.

Compliance with the DSY 1 future weather file is seen as achieving good practice design using the current overheating methodology. The other two weather files, DSY 2 and DSY 3, show how the development is likely to perform considering more extreme conditions, but it is not required for the development to comply under these conditions.

CIBSE TM59 Overheating Results – 1989 (London DSY)



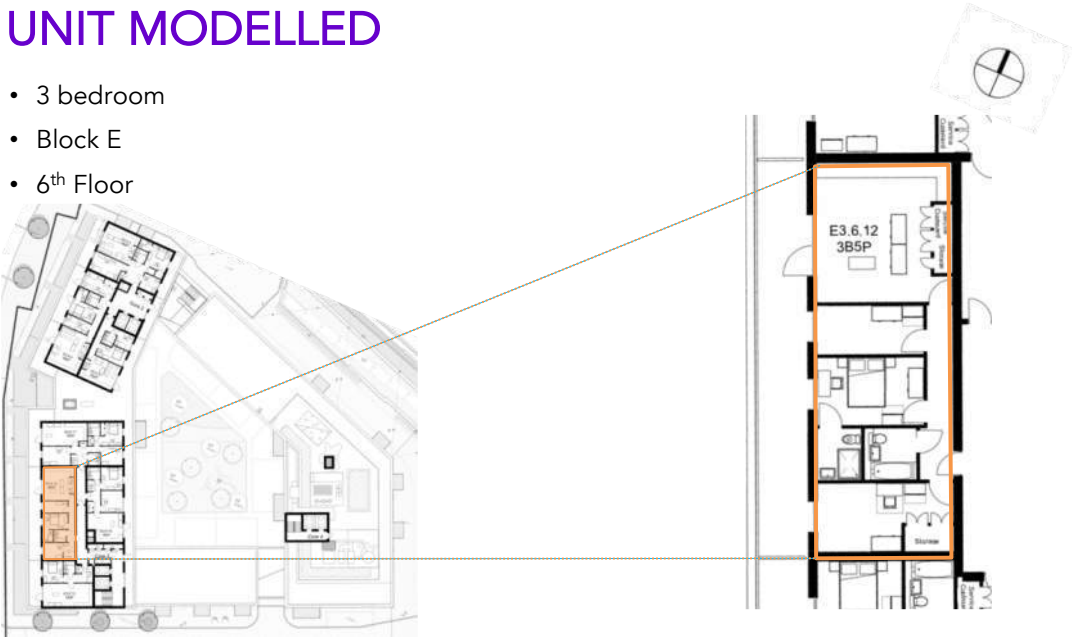
Key

	Passes without blinds
	Passes with blinds
	Fails with or without blinds

Block E – Apartment 7 (E3.6.12)

UNIT MODELLED

- 3 bedroom
- Block E
- 6th Floor



SPECIFIC ASSUMPTIONS

VENTILATION RATES ASSUMED

Infiltration rate

3 m³/h/m² at 50 Pa

approximately equivalent to

0.25 ACH

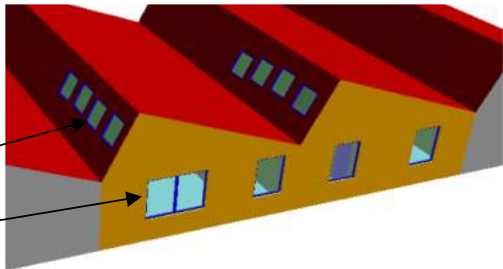
Mechanical ventilation

MVHR Ventilation Rate

50 l/s

Window opening schedule

Windows + Rooflights
80% openable free area
24/7



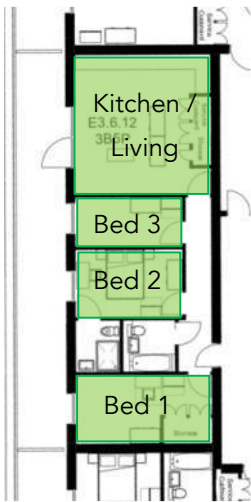
A reduction factor is applied to the openable area when blinds are assumed in the calculations

TM59 ASSESSMENT OF OVERHEATING IN HOMES – RESULTS

CURRENT CLIMATE WEATHER DATA – TM59 LHR FUTURE WEATHER

Block E: Apt 7 - CIBSE TM59 Criteria			
	Criterion 1 (without blinds)	Criterion 1 (with blinds)	Compliance Achieved*
TM 59 LHR 1989 Weather Data – Moderately Warm Summer (DSY 1)			
Kitchen / Living Room	34 / 55	19 / 55	PASS
Bedroom 1	21 / 110	15 / 110	PASS
Bedroom 2	43 / 110	24 / 110	PASS
Bedroom 3	61 / 110	25 / 110	PASS
TM 59 LHR 2003 Weather Data – Intense Warm Spell (DSY 2)			
Kitchen / Living Room	85 / 55	62 / 55	FAIL
Bedroom 1	59 / 110	36 / 110	PASS
Bedroom 2	96 / 110	67 / 110	PASS
Bedroom 3	113 / 110	79 / 110	PASS
TM 59 LHR 1976 Weather Data – Sustained Warm Period (DSY 3)			
Kitchen / Living Room	136 / 55	93 / 55	FAIL
Bedroom 1	98 / 110	60 / 110	PASS
Bedroom 2	152 / 110	108 / 110	PASS
Bedroom 3	176 / 110	129 / 110	FAIL

CIBSE TM59 Overheating Results – 1989 (London DSY)



Bedroom Comfort During Sleeping Hours			
	Number of hours above 26 °C	Percentage of hours above 26 °C	Compliance Achieved*
TM 59 LHR 1989 Weather Data – Moderately Warm Summer*			
Bedroom 1	9 / 3285	0.27%	PASS
Bedroom 2	2 / 3285	0.06%	PASS
Bedroom 3	6 / 3285	0.18%	PASS

*These results reflect the design with blinds incorporated.

Best Practice

The overheating results shown on this page demonstrate how the scheme is likely to perform considering the impacts of Climate Change.

Compliance with the DSY 1 future weather file is seen as achieving good practice design using the current overheating methodology. The other two weather files, DSY 2 and DSY 3, show how the development is likely to perform considering more extreme conditions, but it is not required for the development to comply under these conditions.

Key

- Passes without blinds
- Passes with blinds
- Fails with or without blinds

Summary

As part of the TM 59 adaptive comfort overheating analysis undertaken using the current methodology for the assessment of overheating in homes, all habitable rooms tested comply with the the following two criteria:

Criterion 1: Hours of Exceedance (H_e)

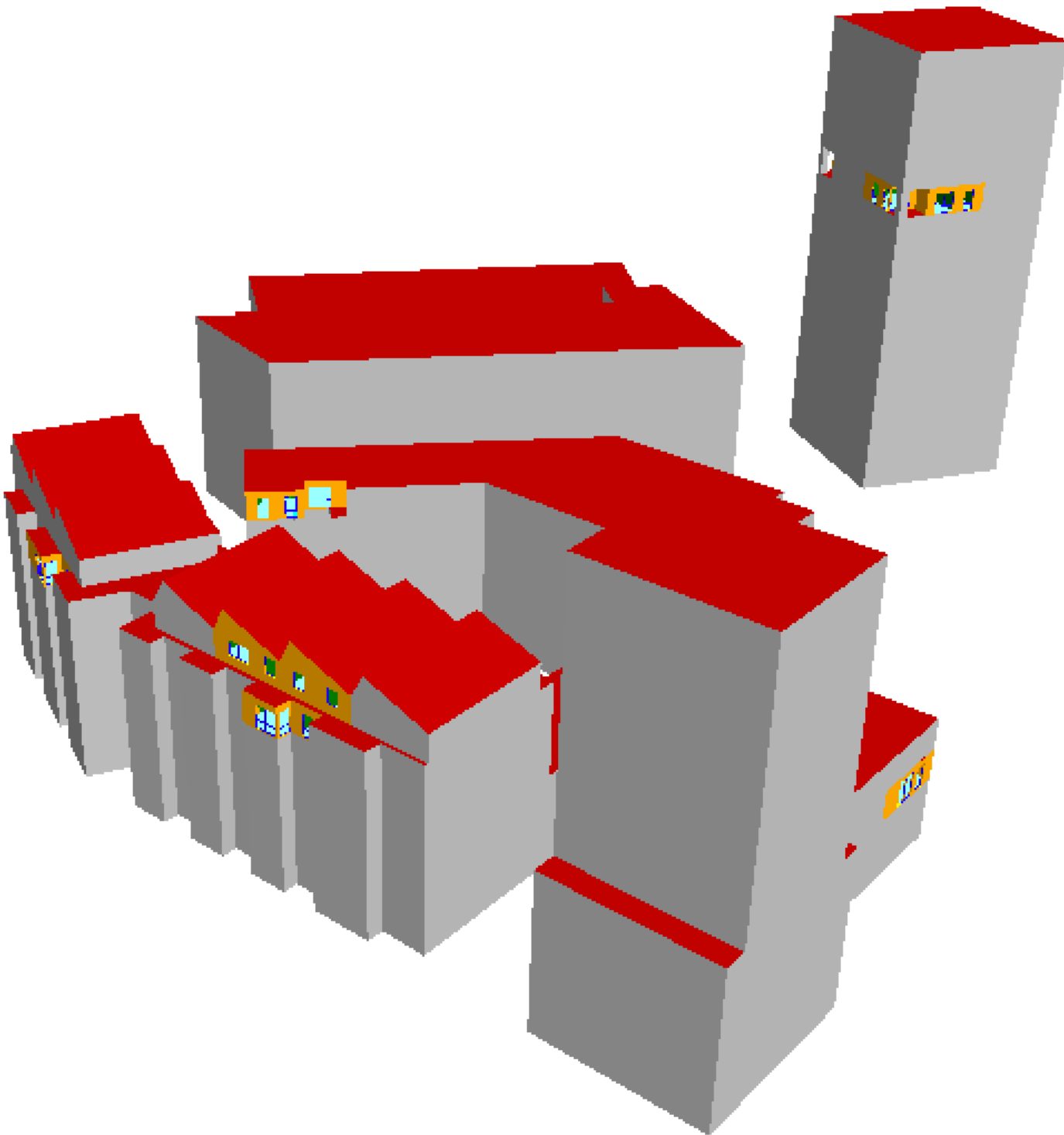
The number of hours (H_e) during which the internal temperature exceeds the TM59 limiting temperature by one degree ($^{\circ}\text{C}$) or more during May to September inclusive must not be greater than 3% of occupied hours.

Criterion 2: Comfort during the sleeping hours

The resultant temperature in the bedroom from 10pm to 7am cannot exceed 26°C for more than 1% of hours. (1% of hours between 2200-0700 for bedrooms is 32 hours)

Only a single living/kitchen space does not pass the overheating assessment without the incorporation of internal blinds, however when blinds are assumed in the model, this space passed the assessment.

It is important to note that for habitable rooms which pass the criterion 1 of TM59 with blinds, that the design of these rooms incorporate them. This is to ensure that occupants have suitable means to reduce the risk of overheating during summer months.



3D Image of Tas thermal model for the Chocolate Factory

PART L1A 2013 SAP WORKSHEETS (BE LEAN)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: B1-14-1

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.9 (1a) x	2.8 (2a) =	184.52 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.9 (4)		
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		184.52 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
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			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]x(8), otherwise (18) = (16)			0.15 (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) =		0.13 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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

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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m= 0.28 0.28 0.27 0.26 0.25 0.24 0.24 0.24 0.24 0.25 0.26 0.27 (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.28 0.28 0.27 0.26 0.25 0.24 0.24 0.24 0.24 0.25 0.26 0.27 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Windows Type 1			3.12	x1/[1/(1.4)+0.04] =	4.14		(27)
Windows Type 2			3.12	x1/[1/(1.4)+0.04] =	4.14		(27)
Windows Type 3			6.5	x1/[1/(1.4)+0.04] =	8.62		(27)
Windows Type 4			3.12	x1/[1/(1.4)+0.04] =	4.14		(27)
Windows Type 5			6.5	x1/[1/(1.4)+0.04] =	8.62		(27)
Walls Type1	34.2	15.86	18.34	x 0.2 =	3.67		(29)
Walls Type2	10.6	6.5	4.1	x 0.2 =	0.82		(29)
Total area of elements, m ²			44.8				(31)
Party wall			29.4	x 0 =	0		(32)
Party wall			63	x 0 =	0		(32)
Party floor			74.3				(32a)
Party ceiling			74.3				(32b)
Internal wall **			50.4				(32c)

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

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

Fabric heat loss, W/K = S (A x u) (26)...(30) + (32) = 34.13 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 18705 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 6.87 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	17.05	16.86	16.67	15.69	15.5	14.53	14.53	14.34	14.92	15.5	15.89	16.28	

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

(39)m=	58.05	57.86	57.67	56.7	56.5	55.53	55.53	55.34	55.92	56.5	56.89	57.28	
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Heat loss parameter (HLP), W/m²K Average = Sum(39)_{1...12} /12= 56.65 (39)

(40)m = (39)m ÷ (4) (40)

(40)m=	0.88	0.88	0.88	0.86	0.86	0.84	0.84	0.84	0.85	0.86	0.86	0.87	
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Average = Sum(40)_{1...12} /12= 0.86 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.14 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.09 (43)

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

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

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

(44)m=	93.6	90.19	86.79	83.39	79.98	76.58	76.58	79.98	83.39	86.79	90.19	93.6	
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	--

Total = Sum(44)_{1...12} = 1021.05 (44)

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

(45)m=	138.8	121.4	125.27	109.21	104.79	90.43	83.79	96.16	97.3	113.4	123.78	134.42	
--------	-------	-------	--------	--------	--------	-------	-------	-------	------	-------	--------	--------	--

Total = Sum(45)_{1...12} = 1338.76 (45)

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

(46)m=	20.82	18.21	18.79	16.38	15.72	13.56	12.57	14.42	14.6	17.01	18.57	20.16	
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	--

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	47.7	41.51	44.23	41.12	40.76	37.76	39.02	40.76	41.12	44.23	44.48	47.7	
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	--

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

(62)m=	186.5	162.91	169.5	150.33	145.55	128.19	122.82	136.91	138.43	157.63	168.26	182.12	
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

Output from water heater

(64)m=	186.5	162.91	169.5	150.33	145.55	128.19	122.82	136.91	138.43	157.63	168.26	182.12	
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Output from water heater (annual)_{1...12} 1849.14 (64)

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

(65)m=	58.08	50.74	52.71	46.59	45.03	39.51	37.62	42.16	42.63	48.76	52.28	56.62	
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	

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

(67)m=	16.72	14.85	12.08	9.14	6.83	5.77	6.23	8.1	10.88	13.81	16.12	17.18	
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	187.55	189.49	184.59	174.15	160.97	148.58	140.31	138.36	143.26	153.7	166.88	179.27	
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	
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Pumps and fans gains (Table 5a)

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

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

(71)m=	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	
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Water heating gains (Table 5)

(72)m=	78.06	75.51	70.85	64.71	60.53	54.87	50.56	56.67	59.21	65.54	72.61	76.1	
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.46	337.99	325.65	306.14	286.47	267.36	255.24	261.27	271.5	291.2	313.75	330.7	
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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.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor		Area		Flux		g_		FF		Gains
	Table 6d		m²		Table 6a		Table 6b		Table 6c		(W)
North	0.9x	0.77	x	3.12	x	10.63	x	0.6	x	0.8	= 11.04 (74)
North	0.9x	0.77	x	3.12	x	10.63	x	0.6	x	0.8	= 11.04 (74)
North	0.9x	0.77	x	6.5	x	10.63	x	0.6	x	0.8	= 22.99 (74)
North	0.9x	0.77	x	3.12	x	10.63	x	0.6	x	0.8	= 11.04 (74)
North	0.9x	0.77	x	3.12	x	20.32	x	0.6	x	0.8	= 21.09 (74)
North	0.9x	0.77	x	3.12	x	20.32	x	0.6	x	0.8	= 21.09 (74)
North	0.9x	0.77	x	6.5	x	20.32	x	0.6	x	0.8	= 43.94 (74)
North	0.9x	0.77	x	3.12	x	20.32	x	0.6	x	0.8	= 21.09 (74)
North	0.9x	0.77	x	3.12	x	34.53	x	0.6	x	0.8	= 35.84 (74)
North	0.9x	0.77	x	3.12	x	34.53	x	0.6	x	0.8	= 35.84 (74)
North	0.9x	0.77	x	6.5	x	34.53	x	0.6	x	0.8	= 74.66 (74)
North	0.9x	0.77	x	3.12	x	34.53	x	0.6	x	0.8	= 35.84 (74)
North	0.9x	0.77	x	3.12	x	55.46	x	0.6	x	0.8	= 57.56 (74)
North	0.9x	0.77	x	3.12	x	55.46	x	0.6	x	0.8	= 57.56 (74)
North	0.9x	0.77	x	6.5	x	55.46	x	0.6	x	0.8	= 119.92 (74)
North	0.9x	0.77	x	3.12	x	55.46	x	0.6	x	0.8	= 57.56 (74)
North	0.9x	0.77	x	3.12	x	74.72	x	0.6	x	0.8	= 77.54 (74)
North	0.9x	0.77	x	3.12	x	74.72	x	0.6	x	0.8	= 77.54 (74)
North	0.9x	0.77	x	6.5	x	74.72	x	0.6	x	0.8	= 161.55 (74)
North	0.9x	0.77	x	3.12	x	74.72	x	0.6	x	0.8	= 77.54 (74)
North	0.9x	0.77	x	3.12	x	79.99	x	0.6	x	0.8	= 83.01 (74)
North	0.9x	0.77	x	3.12	x	79.99	x	0.6	x	0.8	= 83.01 (74)
North	0.9x	0.77	x	6.5	x	79.99	x	0.6	x	0.8	= 172.94 (74)
North	0.9x	0.77	x	3.12	x	79.99	x	0.6	x	0.8	= 83.01 (74)
North	0.9x	0.77	x	3.12	x	74.68	x	0.6	x	0.8	= 77.5 (74)
North	0.9x	0.77	x	3.12	x	74.68	x	0.6	x	0.8	= 77.5 (74)
North	0.9x	0.77	x	6.5	x	74.68	x	0.6	x	0.8	= 161.46 (74)
North	0.9x	0.77	x	3.12	x	74.68	x	0.6	x	0.8	= 77.5 (74)
North	0.9x	0.77	x	3.12	x	59.25	x	0.6	x	0.8	= 61.49 (74)
North	0.9x	0.77	x	3.12	x	59.25	x	0.6	x	0.8	= 61.49 (74)
North	0.9x	0.77	x	6.5	x	59.25	x	0.6	x	0.8	= 128.1 (74)
North	0.9x	0.77	x	3.12	x	59.25	x	0.6	x	0.8	= 61.49 (74)
North	0.9x	0.77	x	3.12	x	41.52	x	0.6	x	0.8	= 43.09 (74)
North	0.9x	0.77	x	3.12	x	41.52	x	0.6	x	0.8	= 43.09 (74)
North	0.9x	0.77	x	6.5	x	41.52	x	0.6	x	0.8	= 89.77 (74)
North	0.9x	0.77	x	3.12	x	41.52	x	0.6	x	0.8	= 43.09 (74)
North	0.9x	0.77	x	3.12	x	24.19	x	0.6	x	0.8	= 25.1 (74)
North	0.9x	0.77	x	3.12	x	24.19	x	0.6	x	0.8	= 25.1 (74)
North	0.9x	0.77	x	6.5	x	24.19	x	0.6	x	0.8	= 52.3 (74)

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North	0.9x	0.77	x	3.12	x	24.19	x	0.6	x	0.8	=	25.1	(74)
North	0.9x	0.77	x	3.12	x	13.12	x	0.6	x	0.8	=	13.61	(74)
North	0.9x	0.77	x	3.12	x	13.12	x	0.6	x	0.8	=	13.61	(74)
North	0.9x	0.77	x	6.5	x	13.12	x	0.6	x	0.8	=	28.36	(74)
North	0.9x	0.77	x	3.12	x	13.12	x	0.6	x	0.8	=	13.61	(74)
North	0.9x	0.77	x	3.12	x	8.86	x	0.6	x	0.8	=	9.2	(74)
North	0.9x	0.77	x	3.12	x	8.86	x	0.6	x	0.8	=	9.2	(74)
North	0.9x	0.77	x	6.5	x	8.86	x	0.6	x	0.8	=	19.17	(74)
North	0.9x	0.77	x	3.12	x	8.86	x	0.6	x	0.8	=	9.2	(74)
West	0.9x	0.77	x	6.5	x	19.64	x	0.6	x	0.8	=	42.47	(80)
West	0.9x	0.77	x	6.5	x	38.42	x	0.6	x	0.8	=	83.07	(80)
West	0.9x	0.77	x	6.5	x	63.27	x	0.6	x	0.8	=	136.81	(80)
West	0.9x	0.77	x	6.5	x	92.28	x	0.6	x	0.8	=	199.52	(80)
West	0.9x	0.77	x	6.5	x	113.09	x	0.6	x	0.8	=	244.52	(80)
West	0.9x	0.77	x	6.5	x	115.77	x	0.6	x	0.8	=	250.31	(80)
West	0.9x	0.77	x	6.5	x	110.22	x	0.6	x	0.8	=	238.31	(80)
West	0.9x	0.77	x	6.5	x	94.68	x	0.6	x	0.8	=	204.7	(80)
West	0.9x	0.77	x	6.5	x	73.59	x	0.6	x	0.8	=	159.11	(80)
West	0.9x	0.77	x	6.5	x	45.59	x	0.6	x	0.8	=	98.57	(80)
West	0.9x	0.77	x	6.5	x	24.49	x	0.6	x	0.8	=	52.95	(80)
West	0.9x	0.77	x	6.5	x	16.15	x	0.6	x	0.8	=	34.92	(80)

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

(83)m= 98.56 190.28 318.98 492.14 638.7 672.29 632.28 517.27 378.14 226.19 122.15 81.69 (83)

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

(84)m= 439.03 528.27 644.63 798.28 925.17 939.65 887.52 778.54 649.63 517.38 435.91 412.38 (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	0.99	0.95	0.79	0.56	0.38	0.28	0.33	0.59	0.91	0.99	1

(86)

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

(87)m= 20.2 20.39 20.66 20.92 20.99 21 21 21 20.99 20.83 20.46 20.17 (87)

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

(88)m= 20.18 20.19 20.19 20.2 20.2 20.22 20.22 20.22 20.21 20.2 20.2 20.19 (88)

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

(89)m= 0.99 0.98 0.93 0.75 0.52 0.33 0.23 0.27 0.52 0.88 0.99 1 (89)

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

(90)m= 19.12 19.39 19.78 20.12 20.2 20.22 20.22 20.22 20.21 20.02 19.5 19.08 (90)

fLA = Living area ÷ (4) = 0.28 (91)

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

DER WorkSheet: New dwelling design stage

(92)m= 19.43 19.67 20.03 20.34 20.42 20.44 20.44 20.44 20.43 20.25 19.78 19.39 (92)

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

(93)m= 19.28 19.52 19.88 20.19 20.27 20.29 20.29 20.29 20.28 20.1 19.63 19.24 (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
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Utilisation factor for gains, hm:

(94)m= 0.99 0.98 0.93 0.75 0.52 0.34 0.23 0.28 0.53 0.88 0.98 1 (94)

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

(95)m= 435.98 517.57 597.72 601.69 480.61 315.71 204.83 215.26 342.74 455.34 428.28 410.34 (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= 869.43 845.86 771.45 640.3 484.31 315.88 204.84 215.29 345.51 536.56 712.57 861.56 (97)

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

(98)m= 322.49 220.61 129.25 27.79 2.75 0 0 0 0 60.43 204.69 335.71

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1303.72 (98)

Space heating requirement in kWh/m²/year

(99) 19.78 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

(201) 0 (201)

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

(202) 1 (202)

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

(204) 1 (204)

Efficiency of main space heating system 1

(206) 90.3 (206)

Efficiency of secondary/supplementary heating system, %

(208) 0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Space heating requirement (calculated above)

322.49	220.61	129.25	27.79	2.75	0	0	0	0	60.43	204.69	335.71
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

357.13	244.31	143.13	30.78	3.05	0	0	0	0	66.93	226.67	371.77
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Total (kWh/year) =Sum(211)_{1...5,10...12} = 1443.77 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

(216) 81 (216)

(217)m= 86.65 86.1 84.78 82.32 81.16 81 81 81 81 83.38 85.85 86.8 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 215.22 189.21 199.93 182.62 179.35 158.26 151.63 169.03 170.9 189.04 195.99 209.82

Total = Sum(219a)_{1...12} = 2211 (219)

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Annual totals

Space heating fuel used, main system 1

kWh/year kWh/year
1443.77

Water heating fuel used

2211

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

220.61 (230a)

central heating pump:

30 (230c)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 250.61 (231)

Electricity for lighting

295.28 (232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	311.85 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	477.57 (264)
Space and water heating	(261) + (262) + (263) + (264) =		789.43 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	130.07 (267)
Electricity for lighting	(232) x	0.519 =	153.25 (268)
Total CO2, kg/year		sum of (265)...(271) =	1072.75 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	16.28 (273)
El rating (section 14)			87 (274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Stroma Number: Stroma FSAP 2012 Software Version: Version: 1.0.4.10

Property Address: B1-14-1

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.9 (1a) x	2.8 (2a) =	184.52 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.9 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.52 (5)

2. Ventilation rate:

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]x(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (21)

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

Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.39	0.38	0.37	0.34	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36
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Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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d) If natural ventilation or whole house positive input ventilation from loft

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

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m2K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Windows Type 1			2.3	x1/[1/(1.4)+ 0.04] =	3.05		
Windows Type 2			2.3	x1/[1/(1.4)+ 0.04] =	3.05		
Windows Type 3			4.79	x1/[1/(1.4)+ 0.04] =	6.35		
Windows Type 4			2.3	x1/[1/(1.4)+ 0.04] =	3.05		
Windows Type 5			4.79	x1/[1/(1.4)+ 0.04] =	6.35		
Walls Type1	34.2	11.69	22.51	x 0.18 =	4.05		
Walls Type2	10.6	4.79	5.81	x 0.18 =	1.05		
Total area of elements, m ²			44.8				
Party wall			29.4	x 0 =	0		
Party wall			63	x 0 =	0		
Party floor			74.3				
Party ceiling			74.3				
Internal wall **			50.4				

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

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

Fabric heat loss, W/K = S (A x u) (26)...(30) + (32) = 26.95 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19498.8 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 5.47 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.41 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.04	34.86	34.69	33.86	33.71	33	33	32.86	33.27	33.71	34.02	34.35	(38)

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

(39)m=	67.45	67.27	67.1	66.28	66.12	65.41	65.41	65.27	65.68	66.12	66.43	66.76	
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Heat loss parameter (HLP), W/m²K Average = Sum(39)_{1...12} / 12 = 66.27 (39)

(40)m = (39)m ÷ (4) (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.02	1.01	1	0.99	0.99	0.99	1	1	1.01	1.01	
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Average = Sum(40)_{1...12} / 12 = 1.01 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.14 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.09 (43)

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

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

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

(44)m=	93.6	90.19	86.79	83.39	79.98	76.58	76.58	79.98	83.39	86.79	90.19	93.6	
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	--

Total = Sum(44)_{1...12} = 1021.05 (44)

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

(45)m=	138.8	121.4	125.27	109.21	104.79	90.43	83.79	96.16	97.3	113.4	123.78	134.42	
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Total = Sum(45)_{1...12} = 1338.76 (45)

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

(46)m=	20.82	18.21	18.79	16.38	15.72	13.56	12.57	14.42	14.6	17.01	18.57	20.16	(46)
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Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

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

(61)m=	47.7	41.51	44.23	41.12	40.76	37.76	39.02	40.76	41.12	44.23	44.48	47.7	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	186.5	162.91	169.5	150.33	145.55	128.19	122.82	136.91	138.43	157.63	168.26	182.12	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

Output from water heater

(64)m=	186.5	162.91	169.5	150.33	145.55	128.19	122.82	136.91	138.43	157.63	168.26	182.12	
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Output from water heater (annual)_{1...12} 1849.14 (64)

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

(65)m=	58.08	50.74	52.71	46.59	45.03	39.51	37.62	42.16	42.63	48.76	52.28	56.62	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	(66)

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

(67)m=	16.72	14.85	12.08	9.14	6.83	5.77	6.23	8.1	10.88	13.81	16.12	17.18	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	187.55	189.49	184.59	174.15	160.97	148.58	140.31	138.36	143.26	153.7	166.88	179.27	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

(71)m=	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	(71)
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Water heating gains (Table 5)

(72)m=	78.06	75.51	70.85	64.71	60.53	54.87	50.56	56.67	59.21	65.54	72.61	76.1	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.46	337.99	325.65	306.14	286.47	267.36	255.24	261.27	271.5	291.2	313.75	330.7	(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.

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Orientation:	Access Factor Table 6d			Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.3	x	10.63	x	0.63	x	0.7	=	7.47	(74)
North	0.9x	0.77	x	2.3	x	10.63	x	0.63	x	0.7	=	7.47	(74)
North	0.9x	0.77	x	4.79	x	10.63	x	0.63	x	0.7	=	15.57	(74)
North	0.9x	0.77	x	2.3	x	10.63	x	0.63	x	0.7	=	7.47	(74)
North	0.9x	0.77	x	2.3	x	20.32	x	0.63	x	0.7	=	14.28	(74)
North	0.9x	0.77	x	2.3	x	20.32	x	0.63	x	0.7	=	14.28	(74)
North	0.9x	0.77	x	4.79	x	20.32	x	0.63	x	0.7	=	29.75	(74)
North	0.9x	0.77	x	2.3	x	20.32	x	0.63	x	0.7	=	14.28	(74)
North	0.9x	0.77	x	2.3	x	34.53	x	0.63	x	0.7	=	24.27	(74)
North	0.9x	0.77	x	2.3	x	34.53	x	0.63	x	0.7	=	24.27	(74)
North	0.9x	0.77	x	4.79	x	34.53	x	0.63	x	0.7	=	50.55	(74)
North	0.9x	0.77	x	2.3	x	34.53	x	0.63	x	0.7	=	24.27	(74)
North	0.9x	0.77	x	2.3	x	55.46	x	0.63	x	0.7	=	38.99	(74)
North	0.9x	0.77	x	2.3	x	55.46	x	0.63	x	0.7	=	38.99	(74)
North	0.9x	0.77	x	4.79	x	55.46	x	0.63	x	0.7	=	81.19	(74)
North	0.9x	0.77	x	2.3	x	55.46	x	0.63	x	0.7	=	38.99	(74)
North	0.9x	0.77	x	2.3	x	74.72	x	0.63	x	0.7	=	52.52	(74)
North	0.9x	0.77	x	2.3	x	74.72	x	0.63	x	0.7	=	52.52	(74)
North	0.9x	0.77	x	4.79	x	74.72	x	0.63	x	0.7	=	109.38	(74)
North	0.9x	0.77	x	2.3	x	74.72	x	0.63	x	0.7	=	52.52	(74)
North	0.9x	0.77	x	2.3	x	79.99	x	0.63	x	0.7	=	56.22	(74)
North	0.9x	0.77	x	2.3	x	79.99	x	0.63	x	0.7	=	56.22	(74)
North	0.9x	0.77	x	4.79	x	79.99	x	0.63	x	0.7	=	117.09	(74)
North	0.9x	0.77	x	2.3	x	79.99	x	0.63	x	0.7	=	56.22	(74)
North	0.9x	0.77	x	2.3	x	74.68	x	0.63	x	0.7	=	52.49	(74)
North	0.9x	0.77	x	2.3	x	74.68	x	0.63	x	0.7	=	52.49	(74)
North	0.9x	0.77	x	4.79	x	74.68	x	0.63	x	0.7	=	109.32	(74)
North	0.9x	0.77	x	2.3	x	74.68	x	0.63	x	0.7	=	52.49	(74)
North	0.9x	0.77	x	2.3	x	59.25	x	0.63	x	0.7	=	41.64	(74)
North	0.9x	0.77	x	2.3	x	59.25	x	0.63	x	0.7	=	41.64	(74)
North	0.9x	0.77	x	4.79	x	59.25	x	0.63	x	0.7	=	86.73	(74)
North	0.9x	0.77	x	2.3	x	59.25	x	0.63	x	0.7	=	41.64	(74)
North	0.9x	0.77	x	2.3	x	41.52	x	0.63	x	0.7	=	29.18	(74)
North	0.9x	0.77	x	2.3	x	41.52	x	0.63	x	0.7	=	29.18	(74)
North	0.9x	0.77	x	4.79	x	41.52	x	0.63	x	0.7	=	60.78	(74)
North	0.9x	0.77	x	2.3	x	41.52	x	0.63	x	0.7	=	29.18	(74)
North	0.9x	0.77	x	2.3	x	24.19	x	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	2.3	x	24.19	x	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	4.79	x	24.19	x	0.63	x	0.7	=	35.41	(74)

TER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.3	x	24.19	x	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	2.3	x	13.12	x	0.63	x	0.7	=	9.22	(74)
North	0.9x	0.77	x	2.3	x	13.12	x	0.63	x	0.7	=	9.22	(74)
North	0.9x	0.77	x	4.79	x	13.12	x	0.63	x	0.7	=	19.2	(74)
North	0.9x	0.77	x	2.3	x	13.12	x	0.63	x	0.7	=	9.22	(74)
North	0.9x	0.77	x	2.3	x	8.86	x	0.63	x	0.7	=	6.23	(74)
North	0.9x	0.77	x	2.3	x	8.86	x	0.63	x	0.7	=	6.23	(74)
North	0.9x	0.77	x	4.79	x	8.86	x	0.63	x	0.7	=	12.98	(74)
North	0.9x	0.77	x	2.3	x	8.86	x	0.63	x	0.7	=	6.23	(74)
West	0.9x	0.77	x	4.79	x	19.64	x	0.63	x	0.7	=	28.75	(80)
West	0.9x	0.77	x	4.79	x	38.42	x	0.63	x	0.7	=	56.24	(80)
West	0.9x	0.77	x	4.79	x	63.27	x	0.63	x	0.7	=	92.62	(80)
West	0.9x	0.77	x	4.79	x	92.28	x	0.63	x	0.7	=	135.09	(80)
West	0.9x	0.77	x	4.79	x	113.09	x	0.63	x	0.7	=	165.55	(80)
West	0.9x	0.77	x	4.79	x	115.77	x	0.63	x	0.7	=	169.47	(80)
West	0.9x	0.77	x	4.79	x	110.22	x	0.63	x	0.7	=	161.35	(80)
West	0.9x	0.77	x	4.79	x	94.68	x	0.63	x	0.7	=	138.59	(80)
West	0.9x	0.77	x	4.79	x	73.59	x	0.63	x	0.7	=	107.73	(80)
West	0.9x	0.77	x	4.79	x	45.59	x	0.63	x	0.7	=	66.74	(80)
West	0.9x	0.77	x	4.79	x	24.49	x	0.63	x	0.7	=	35.85	(80)
West	0.9x	0.77	x	4.79	x	16.15	x	0.63	x	0.7	=	23.64	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ... (82)m
(83)m= 66.74 128.84 215.99 333.24 432.49 455.23 428.14 350.26 256.05 153.16 82.71 55.31 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts
(84)m= 407.2 466.83 541.64 639.38 718.96 722.6 683.38 611.53 527.54 444.35 396.46 386.01 (84)

7. Mean internal temperature (heating season)

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

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.99	0.98	0.93	0.78	0.57	0.42	0.49	0.78	0.97	0.99	1

 (86)

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

19.95	20.1	20.36	20.69	20.92	20.99	21	21	20.94	20.62	20.23	19.92
-------	------	-------	-------	-------	-------	----	----	-------	-------	-------	-------

 (87)

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

20.06	20.07	20.07	20.08	20.08	20.09	20.09	20.09	20.09	20.08	20.08	20.07
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (88)

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

1	0.99	0.98	0.9	0.72	0.49	0.33	0.39	0.7	0.95	0.99	1
---	------	------	-----	------	------	------	------	-----	------	------	---

 (89)

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

18.66	18.88	19.25	19.73	20	20.08	20.09	20.09	20.04	19.64	19.07	18.63
-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------

 (90)

fLA = Living area ÷ (4) = 0.28 (91)

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

TER WorkSheet: New dwelling design stage

(92)m= 19.03 19.22 19.57 20 20.26 20.34 20.35 20.35 20.29 19.92 19.4 19 (92)

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

(93)m= 19.03 19.22 19.57 20 20.26 20.34 20.35 20.35 20.29 19.92 19.4 19 (93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m= 1 0.99 0.97 0.9 0.73 0.51 0.36 0.42 0.72 0.95 0.99 1 (94)

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

(95)m= 405.45 462.43 526.68 576.3 526.54 370.91 244.6 256.52 380.69 422.04 392.86 384.75 (95)

Monthly average external temperature from Table 8

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

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

(97)m= 993.23 963.49 876.66 735.83 566.17 375.38 245.07 257.63 406.81 616.39 817.14 987.76 (97)

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

(98)m= 437.31 336.71 260.39 114.86 29.48 0 0 0 0 144.59 305.48 448.64
Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2077.46 (98)

Space heating requirement in kWh/m²/year

(99) 31.52 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

(201) 0 (201)

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

(202) 1 (202)

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

(204) 1 (204)

Efficiency of main space heating system 1

(206) 93.4 (206)

Efficiency of secondary/supplementary heating system, %

(208) 0 (208)

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

Space heating requirement (calculated above)

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

(211)m= 468.21 360.5 278.79 122.98 31.57 0 0 0 0 154.81 327.07 480.34
Total (kWh/year) =Sum(211)_{1...5,10...12} = 2224.26 (211)

Space heating fuel (secondary), kWh/month

(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)

(216) 80.3 (216)

(217)m= 87.12 86.84 86.13 84.38 81.84 80.3 80.3 80.3 80.3 84.83 86.53 87.23 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m
(219)m= 214.06 187.6 196.79 178.16 177.85 159.64 152.95 170.5 172.39 185.8 194.45 208.77
Total = Sum(219a)_{1...12} = 2198.96 (219)

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Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

2224.26

Water heating fuel used

2198.96

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

(231)

Electricity for lighting

295.28

(232)

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

Energy

kWh/year

Emission factor

kg CO2/kWh

Emissions

kg CO2/year

Space heating (main system 1)

(211) x

0.216

=

480.44

(261)

Space heating (secondary)

(215) x

0.519

=

0

(263)

Water heating

(219) x

0.216

=

474.98

(264)

Space and water heating

(261) + (262) + (263) + (264) =

955.42

(265)

Electricity for pumps, fans and electric keep-hot

(231) x

0.519

=

38.93

(267)

Electricity for lighting

(232) x

0.519

=

153.25

(268)

Total CO2, kg/year

sum of (265)...(271) =

1147.59

(272)

TER =

17.41

(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name:

Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: B1-15-4

Address :

5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	36.5 (1a) x	4.7 (2a) =	171.55 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	36.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.55 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
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			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.15 (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) =		0.13 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

DER WorkSheet: New dwelling design stage

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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)
---------	---	---	---	---	---	---	---	---	---	---	---	---	-------

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

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m2K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Windows Type 1			6.5	x1/[1/(1.4)+0.04] =	8.62		(27)
Windows Type 2			3.12	x1/[1/(1.4)+0.04] =	4.14		(27)
Windows Type 3			6.5	x1/[1/(1.4)+0.04] =	8.62		(27)
Walls Type1	29.6	6.5	23.1	x 0.2 =	4.62		(29)
Walls Type2	27.3	9.62	17.68	x 0.2 =	3.54		(29)
Roof	36.5	0	36.5	x 0.13 =	4.74		(30)
Total area of elements, m ²			93.4				(31)
Party wall			29.4	x 0 =	0		(32)
Party wall			63	x 0 =	0		(32)
Party floor			74.3				(32a)
Party ceiling			74.3				(32b)
Internal wall **			50.4				(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34.27 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 21509.4 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 4.81 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss

(33) + (36) =

39.09

(37)

Ventilation heat loss calculated monthly

(38)m = 0.33 × (25)m × (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	15.85	15.67	15.49	14.59	14.41	13.51	13.51	13.33	13.87	14.41	14.77	15.13

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=	54.94	54.76	54.58	53.68	53.5	52.6	52.6	52.41	52.96	53.5	53.86	54.22
--------	-------	-------	-------	-------	------	------	------	-------	-------	------	-------	-------

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

53.63

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=	1.51	1.5	1.5	1.47	1.47	1.44	1.44	1.44	1.45	1.47	1.48	1.49
--------	------	-----	-----	------	------	------	------	------	------	------	------	------

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

1.47

(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

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

1.32

(42)

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

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

65.47

(43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	72.02	69.4	66.78	64.16	61.54	58.93	58.93	61.54	64.16	66.78	69.4	72.02

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

785.67

(44)

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

(45)m=	106.8	93.41	96.39	84.04	80.64	69.58	64.48	73.99	74.87	87.26	95.25	103.43
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

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

1030.14

(45)

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

(46)m=	16.02	14.01	14.46	12.61	12.1	10.44	9.67	11.1	11.23	13.09	14.29	15.51
--------	-------	-------	-------	-------	------	-------	------	------	-------	-------	-------	-------

(46)

Water storage loss:

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

0

(47)

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

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

Water storage loss:

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

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

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

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

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

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

0

(54)

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

0

(55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

((56)m = (55) × (41)m

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

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=	36.7	31.94	34.03	31.64	31.36	29.06	30.03	31.36	31.64	34.03	34.23	36.7
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

(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=	143.5	125.35	130.42	115.68	112	98.64	94.51	105.35	106.52	121.29	129.47	140.13
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(62)

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

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

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

(63)

Output from water heater

(64)m=	143.5	125.35	130.42	115.68	112	98.64	94.51	105.35	106.52	121.29	129.47	140.13
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Output from water heater (annual)_{1...12}

1422.86

(64)

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

(65)m=	44.69	39.04	40.56	35.85	34.65	30.4	28.95	32.44	32.81	37.52	40.23	43.57
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

(65)

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=	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84

(66)

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

(67)m=	10.06	8.94	7.27	5.5	4.11	3.47	3.75	4.88	6.54	8.31	9.7	10.34
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(67)

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

(68)m=	112.84	114.01	111.06	104.78	96.85	89.4	84.42	83.25	86.2	92.48	100.41	107.86
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(68)

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

(69)m=	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=	60.06	58.1	54.51	49.8	46.57	42.22	38.91	43.6	45.56	50.43	55.87	58.56
--------	-------	------	-------	------	-------	-------	-------	------	-------	-------	-------	-------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	228.72	226.8	218.59	205.83	193.29	180.84	172.83	177.48	184.06	196.97	211.73	222.51
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(73)

6. Solar gains:

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

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	3.12	x	19.64	x	0.6	x	0.8	=	20.38	(76)
East	0.9x	1	x	6.5	x	19.64	x	0.6	x	0.8	=	42.47	(76)
East	0.9x	1	x	3.12	x	38.42	x	0.6	x	0.8	=	39.87	(76)
East	0.9x	1	x	6.5	x	38.42	x	0.6	x	0.8	=	83.07	(76)
East	0.9x	1	x	3.12	x	63.27	x	0.6	x	0.8	=	65.67	(76)
East	0.9x	1	x	6.5	x	63.27	x	0.6	x	0.8	=	136.81	(76)
East	0.9x	1	x	3.12	x	92.28	x	0.6	x	0.8	=	95.77	(76)
East	0.9x	1	x	6.5	x	92.28	x	0.6	x	0.8	=	199.52	(76)
East	0.9x	1	x	3.12	x	113.09	x	0.6	x	0.8	=	117.37	(76)
East	0.9x	1	x	6.5	x	113.09	x	0.6	x	0.8	=	244.52	(76)
East	0.9x	1	x	3.12	x	115.77	x	0.6	x	0.8	=	120.15	(76)
East	0.9x	1	x	6.5	x	115.77	x	0.6	x	0.8	=	250.31	(76)
East	0.9x	1	x	3.12	x	110.22	x	0.6	x	0.8	=	114.39	(76)
East	0.9x	1	x	6.5	x	110.22	x	0.6	x	0.8	=	238.31	(76)
East	0.9x	1	x	3.12	x	94.68	x	0.6	x	0.8	=	98.26	(76)
East	0.9x	1	x	6.5	x	94.68	x	0.6	x	0.8	=	204.7	(76)
East	0.9x	1	x	3.12	x	73.59	x	0.6	x	0.8	=	76.37	(76)
East	0.9x	1	x	6.5	x	73.59	x	0.6	x	0.8	=	159.11	(76)
East	0.9x	1	x	3.12	x	45.59	x	0.6	x	0.8	=	47.31	(76)
East	0.9x	1	x	6.5	x	45.59	x	0.6	x	0.8	=	98.57	(76)
East	0.9x	1	x	3.12	x	24.49	x	0.6	x	0.8	=	25.42	(76)
East	0.9x	1	x	6.5	x	24.49	x	0.6	x	0.8	=	52.95	(76)
East	0.9x	1	x	3.12	x	16.15	x	0.6	x	0.8	=	16.76	(76)
East	0.9x	1	x	6.5	x	16.15	x	0.6	x	0.8	=	34.92	(76)
South	0.9x	0.77	x	6.5	x	46.75	x	0.6	x	0.8	=	101.09	(78)
South	0.9x	0.77	x	6.5	x	76.57	x	0.6	x	0.8	=	165.55	(78)
South	0.9x	0.77	x	6.5	x	97.53	x	0.6	x	0.8	=	210.88	(78)
South	0.9x	0.77	x	6.5	x	110.23	x	0.6	x	0.8	=	238.34	(78)
South	0.9x	0.77	x	6.5	x	114.87	x	0.6	x	0.8	=	248.37	(78)
South	0.9x	0.77	x	6.5	x	110.55	x	0.6	x	0.8	=	239.02	(78)
South	0.9x	0.77	x	6.5	x	108.01	x	0.6	x	0.8	=	233.54	(78)
South	0.9x	0.77	x	6.5	x	104.89	x	0.6	x	0.8	=	226.8	(78)
South	0.9x	0.77	x	6.5	x	101.89	x	0.6	x	0.8	=	220.29	(78)
South	0.9x	0.77	x	6.5	x	82.59	x	0.6	x	0.8	=	178.56	(78)
South	0.9x	0.77	x	6.5	x	55.42	x	0.6	x	0.8	=	119.82	(78)
South	0.9x	0.77	x	6.5	x	40.4	x	0.6	x	0.8	=	87.35	(78)

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

(83)m=	163.93	288.5	413.36	533.64	610.27	609.49	586.24	529.76	455.78	324.45	198.19	139.03
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

(84)m=	392.65	515.3	631.95	739.47	803.56	790.33	759.06	707.24	639.84	521.42	409.92	361.54
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7. Mean internal temperature (heating season)

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

21	(85)
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Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.98	0.95	0.88	0.75	0.58	0.42	0.3	0.34	0.55	0.83	0.96	0.99

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

(87)m=	19.71	20.05	20.43	20.77	20.93	20.99	21	21	20.96	20.7	20.14	19.66
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.68	19.69	19.69	19.71	19.71	19.73	19.73	19.74	19.72	19.71	19.71	19.7
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.94	0.85	0.7	0.51	0.34	0.22	0.25	0.46	0.78	0.95	0.98
--------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(90)m=	18.05	18.53	19.05	19.48	19.66	19.73	19.73	19.73	19.7	19.42	18.67	17.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

fLA = Living area ÷ (4) =

0.86	(91)
------	------

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

(92)m=	19.49	19.84	20.24	20.59	20.76	20.81	20.82	20.82	20.79	20.53	19.94	19.43
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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

(93)m=	19.34	19.69	20.09	20.44	20.61	20.66	20.67	20.67	20.64	20.38	19.79	19.28
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8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m=	0.97	0.94	0.86	0.73	0.56	0.4	0.28	0.31	0.52	0.81	0.95	0.98

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

(95)m=	382.48	482.48	545.03	538.92	452.84	314.74	213.52	222.78	333.62	420.97	388.57	354.42
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

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

(97)m=	826.1	810.09	741.98	619.62	476.51	318.94	214.27	223.97	346.26	522.98	683.32	817.39
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

(98)m=	330.05	220.15	146.53	58.1	17.61	0	0	0	0	75.89	212.22	344.46
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Total per year (kWh/year) = Sum(98)_{1..5,9..12} =

1405.02	(98)
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Space heating requirement in kWh/m²/year

38.49	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system

0	(201)
---	-------

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

1	(202)
---	-------

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

1	(204)
---	-------

Efficiency of main space heating system 1

90.3	(206)
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Efficiency of secondary/supplementary heating system, %

0	(208)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
330.05	220.15	146.53	58.1	17.61	0	0	0	0	75.89	212.22	344.46	
(211)m = $\{[(98)m \times (204)]\} \times 100 \div (206)$ (211)												
365.51	243.8	162.27	64.35	19.5	0	0	0	0	84.05	235.01	381.46	
Total (kWh/year) =Sum(211) _{1...5,10...12} =												1555.94 (211)
Space heating fuel (secondary), kWh/month												
= $\{[(98)m \times (201)]\} \times 100 \div (208)$												
(215)m=	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215) _{1...5,10...12} =												0 (215)
Water heating												
Output from water heater (calculated above)												
143.5	125.35	130.42	115.68	112	98.64	94.51	105.35	106.52	121.29	129.47	140.13	
Efficiency of water heater												81 (216)
(217)m=	87.26	86.69	85.67	83.89	82.15	81	81	81	84.34	86.54	87.4	(217)
Fuel for water heating, kWh/month												
(219)m = (64)m x 100 ÷ (217)m												
(219)m=	164.45	144.6	152.24	137.9	136.33	121.78	116.67	130.06	131.5	143.8	149.62	160.34
Total = Sum(219a) _{1...12} =												1689.3 (219)
Annual totals												
Space heating fuel used, main system 1												kWh/year 1555.94
Water heating fuel used												kWh/year 1689.3
Electricity for pumps, fans and electric keep-hot												
mechanical ventilation - balanced, extract or positive input from outside												205.11 (230a)
central heating pump:												30 (230c)
Total electricity for the above, kWh/year												sum of (230a)...(230g) = 235.11 (231)
Electricity for lighting												177.66 (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	= 336.08 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 364.89 (264)
Space and water heating	(261) + (262) + (263) + (264) =		700.97 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 122.02 (267)
Electricity for lighting	(232) x	0.519	= 92.21 (268)
Total CO2, kg/year	sum of (265)...(271) =		915.2 (272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		25.07 (273)
El rating (section 14)			85 (274)

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User Details:			
Assessor Name:	Stroma FSAP 2012	Stroma Number:	Version: 1.0.4.10
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.4.10
Property Address: B1-15-4			
Address : 5 Clarendon Road, Wood Green, London, N22 6XJ			
1. Overall dwelling dimensions:			

	Area(m²)	Av. Height(m)	Volume(m³)
Ground floor	36.5 (1a) x	4.7 (2a) =	171.55 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	36.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.55 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m³ per hour							
Number of chimneys	0	0	0	0	x 40 = 0 (6a)							
Number of open flues	0	0	0	0	x 20 = 0 (6b)							
Number of intermittent fans				2	x 10 = 20 (7a)							
Number of passive vents				0	x 10 = 0 (7b)							
Number of flueless gas fires				0	x 40 = 0 (7c)							
Air changes per hour												
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20	÷ (5) = 0.12 (8)							
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)												
Number of storeys in the dwelling (ns)					0 (9)							
Additional infiltration					[(9)-1]x0.1 = 0 (10)							
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction					0 (11)							
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35												
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0					0 (12)							
If no draught lobby, enter 0.05, else enter 0					0 (13)							
Percentage of windows and doors draught stripped					0 (14)							
Window infiltration				0.25 - [0.2 x (14) ÷ 100] =	0 (15)							
Infiltration rate				(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)							
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area					5 (17)							
If based on air permeability value, then (18) = [(17) ÷ 20]x(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	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.4	0.39	0.38	0.34	0.33	0.3	0.3	0.29	0.31	0.33	0.35	0.37
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

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

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

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
Windows Type 1			3.68	x1/[1/(1.4)+ 0.04] =	4.88		(27)
Windows Type 2			1.77	x1/[1/(1.4)+ 0.04] =	2.35		(27)
Windows Type 3			3.68	x1/[1/(1.4)+ 0.04] =	4.88		(27)
Walls Type1	29.6	3.68	25.92	x 0.18 =	4.67		(29)
Walls Type2	27.3	5.45	21.85	x 0.18 =	3.93		(29)
Roof	36.5	0	36.5	x 0.13 =	4.74		(30)
Total area of elements, m²			93.4				(31)
Party wall			29.4	x 0 =	0		(32)
Party wall			63	x 0 =	0		(32)
Party floor			74.3				(32a)
Party ceiling			74.3				(32b)
Internal wall **			50.4				(32c)

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

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

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

25.45

 (33)

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

22453.05

 (34)

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

250

 (35)

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

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

11.45

 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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

36.9

 (37)

Ventilation heat loss calculated monthly

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
32.77	32.6	32.43	31.63	31.48	30.79	30.79	30.66	31.05	31.48	31.78	32.1

 (38)

Heat transfer coefficient, W/K

(39)m=

69.67	69.5	69.33	68.53	68.38	67.68	67.68	67.56	67.95	68.38	68.68	69
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----

 (39)

Heat loss parameter (HLP), W/m²K

(40)m=

1.91	1.9	1.9	1.88	1.87	1.85	1.85	1.85	1.86	1.87	1.88	1.89
------	-----	-----	------	------	------	------	------	------	------	------	------

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

65.47

 (43)

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

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
72.02	69.4	66.78	64.16	61.54	58.93	58.93	61.54	64.16	66.78	69.4	72.02

 (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=

106.8	93.41	96.39	84.04	80.64	69.58	64.48	73.99	74.87	87.26	95.25	103.43
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

 (45)

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

(46)m=

16.02	14.01	14.46	12.61	12.1	10.44	9.67	11.1	11.23	13.09	14.29	15.51
-------	-------	-------	-------	------	-------	------	------	-------	-------	-------	-------

 (46)

Water storage loss:

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

0

 (47)

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

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

Water storage loss:

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

0

 (48)

Temperature factor from Table 2b

0

 (49)

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

0

 (50)

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

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

0

 (51)

If community heating see section 4.3

Volume factor from Table 2a

0

 (52)

Temperature factor from Table 2b

0

 (53)

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

0

 (54)

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

0

 (55)

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Water storage loss calculated for each month

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

(56)m=

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

 (56)

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

(57)m=

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

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

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

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

(59)m=

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

 (59)

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

(61)m=

36.7	31.94	34.03	31.64	31.36	29.06	30.03	31.36	31.64	34.03	34.23	36.7
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (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=

143.5	125.35	130.42	115.68	112	98.64	94.51	105.35	106.52	121.29	129.47	140.13
-------	--------	--------	--------	-----	-------	-------	--------	--------	--------	--------	--------

 (62)

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

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

(63)m=

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

 (63)

Output from water heater

(64)m=

143.5	125.35	130.42	115.68	112	98.64	94.51	105.35	106.52	121.29	129.47	140.13
-------	--------	--------	--------	-----	-------	-------	--------	--------	--------	--------	--------

Output from water heater (annual)

1422.86

 (64)

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

(65)m=

44.69	39.04	40.56	35.85	34.65	30.4	28.95	32.44	32.81	37.52	40.23	43.57
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

 (65)

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

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

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84

 (66)

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

(67)m=

10.06	8.94	7.27	5.5	4.11	3.47	3.75	4.88	6.54	8.31	9.7	10.34
-------	------	------	-----	------	------	------	------	------	------	-----	-------

 (67)

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

(68)m=

112.84	114.01	111.06	104.78	96.85	89.4	84.42	83.25	86.2	92.48	100.41	107.86
--------	--------	--------	--------	-------	------	-------	-------	------	-------	--------	--------

 (68)

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

(69)m=

29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

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

(71)m=

-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

60.06	58.1	54.51	49.8	46.57	42.22	38.91	43.6	45.56	50.43	55.87	58.56
-------	------	-------	------	-------	-------	-------	------	-------	-------	-------	-------

 (72)

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

(73)m=

228.72	226.8	218.59	205.83	193.29	180.84	172.83	177.48	184.06	196.97	211.73	222.51
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (73)

6. Solar gains:

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

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Orientation:	Access Factor			Area			Flux			g_			FF			Gains
	Table 6d			m²			Table 6a			Table 6b			Table 6c			(W)
East	0.9x	1	x	1.77	x		19.64	x		0.63	x		0.7	=		10.62 (76)
East	0.9x	1	x	3.68	x		19.64	x		0.63	x		0.7	=		22.09 (76)
East	0.9x	1	x	1.77	x		38.42	x		0.63	x		0.7	=		20.78 (76)
East	0.9x	1	x	3.68	x		38.42	x		0.63	x		0.7	=		43.21 (76)
East	0.9x	1	x	1.77	x		63.27	x		0.63	x		0.7	=		34.23 (76)
East	0.9x	1	x	3.68	x		63.27	x		0.63	x		0.7	=		71.16 (76)
East	0.9x	1	x	1.77	x		92.28	x		0.63	x		0.7	=		49.92 (76)
East	0.9x	1	x	3.68	x		92.28	x		0.63	x		0.7	=		103.78 (76)
East	0.9x	1	x	1.77	x		113.09	x		0.63	x		0.7	=		61.18 (76)
East	0.9x	1	x	3.68	x		113.09	x		0.63	x		0.7	=		127.19 (76)
East	0.9x	1	x	1.77	x		115.77	x		0.63	x		0.7	=		62.62 (76)
East	0.9x	1	x	3.68	x		115.77	x		0.63	x		0.7	=		130.2 (76)
East	0.9x	1	x	1.77	x		110.22	x		0.63	x		0.7	=		59.62 (76)
East	0.9x	1	x	3.68	x		110.22	x		0.63	x		0.7	=		123.96 (76)
East	0.9x	1	x	1.77	x		94.68	x		0.63	x		0.7	=		51.21 (76)
East	0.9x	1	x	3.68	x		94.68	x		0.63	x		0.7	=		106.48 (76)
East	0.9x	1	x	1.77	x		73.59	x		0.63	x		0.7	=		39.81 (76)
East	0.9x	1	x	3.68	x		73.59	x		0.63	x		0.7	=		82.76 (76)
East	0.9x	1	x	1.77	x		45.59	x		0.63	x		0.7	=		24.66 (76)
East	0.9x	1	x	3.68	x		45.59	x		0.63	x		0.7	=		51.27 (76)
East	0.9x	1	x	1.77	x		24.49	x		0.63	x		0.7	=		13.25 (76)
East	0.9x	1	x	3.68	x		24.49	x		0.63	x		0.7	=		27.54 (76)
East	0.9x	1	x	1.77	x		16.15	x		0.63	x		0.7	=		8.74 (76)
East	0.9x	1	x	3.68	x		16.15	x		0.63	x		0.7	=		18.16 (76)
South	0.9x	0.77	x	3.68	x		46.75	x		0.63	x		0.7	=		52.58 (78)
South	0.9x	0.77	x	3.68	x		76.57	x		0.63	x		0.7	=		86.11 (78)
South	0.9x	0.77	x	3.68	x		97.53	x		0.63	x		0.7	=		109.69 (78)
South	0.9x	0.77	x	3.68	x		110.23	x		0.63	x		0.7	=		123.98 (78)
South	0.9x	0.77	x	3.68	x		114.87	x		0.63	x		0.7	=		129.19 (78)
South	0.9x	0.77	x	3.68	x		110.55	x		0.63	x		0.7	=		124.33 (78)
South	0.9x	0.77	x	3.68	x		108.01	x		0.63	x		0.7	=		121.48 (78)
South	0.9x	0.77	x	3.68	x		104.89	x		0.63	x		0.7	=		117.97 (78)
South	0.9x	0.77	x	3.68	x		101.89	x		0.63	x		0.7	=		114.59 (78)
South	0.9x	0.77	x	3.68	x		82.59	x		0.63	x		0.7	=		92.88 (78)
South	0.9x	0.77	x	3.68	x		55.42	x		0.63	x		0.7	=		62.33 (78)
South	0.9x	0.77	x	3.68	x		40.4	x		0.63	x		0.7	=		45.43 (78)

Solar gains in watts, calculated for each month

$$(83)m = \text{Sum}(74)m \dots (82)m$$

(83)m=

85.29	150.11	215.08	277.68	317.56	317.15	305.05	275.66	237.16	168.81	103.11	72.34
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (83)

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

(84)m=

314.01	376.91	433.67	483.51	510.85	498	477.88	453.14	421.21	365.79	314.84	294.85
--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------

 (84)

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7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, h1,m (see Table 9a) (86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.97	0.93	0.85	0.72	0.57	0.62	0.82	0.95	0.99	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c) (87)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
19.07	19.31	19.67	20.14	20.54	20.83	20.94	20.93	20.72	20.17	19.54	19.04

(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C) (88)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
20.05	20.05	20.05	20.06	20.06	20.07	20.07	20.07	20.07	20.06	20.06	20.05

(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.96	0.91	0.82	0.65	0.47	0.52	0.76	0.93	0.98	0.99

(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
18.27	18.5	18.87	19.33	19.71	19.97	20.05	20.04	19.88	19.37	18.74	18.24

(90)

fLA = Living area ÷ (4) = 0.86 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2 (92)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
18.96	19.2	19.56	20.03	20.43	20.71	20.82	20.81	20.6	20.06	19.43	18.93

(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
18.96	19.2	19.56	20.03	20.43	20.71	20.82	20.81	20.6	20.06	19.43	18.93

(93)

8. Space heating requirement

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

Utilisation factor for gains, hm: (94)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.99	0.98	0.96	0.91	0.83	0.7	0.55	0.6	0.8	0.93	0.98	0.99

(94)

Useful gains, hmGm , W = (94)m x (84)m (95)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
310.17	368.39	414.98	441.53	425.32	348.98	264.63	270.03	334.96	341.97	308.32	291.9

(95)

Monthly average external temperature from Table 8 (96)m=

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1021.62	993.64	905.67	762.46	597	413.71	285.74	297.64	441.74	647.04	846.69	1016.1

(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m (98)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
529.32	420.17	365.07	231.07	127.73	0	0	0	0	226.97	387.63	538.8

(98)
Total per year (kWh/year) = Sum(98)_{1..5,9..12} = 2826.77 (98)

Space heating requirement in kWh/m²/year 77.45 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.4 (206)

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

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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
529.32	420.17	365.07	231.07	127.73	0	0	0	0	226.97	387.63	538.8	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)												
566.73	449.86	390.87	247.4	136.75	0	0	0	0	243.01	415.02	576.88	
Total (kWh/year) =Sum(211) _{1..5,10..12} =												3026.52 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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		
143.5	125.35	130.42	115.68	112	98.64	94.51	105.35	106.52	121.29	129.47	140.13		
Efficiency of water heater												80.3 (216)	
(217)m=													80.3 (217)
88.04	87.86	87.5	86.76	85.38	80.3	80.3	80.3	80.3	86.61	87.64	88.11		

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
163	142.67	149.05	133.33	131.17	122.84	117.69	131.2	132.65	140.05	147.73	159.04	
Total = Sum(219a) _{1..12} =												1670.42 (219)

	kWh/year	kWh/year
Annual totals		
Space heating fuel used, main system 1	3026.52	
Water heating fuel used	1670.42	
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	75	(231)
Electricity for lighting	177.66	(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	= 653.73 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 360.81 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1014.54 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 92.21 (268)
Total CO2, kg/year		sum of (265)...(271) =	1145.67 (272)

TER = 31.39 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Stroma Number: Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.10

Property Address: D1 1-12-2

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	60 (1a) x	2.8 (2a) =	168 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	168 (5)

2. Ventilation rate:

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
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 a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Percentage of windows and doors draught stripped			0 (12)
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			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]x(8), otherwise (18) = (16)			0.15 (18)
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.12 (21)

Infiltration rate modified for monthly wind speed			
Monthly average wind speed from Table 7			
(22)m=	5.1	5	4.9
	4.4	4.3	3.8
	3.8	3.8	3.7
	4	4.3	4.5
	4.7		

Wind Factor (22a)m = (22)m ÷ 4			
(22a)m=	1.27	1.25	1.23
	1.1	1.08	0.95
	0.95	0.92	1
	1.08	1.12	1.18

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

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
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c) If whole house extract ventilation or positive input ventilation from outside

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

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

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	0	0	0	0	0	0	0	0	0	0	0
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m2K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Windows Type 1			2.98	x1/[1/(1.4)+ 0.04] =	3.95		
Windows Type 2			2.45	x1/[1/(1.4)+ 0.04] =	3.25		
Windows Type 3			6.02	x1/[1/(1.4)+ 0.04] =	7.98		
Windows Type 4			3	x1/[1/(1.4)+ 0.04] =	3.98		
Walls Type1	6.6	0	6.6	x 0.2 =	1.32		
Walls Type2	19.6	3	16.6	x 0.2 =	3.32		
Walls Type3	26.8	11.45	15.35	x 0.2 =	3.07		
Roof	60	0	60	x 0.13 =	7.8		
Total area of elements, m ²			113				
Party wall			4.2	x 0 =	0		
Party wall			43.4	x 0 =	0		
Party floor			60				
Internal wall **			70.56				

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

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

Fabric heat loss, W/K = S (A x u) (26)...(30) + (32) = 34.67 (33)

Heat capacity Cm = S(A x k) (28)...(30) + (32) + (32a)...(32e) = 7466.74 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 6.17 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 40.84 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	14.73	14.57	14.41	13.6	13.44	12.64	12.64	12.48	12.96	13.44	13.76	14.09	(38)

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

(39)m=	55.57	55.41	55.24	54.44	54.28	53.47	53.47	53.31	53.79	54.28	54.6	54.92	
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Average = Sum(39)_{1...12} /12= 54.4 (39)

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

(40)m=	0.93	0.92	0.92	0.91	0.9	0.89	0.89	0.89	0.9	0.9	0.91	0.92	
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Average = Sum(40)_{1...12} /12= 0.91 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.98 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 81.26 (43)

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

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

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

(44)m=	89.39	86.14	82.89	79.64	76.39	73.14	73.14	76.39	79.64	82.89	86.14	89.39	
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Total = Sum(44)_{1...12} = 975.17 (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=	132.56	115.94	119.64	104.31	100.08	86.36	80.03	91.83	92.93	108.3	118.22	128.38	
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Total = Sum(45)_{1...12} = 1278.6 (45)

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

(46)m=	19.88	17.39	17.95	15.65	15.01	12.95	12	13.78	13.94	16.25	17.73	19.26	(46)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

(61)m=	45.55	39.65	42.24	39.27	38.93	36.07	37.27	38.93	39.27	42.24	42.48	45.55	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	178.12	155.59	161.88	143.58	139.01	122.43	117.3	130.76	132.21	150.54	160.7	173.93	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

Output from water heater

(64)m=	178.12	155.59	161.88	143.58	139.01	122.43	117.3	130.76	132.21	150.54	160.7	173.93	
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Output from water heater (annual)_{1...12} 1766.05 (64)

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

(65)m=	55.47	48.46	50.34	44.5	43.01	37.73	35.93	40.27	40.72	46.57	49.93	54.07	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	(66)

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

(67)m=	15.42	13.69	11.13	8.43	6.3	5.32	5.75	7.47	10.03	12.73	14.86	15.84	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	172.95	174.74	170.22	160.59	148.44	137.02	129.38	127.59	132.11	141.74	153.89	165.32	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	(69)
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Pumps and fans gains (Table 5a)

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

(71)m=	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	(71)
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Water heating gains (Table 5)

(72)m=	74.55	72.12	67.66	61.81	57.81	52.41	48.29	54.12	56.55	62.59	69.35	72.68	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.64	316.27	304.74	286.55	268.27	250.47	239.15	244.91	254.42	272.79	293.83	309.57	(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.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.98	x	36.79	x	0.6	x	0.75	=	34.19	(77)
Southeast 0.9x	0.77	x	2.45	x	36.79	x	0.6	x	0.75	=	28.11	(77)
Southeast 0.9x	0.54	x	6.02	x	36.79	x	0.6	x	0.75	=	48.44	(77)
Southeast 0.9x	0.77	x	2.98	x	62.67	x	0.6	x	0.75	=	58.24	(77)
Southeast 0.9x	0.77	x	2.45	x	62.67	x	0.6	x	0.75	=	47.88	(77)
Southeast 0.9x	0.54	x	6.02	x	62.67	x	0.6	x	0.75	=	82.51	(77)
Southeast 0.9x	0.77	x	2.98	x	85.75	x	0.6	x	0.75	=	79.69	(77)
Southeast 0.9x	0.77	x	2.45	x	85.75	x	0.6	x	0.75	=	65.52	(77)
Southeast 0.9x	0.54	x	6.02	x	85.75	x	0.6	x	0.75	=	112.9	(77)
Southeast 0.9x	0.77	x	2.98	x	106.25	x	0.6	x	0.75	=	98.74	(77)
Southeast 0.9x	0.77	x	2.45	x	106.25	x	0.6	x	0.75	=	81.18	(77)
Southeast 0.9x	0.54	x	6.02	x	106.25	x	0.6	x	0.75	=	139.89	(77)
Southeast 0.9x	0.77	x	2.98	x	119.01	x	0.6	x	0.75	=	110.6	(77)
Southeast 0.9x	0.77	x	2.45	x	119.01	x	0.6	x	0.75	=	90.93	(77)
Southeast 0.9x	0.54	x	6.02	x	119.01	x	0.6	x	0.75	=	156.69	(77)
Southeast 0.9x	0.77	x	2.98	x	118.15	x	0.6	x	0.75	=	109.8	(77)
Southeast 0.9x	0.77	x	2.45	x	118.15	x	0.6	x	0.75	=	90.27	(77)
Southeast 0.9x	0.54	x	6.02	x	118.15	x	0.6	x	0.75	=	155.55	(77)
Southeast 0.9x	0.77	x	2.98	x	113.91	x	0.6	x	0.75	=	105.86	(77)
Southeast 0.9x	0.77	x	2.45	x	113.91	x	0.6	x	0.75	=	87.03	(77)
Southeast 0.9x	0.54	x	6.02	x	113.91	x	0.6	x	0.75	=	149.97	(77)
Southeast 0.9x	0.77	x	2.98	x	104.39	x	0.6	x	0.75	=	97.01	(77)
Southeast 0.9x	0.77	x	2.45	x	104.39	x	0.6	x	0.75	=	79.76	(77)
Southeast 0.9x	0.54	x	6.02	x	104.39	x	0.6	x	0.75	=	137.44	(77)
Southeast 0.9x	0.77	x	2.98	x	92.85	x	0.6	x	0.75	=	86.29	(77)
Southeast 0.9x	0.77	x	2.45	x	92.85	x	0.6	x	0.75	=	70.94	(77)
Southeast 0.9x	0.54	x	6.02	x	92.85	x	0.6	x	0.75	=	122.25	(77)
Southeast 0.9x	0.77	x	2.98	x	69.27	x	0.6	x	0.75	=	64.37	(77)
Southeast 0.9x	0.77	x	2.45	x	69.27	x	0.6	x	0.75	=	52.92	(77)
Southeast 0.9x	0.54	x	6.02	x	69.27	x	0.6	x	0.75	=	91.2	(77)
Southeast 0.9x	0.77	x	2.98	x	44.07	x	0.6	x	0.75	=	40.96	(77)
Southeast 0.9x	0.77	x	2.45	x	44.07	x	0.6	x	0.75	=	33.67	(77)
Southeast 0.9x	0.54	x	6.02	x	44.07	x	0.6	x	0.75	=	58.02	(77)
Southeast 0.9x	0.77	x	2.98	x	31.49	x	0.6	x	0.75	=	29.26	(77)
Southeast 0.9x	0.77	x	2.45	x	31.49	x	0.6	x	0.75	=	24.06	(77)
Southeast 0.9x	0.54	x	6.02	x	31.49	x	0.6	x	0.75	=	41.46	(77)
Southwest 0.9x	0.54	x	3	x	36.79	x	0.6	x	0.75	=	24.14	(79)
Southwest 0.9x	0.54	x	3	x	62.67	x	0.6	x	0.75	=	41.12	(79)
Southwest 0.9x	0.54	x	3	x	85.75	x	0.6	x	0.75	=	56.26	(79)

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Southwest 0.9x	0.54	x	3	x	106.25	0.6	x	0.75	=	69.71	(79)
Southwest 0.9x	0.54	x	3	x	119.01	0.6	x	0.75	=	78.08	(79)
Southwest 0.9x	0.54	x	3	x	118.15	0.6	x	0.75	=	77.52	(79)
Southwest 0.9x	0.54	x	3	x	113.91	0.6	x	0.75	=	74.74	(79)
Southwest 0.9x	0.54	x	3	x	104.39	0.6	x	0.75	=	68.49	(79)
Southwest 0.9x	0.54	x	3	x	92.85	0.6	x	0.75	=	60.92	(79)
Southwest 0.9x	0.54	x	3	x	69.27	0.6	x	0.75	=	45.45	(79)
Southwest 0.9x	0.54	x	3	x	44.07	0.6	x	0.75	=	28.91	(79)
Southwest 0.9x	0.54	x	3	x	31.49	0.6	x	0.75	=	20.66	(79)

Solar gains in watts, calculated for each month												(83)m = Sum(74)m ... (82)m	
(83)m=	134.89	229.76	314.37	389.52	436.3	433.14	417.59	382.7	340.4	253.94	161.56	115.44	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	453.52	546.04	619.11	676.07	704.57	683.61	656.74	627.61	594.82	526.73	455.39	425	(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	0.94	0.85	0.69	0.5	0.36	0.39	0.61	0.89	0.98	1	(86)

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

(87)m=

20.22	20.42	20.64	20.86	20.97	21	21	21	20.99	20.84	20.49	20.18
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(87)

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

(88)m=

20.15	20.15	20.15	20.16	20.16	20.17	20.17	20.18	20.17	20.16	20.16	20.15
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(88)

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

(89)m=

0.99	0.97	0.93	0.81	0.63	0.43	0.29	0.32	0.54	0.85	0.98	0.99
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(89)

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

(90)m=

19.12	19.4	19.72	20.01	20.13	20.17	20.17	20.18	20.16	20	19.51	19.07
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(90)

$fLA = \text{Living area} \div (4) =$

0.45

(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=

19.62	19.86	20.14	20.4	20.51	20.55	20.55	20.55	20.54	20.38	19.96	19.57
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(92)

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

(93)m=

19.47	19.71	19.99	20.25	20.36	20.4	20.4	20.4	20.39	20.23	19.81	19.42
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(93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	0.99	0.97	0.92	0.82	0.65	0.45	0.31	0.34	0.56	0.86	0.97	0.99
--------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	448.37	529.31	572.07	552.78	456.24	308.73	203.1	213.13	333.64	450.99	442.69	421.51
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
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Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97)m=	842.84	820.64	745.27	617.72	470.2	309.99	203.2	213.3	338.21	522.73	693.86	836.18
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DER WorkSheet: New dwelling design stage

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

(98)m=	293.49	195.77	128.86	46.76	10.39	0	0	0	0	53.37	180.84	308.52	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													1217.99 (98)

Space heating requirement in kWh/m²/year	20.3 (99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system	0 (201)
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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
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Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
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Efficiency of main space heating system 1	90.3 (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)

293.49	195.77	128.86	46.76	10.39	0	0	0	0	53.37	180.84	308.52		
211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)	
325.01	216.8	142.7	51.78	11.5	0	0	0	0	59.11	200.27	341.66		
Total (kWh/year) =Sum(211) _{1...5,10...12} =												1348.83	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

178.12	155.59	161.88	143.58	139.01	122.43	117.3	130.76	132.21	150.54	160.7	173.93	
Efficiency of water heater												81 (216)

(217)m=	86.55	85.93	84.87	83.1	81.58	81	81	81	81	83.24	85.67	86.71	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	205.8	181.06	190.73	172.77	170.39	151.15	144.81	161.43	163.22	180.84	187.58	200.59	
Total = Sum(219a) _{1...12} =													2110.38 (219)

Annual totals

Space heating fuel used, main system 1	kWh/year	1348.83 kWh/year
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Water heating fuel used	2110.38 kWh/year
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Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside	200.86 (230a)
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central heating pump:	30 (230c)
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Total electricity for the above, kWh/year	sum of (230a)...(230g) =	230.86 (231)
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Electricity for lighting	272.24 (232)
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12a. CO2 emissions – Individual heating systems including micro-CHP

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	291.35 (261)
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Space heating (secondary)	(215) x	0.519	=	0 (263)
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Water heating	(219) x	0.216	=	455.84 (264)
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Space and water heating	(261) + (262) + (263) + (264) =			747.19 (265)
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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	119.82 (267)
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Electricity for lighting	(232) x	0.519	=	141.29 (268)
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Total CO2, kg/year	sum of (265)...(271) =			1008.3 (272)
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Dwelling CO2 Emission Rate	(272) ÷ (4) =			16.8 (273)
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EI rating (section 14)				87 (274)
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DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Stroma Number: Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.10

Property Address: D1 1-12-2

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m²)	Av. Height(m)	Volume(m³)
Ground floor	60 (1a) x	2.8 (2a) =	168 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	168 (5)

2. Ventilation rate:

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

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20 ÷ (5) = 0.12 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>	
Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration [(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>	
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]x(8), otherwise (18) = (16)	0.37 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>	
Number of sides sheltered	3 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor (21) = (18) x (20) =	0.29 (21)

Infiltration rate modified for monthly wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7	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	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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TER WorkSheet: New dwelling design stage

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

0.36	0.36	0.35	0.31	0.31	0.27	0.27	0.26	0.29	0.31	0.32	0.34
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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d) If natural ventilation or whole house positive input ventilation from loft

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

(24d)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.98	x1/[1/(1.4)+ 0.04] =	3.95		
Windows Type 2			2.45	x1/[1/(1.4)+ 0.04] =	3.25		
Windows Type 3			6.02	x1/[1/(1.4)+ 0.04] =	7.98		
Windows Type 4			3	x1/[1/(1.4)+ 0.04] =	3.98		
Walls Type1	6.6	0	6.6	x 0.18 =	1.19		
Walls Type2	19.6	3	16.6	x 0.18 =	2.99		
Walls Type3	26.8	11.45	15.35	x 0.18 =	2.76		
Roof	60	0	60	x 0.13 =	7.8		
Total area of elements, m²			113				
Party wall			4.2	x 0 =	0		
Party wall			43.4	x 0 =	0		
Party floor			60				
Internal wall **			70.56				

* 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) = 33.9 (33)

Heat capacity Cm = S(A x k) (28)...(30) + (32) + (32a)...(32e) = 7466.74 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 14.6 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 48.49 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	31.41	31.26	31.12	30.46	30.34	29.77	29.77	29.66	29.99	30.34	30.59	30.85	(38)

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

(39)m=	79.9	79.76	79.62	78.96	78.83	78.26	78.26	78.15	78.48	78.83	79.08	79.34	
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Average = Sum(39)_{1...12} /12= 78.96 (39)

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

(40)m=	1.33	1.33	1.33	1.32	1.31	1.3	1.3	1.3	1.31	1.31	1.32	1.32	
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Average = Sum(40)_{1...12} /12= 1.32 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.98 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 81.26 (43)

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

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

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

(44)m=	89.39	86.14	82.89	79.64	76.39	73.14	73.14	76.39	79.64	82.89	86.14	89.39	
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Total = Sum(44)_{1...12} = 975.17 (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=	132.56	115.94	119.64	104.31	100.08	86.36	80.03	91.83	92.93	108.3	118.22	128.38	
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Total = Sum(45)_{1...12} = 1278.6 (45)

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

(46)m=	19.88	17.39	17.95	15.65	15.01	12.95	12	13.78	13.94	16.25	17.73	19.26	(46)
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Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

(61)m=	45.55	39.65	42.24	39.27	38.93	36.07	37.27	38.93	39.27	42.24	42.48	45.55	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	178.12	155.59	161.88	143.58	139.01	122.43	117.3	130.76	132.21	150.54	160.7	173.93	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

(64)m=	178.12	155.59	161.88	143.58	139.01	122.43	117.3	130.76	132.21	150.54	160.7	173.93	
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Output from water heater (annual)_{1...12} 1766.05 (64)

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

(65)m=	55.47	48.46	50.34	44.5	43.01	37.73	35.93	40.27	40.72	46.57	49.93	54.07	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	99.08	(66)

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

(67)m=	15.45	13.72	11.16	8.45	6.32	5.33	5.76	7.49	10.05	12.76	14.9	15.88	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	172.95	174.74	170.22	160.59	148.44	137.02	129.38	127.59	132.11	141.74	153.89	165.32	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	32.91	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

(71)m=	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	-79.27	(71)
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Water heating gains (Table 5)

(72)m=	74.55	72.12	67.66	61.81	57.81	52.41	48.29	54.12	56.55	62.59	69.35	72.68	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	318.67	316.31	304.77	286.57	268.29	250.48	239.16	244.93	254.44	272.82	293.86	309.6	(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.

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Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.98	x	36.79	x	0.63	x	0.7	=	33.51	(77)
Southeast 0.9x	0.77	x	2.45	x	36.79	x	0.63	x	0.7	=	27.55	(77)
Southeast 0.9x	0.54	x	6.02	x	36.79	x	0.63	x	0.7	=	47.47	(77)
Southeast 0.9x	0.77	x	2.98	x	62.67	x	0.63	x	0.7	=	57.08	(77)
Southeast 0.9x	0.77	x	2.45	x	62.67	x	0.63	x	0.7	=	46.93	(77)
Southeast 0.9x	0.54	x	6.02	x	62.67	x	0.63	x	0.7	=	80.86	(77)
Southeast 0.9x	0.77	x	2.98	x	85.75	x	0.63	x	0.7	=	78.1	(77)
Southeast 0.9x	0.77	x	2.45	x	85.75	x	0.63	x	0.7	=	64.21	(77)
Southeast 0.9x	0.54	x	6.02	x	85.75	x	0.63	x	0.7	=	110.64	(77)
Southeast 0.9x	0.77	x	2.98	x	106.25	x	0.63	x	0.7	=	96.77	(77)
Southeast 0.9x	0.77	x	2.45	x	106.25	x	0.63	x	0.7	=	79.56	(77)
Southeast 0.9x	0.54	x	6.02	x	106.25	x	0.63	x	0.7	=	137.09	(77)
Southeast 0.9x	0.77	x	2.98	x	119.01	x	0.63	x	0.7	=	108.39	(77)
Southeast 0.9x	0.77	x	2.45	x	119.01	x	0.63	x	0.7	=	89.11	(77)
Southeast 0.9x	0.54	x	6.02	x	119.01	x	0.63	x	0.7	=	153.55	(77)
Southeast 0.9x	0.77	x	2.98	x	118.15	x	0.63	x	0.7	=	107.6	(77)
Southeast 0.9x	0.77	x	2.45	x	118.15	x	0.63	x	0.7	=	88.47	(77)
Southeast 0.9x	0.54	x	6.02	x	118.15	x	0.63	x	0.7	=	152.44	(77)
Southeast 0.9x	0.77	x	2.98	x	113.91	x	0.63	x	0.7	=	103.74	(77)
Southeast 0.9x	0.77	x	2.45	x	113.91	x	0.63	x	0.7	=	85.29	(77)
Southeast 0.9x	0.54	x	6.02	x	113.91	x	0.63	x	0.7	=	146.97	(77)
Southeast 0.9x	0.77	x	2.98	x	104.39	x	0.63	x	0.7	=	95.07	(77)
Southeast 0.9x	0.77	x	2.45	x	104.39	x	0.63	x	0.7	=	78.16	(77)
Southeast 0.9x	0.54	x	6.02	x	104.39	x	0.63	x	0.7	=	134.69	(77)
Southeast 0.9x	0.77	x	2.98	x	92.85	x	0.63	x	0.7	=	84.56	(77)
Southeast 0.9x	0.77	x	2.45	x	92.85	x	0.63	x	0.7	=	69.52	(77)
Southeast 0.9x	0.54	x	6.02	x	92.85	x	0.63	x	0.7	=	119.8	(77)
Southeast 0.9x	0.77	x	2.98	x	69.27	x	0.63	x	0.7	=	63.08	(77)
Southeast 0.9x	0.77	x	2.45	x	69.27	x	0.63	x	0.7	=	51.86	(77)
Southeast 0.9x	0.54	x	6.02	x	69.27	x	0.63	x	0.7	=	89.37	(77)
Southeast 0.9x	0.77	x	2.98	x	44.07	x	0.63	x	0.7	=	40.14	(77)
Southeast 0.9x	0.77	x	2.45	x	44.07	x	0.63	x	0.7	=	33	(77)
Southeast 0.9x	0.54	x	6.02	x	44.07	x	0.63	x	0.7	=	56.86	(77)
Southeast 0.9x	0.77	x	2.98	x	31.49	x	0.63	x	0.7	=	28.68	(77)
Southeast 0.9x	0.77	x	2.45	x	31.49	x	0.63	x	0.7	=	23.58	(77)
Southeast 0.9x	0.54	x	6.02	x	31.49	x	0.63	x	0.7	=	40.63	(77)
Southwest 0.9x	0.54	x	3	x	36.79	x	0.63	x	0.7	=	23.66	(79)
Southwest 0.9x	0.54	x	3	x	62.67	x	0.63	x	0.7	=	40.3	(79)
Southwest 0.9x	0.54	x	3	x	85.75	x	0.63	x	0.7	=	55.14	(79)

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Southwest 0.9x	0.54	x	3	x	106.25	0.63	x	0.7	=	68.32	(79)
Southwest 0.9x	0.54	x	3	x	119.01	0.63	x	0.7	=	76.52	(79)
Southwest 0.9x	0.54	x	3	x	118.15	0.63	x	0.7	=	75.97	(79)
Southwest 0.9x	0.54	x	3	x	113.91	0.63	x	0.7	=	73.24	(79)
Southwest 0.9x	0.54	x	3	x	104.39	0.63	x	0.7	=	67.12	(79)
Southwest 0.9x	0.54	x	3	x	92.85	0.63	x	0.7	=	59.7	(79)
Southwest 0.9x	0.54	x	3	x	69.27	0.63	x	0.7	=	44.54	(79)
Southwest 0.9x	0.54	x	3	x	44.07	0.63	x	0.7	=	28.34	(79)
Southwest 0.9x	0.54	x	3	x	31.49	0.63	x	0.7	=	20.25	(79)

Solar gains in watts, calculated for each month												(83)m = Sum(74)m ... (82)m	
(83)m=	132.19	225.17	308.08	381.73	427.57	424.48	409.24	375.04	333.59	248.86	158.33	113.13	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	450.86	541.47	612.85	668.3	695.86	674.96	648.4	619.97	588.03	521.68	452.19	422.73	(84)

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.93	0.84	0.68	0.52	0.56	0.78	0.95	0.99	1	(86)

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

(87)m=

19.66	19.86	20.15	20.49	20.77	20.94	20.99	20.98	20.88	20.51	20.01	19.62
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(87)

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

(88)m=

19.82	19.82	19.82	19.83	19.83	19.84	19.84	19.84	19.83	19.83	19.83	19.82
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(88)

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

(89)m=

0.99	0.98	0.96	0.91	0.78	0.58	0.39	0.43	0.7	0.93	0.98	0.99
------	------	------	------	------	------	------	------	-----	------	------	------

(89)

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

(90)m=

18.06	18.36	18.77	19.26	19.62	19.8	19.83	19.83	19.74	19.28	18.58	18
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	----

(90)

$$fLA = \text{Living area} \div (4) =$$

0.45

(91)

Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92)m=

18.79	19.04	19.4	19.82	20.14	20.32	20.36	20.35	20.26	19.84	19.23	18.74
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(92)

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

(93)m=

18.79	19.04	19.4	19.82	20.14	20.32	20.36	20.35	20.26	19.84	19.23	18.74
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	0.99	0.98	0.96	0.91	0.8	0.62	0.45	0.49	0.73	0.93	0.98	0.99
--------	------	------	------	------	-----	------	------	------	------	------	------	------

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

(95)m=	446.8	530.8	586.99	605.3	556.9	421.5	289.59	302.36	430.05	482.83	444.04	419.79
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Monthly average external temperature from Table 8

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

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

(97)m=	1157.45	1128.08	1027.15	862.11	665.63	447.36	294.05	309	483.43	728.46	959.26	1153.4
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	528.72	401.37	327.47	184.9	80.89	0	0	0	0	182.74	370.96	545.81	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2622.88 (98)

Space heating requirement in kWh/m²/year	43.71 (99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system	0 (201)
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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
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Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
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Efficiency of main space heating system 1	93.4 (206)
---	------------

Efficiency of secondary/supplementary heating system, %	0 (208)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

528.72	401.37	327.47	184.9	80.89	0	0	0	0	182.74	370.96	545.81
--------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------

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

566.09	429.74	350.61	197.97	86.61	0	0	0	0	195.66	397.18	584.37	
Total (kWh/year) =Sum(211) _{1...5,10...12} =											2808.23	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

178.12	155.59	161.88	143.58	139.01	122.43	117.3	130.76	132.21	150.54	160.7	173.93
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Efficiency of water heater	80.3 (216)
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(217)m=	87.62	87.33	86.79	85.69	83.74	80.3	80.3	80.3	80.3	85.54	87.09	87.73	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.28	178.16	186.52	167.56	166	152.47	146.08	162.84	164.64	175.99	184.52	198.25	
Total = Sum(219a) _{1...12} =													2086.3 (219)

Annual totals

Space heating fuel used, main system 1	kWh/year	2808.23 kWh/year
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Water heating fuel used	2086.3 kWh/year
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Electricity for pumps, fans and electric keep-hot

central heating pump:	30 (230c)
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boiler with a fan-assisted flue	45 (230e)
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Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75 (231)
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Electricity for lighting	272.88 (232)
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12a. CO2 emissions – Individual heating systems including micro-CHP

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	606.58 (261)
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Space heating (secondary)	(215) x	0.519	=	0 (263)
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Water heating	(219) x	0.216	=	450.64 (264)
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Space and water heating	(261) + (262) + (263) + (264) =			1057.22 (265)
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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
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Electricity for lighting	(232) x	0.519	=	141.62 (268)
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Total CO2, kg/year	sum of (265)...(271) =			1237.77 (272)
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TER =				20.63 (273)
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DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: D1 2-3-2

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80 (1a) x	2.8 (2a) =	224 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	224 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
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			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.14 (21)

Infiltration rate modified for monthly wind speed

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

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

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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m=	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(24a)
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)
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d) If natural ventilation or whole house positive input ventilation from loft

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(25)
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A, m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Doors			2.2	1.3	2.86		
Windows Type 1			2.98	1.3	3.95		
Windows Type 2			5.95	1.3	7.89		
Windows Type 3			2.98	1.3	3.95		
Windows Type 4			5.95	1.3	7.89		
Walls Type1	22.8	8.93	13.87	0.2	2.77		
Walls Type2	4.5	2.2	2.3	0.2	0.46		
Walls Type3	22.8	8.93	13.87	0.2	2.77		
Walls Type4	27.4	0	27.4	0.2	5.48		
Roof	80	0	80	0.13	10.4		
Total area of elements, m ²			157.5				
Party wall			22.96	0	0		
Party floor			80				
Internal wall **			70.56				

* 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) = 48.43 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 9018.4 (34)

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

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

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can be used instead of a detailed calculation.

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

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

Ventilation heat loss calculated monthly

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.76	21.51	21.25	19.97	19.71	18.43	18.43	18.17	18.94	19.71	20.22	20.74	(38)

Heat transfer coefficient, W/K

(39)m=	78.79	78.53	78.28	76.99	76.74	75.46	75.46	75.2	75.97	76.74	77.25	77.76	
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Heat loss parameter (HLP), W/m²K

(40)m=	0.98	0.98	0.98	0.96	0.96	0.94	0.94	0.94	0.95	0.96	0.97	0.97	
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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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	101.96	98.25	94.55	90.84	87.13	83.42	83.42	87.13	90.84	94.55	98.25	101.96	
	Total = Sum(44) _{1...12} =											1112.32	(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=	151.21	132.25	136.47	118.97	114.16	98.51	91.28	104.75	106	123.53	134.85	146.44	
	Total = Sum(45) _{1...12} =											1458.42	(45)

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

(46)m=	22.68	19.84	20.47	17.85	17.12	14.78	13.69	15.71	15.9	18.53	20.23	21.97	(46)
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Water storage loss:

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

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)
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Temperature factor from Table 2b	0	(53)
----------------------------------	---	------

DER WorkSheet: New dwelling design stage

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=	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

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

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

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

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

(61)m=	50.96	45.22	48.18	44.8	44.4	41.14	42.51	44.4	44.8	48.18	48.45	50.96	(61)
--------	-------	-------	-------	------	------	-------	-------	------	------	-------	-------	-------	------

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

(62)m=	202.17	177.47	184.65	163.77	158.56	139.65	133.8	149.15	150.8	171.71	183.3	197.39	(62)
--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	-------	--------	------

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

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

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

Output from water heater

(64)m=	202.17	177.47	184.65	163.77	158.56	139.65	133.8	149.15	150.8	171.71	183.3	197.39	
	Output from water heater (annual) _{1...12}											2012.43	(64)

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

(65)m=	63.02	55.28	57.42	50.76	49.06	43.04	40.98	45.93	46.44	53.12	56.95	61.43	(65)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.14	123.14	123.14	123.14	123.14	123.14	123.14	123.14	123.14	123.14	123.14	123.14	(66)

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

(67)m=	19.56	17.38	14.13	10.7	8	6.75	7.3	9.48	12.73	16.16	18.86	20.11	(67)
--------	-------	-------	-------	------	---	------	-----	------	-------	-------	-------	-------	------

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

(68)m=	219.44	221.72	215.98	203.76	188.34	173.85	164.17	161.89	167.63	179.84	195.27	209.76	(68)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	84.7	82.26	77.18	70.5	65.94	59.78	55.08	61.73	64.51	71.4	79.1	82.57	(72)
--------	------	-------	-------	------	-------	-------	-------	-------	-------	------	------	-------	------

Total internal gains =

(73)m=	386.65	384.3	370.23	347.9	325.22	303.32	289.49	296.05	307.81	330.35	356.17	375.37	(73)
--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

6. Solar gains:

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

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.98	x	36.79	x	0.6	x	0.75	=	34.19	(77)
Southeast 0.9x	0.77	x	5.95	x	36.79	x	0.6	x	0.75	=	68.27	(77)
Southeast 0.9x	0.77	x	2.98	x	62.67	x	0.6	x	0.75	=	58.24	(77)
Southeast 0.9x	0.77	x	5.95	x	62.67	x	0.6	x	0.75	=	116.29	(77)
Southeast 0.9x	0.77	x	2.98	x	85.75	x	0.6	x	0.75	=	79.69	(77)
Southeast 0.9x	0.77	x	5.95	x	85.75	x	0.6	x	0.75	=	159.11	(77)
Southeast 0.9x	0.77	x	2.98	x	106.25	x	0.6	x	0.75	=	98.74	(77)
Southeast 0.9x	0.77	x	5.95	x	106.25	x	0.6	x	0.75	=	197.15	(77)
Southeast 0.9x	0.77	x	2.98	x	119.01	x	0.6	x	0.75	=	110.6	(77)
Southeast 0.9x	0.77	x	5.95	x	119.01	x	0.6	x	0.75	=	220.83	(77)
Southeast 0.9x	0.77	x	2.98	x	118.15	x	0.6	x	0.75	=	109.8	(77)
Southeast 0.9x	0.77	x	5.95	x	118.15	x	0.6	x	0.75	=	219.23	(77)
Southeast 0.9x	0.77	x	2.98	x	113.91	x	0.6	x	0.75	=	105.86	(77)
Southeast 0.9x	0.77	x	5.95	x	113.91	x	0.6	x	0.75	=	211.36	(77)
Southeast 0.9x	0.77	x	2.98	x	104.39	x	0.6	x	0.75	=	97.01	(77)
Southeast 0.9x	0.77	x	5.95	x	104.39	x	0.6	x	0.75	=	193.7	(77)
Southeast 0.9x	0.77	x	2.98	x	92.85	x	0.6	x	0.75	=	86.29	(77)
Southeast 0.9x	0.77	x	5.95	x	92.85	x	0.6	x	0.75	=	172.29	(77)
Southeast 0.9x	0.77	x	2.98	x	69.27	x	0.6	x	0.75	=	64.37	(77)
Southeast 0.9x	0.77	x	5.95	x	69.27	x	0.6	x	0.75	=	128.53	(77)
Southeast 0.9x	0.77	x	2.98	x	44.07	x	0.6	x	0.75	=	40.96	(77)
Southeast 0.9x	0.77	x	5.95	x	44.07	x	0.6	x	0.75	=	81.77	(77)
Southeast 0.9x	0.77	x	2.98	x	31.49	x	0.6	x	0.75	=	29.26	(77)
Southeast 0.9x	0.77	x	5.95	x	31.49	x	0.6	x	0.75	=	58.43	(77)
Northwest 0.9x	0.77	x	2.98	x	11.28	x	0.6	x	0.75	=	10.49	(81)
Northwest 0.9x	0.77	x	5.95	x	11.28	x	0.6	x	0.75	=	20.94	(81)
Northwest 0.9x	0.77	x	2.98	x	22.97	x	0.6	x	0.75	=	21.34	(81)
Northwest 0.9x	0.77	x	5.95	x	22.97	x	0.6	x	0.75	=	42.61	(81)
Northwest 0.9x	0.77	x	2.98	x	41.38	x	0.6	x	0.75	=	38.45	(81)
Northwest 0.9x	0.77	x	5.95	x	41.38	x	0.6	x	0.75	=	76.78	(81)
Northwest 0.9x	0.77	x	2.98	x	67.96	x	0.6	x	0.75	=	63.15	(81)
Northwest 0.9x	0.77	x	5.95	x	67.96	x	0.6	x	0.75	=	126.09	(81)
Northwest 0.9x	0.77	x	2.98	x	91.35	x	0.6	x	0.75	=	84.89	(81)
Northwest 0.9x	0.77	x	5.95	x	91.35	x	0.6	x	0.75	=	169.49	(81)
Northwest 0.9x	0.77	x	2.98	x	97.38	x	0.6	x	0.75	=	90.5	(81)
Northwest 0.9x	0.77	x	5.95	x	97.38	x	0.6	x	0.75	=	180.7	(81)
Northwest 0.9x	0.77	x	2.98	x	91.1	x	0.6	x	0.75	=	84.66	(81)
Northwest 0.9x	0.77	x	5.95	x	91.1	x	0.6	x	0.75	=	169.04	(81)
Northwest 0.9x	0.77	x	2.98	x	72.63	x	0.6	x	0.75	=	67.49	(81)

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Northwest 0.9x	0.77	x	5.95	x	72.63	x	0.6	x	0.75	=	134.76	(81)
Northwest 0.9x	0.77	x	2.98	x	50.42	x	0.6	x	0.75	=	46.86	(81)
Northwest 0.9x	0.77	x	5.95	x	50.42	x	0.6	x	0.75	=	93.56	(81)
Northwest 0.9x	0.77	x	2.98	x	28.07	x	0.6	x	0.75	=	26.08	(81)
Northwest 0.9x	0.77	x	5.95	x	28.07	x	0.6	x	0.75	=	52.08	(81)
Northwest 0.9x	0.77	x	2.98	x	14.2	x	0.6	x	0.75	=	13.19	(81)
Northwest 0.9x	0.77	x	5.95	x	14.2	x	0.6	x	0.75	=	26.34	(81)
Northwest 0.9x	0.77	x	2.98	x	9.21	x	0.6	x	0.75	=	8.56	(81)
Northwest 0.9x	0.77	x	5.95	x	9.21	x	0.6	x	0.75	=	17.1	(81)

Solar gains in watts, calculated for each month												(83)m = Sum(74)m ... (82)m	
(83)m=	133.89	238.49	354.04	485.14	585.81	600.22	570.92	492.96	398.99	271.06	162.26	113.35	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	520.53	622.79	724.27	833.04	911.03	903.55	860.4	789.01	706.79	601.41	518.43	488.72	(84)

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.73	0.53	0.39	0.44	0.7	0.94	0.99	1	(86)

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

(87)m=

20.04	20.22	20.48	20.78	20.94	20.99	21	21	20.97	20.72	20.32	20.01
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(87)

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

(88)m=

20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.13	20.12	20.11	20.11
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(88)

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

(89)m=

1	0.99	0.96	0.87	0.68	0.46	0.31	0.36	0.63	0.92	0.99	1
---	------	------	------	------	------	------	------	------	------	------	---

(89)

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

(90)m=

18.81	19.07	19.45	19.86	20.07	20.13	20.13	20.13	20.1	19.8	19.24	18.77
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(90)

fLA = Living area ÷ (4) =

0.37

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2													
(92)m=	19.26	19.49	19.82	20.2	20.39	20.44	20.45	20.45	20.42	20.14	19.63	19.22	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m=	19.11	19.34	19.67	20.05	20.24	20.29	20.3	20.3	20.27	19.99	19.48	19.07	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains, h_m :												
(94)m=	0.99	0.99	0.96	0.87	0.69	0.47	0.32	0.37	0.64	0.92	0.99	1

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

(95)m=	517.62	613.49	692.91	721.06	625.02	426.76	278.76	292.66	453.56	552.45	511.5	486.75
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Monthly average external temperature from Table 8

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

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

(97)m=	1166.58	1134.04	1031.19	858.26	655.14	429.56	279	293.18	468.56	720.48	956.52	1156.67
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DER WorkSheet: New dwelling design stage

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

(98)m=	482.83	349.81	251.68	98.78	22.41	0	0	0	0	125.02	320.41	498.42	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2149.36 (98)

Space heating requirement in kWh/m²/year	26.87 (99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system	0 (201)
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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
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Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
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Efficiency of main space heating system 1	90.3 (206)
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Efficiency of secondary/supplementary heating system, %	0 (208)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

482.83	349.81	251.68	98.78	22.41	0	0	0	0	125.02	320.41	498.42	
211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
534.69	387.38	278.71	109.39	24.82	0	0	0	0	138.44	354.83	551.96	
Total (kWh/year) =Sum(211) _{1...5,10...12} =												2380.24 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

202.17	177.47	184.65	163.77	158.56	139.65	133.8	149.15	150.8	171.71	183.3	197.39		
Efficiency of water heater												81	(216)

(217)m=	87.34	86.94	86.12	84.27	82.05	81	81	81	81	84.67	86.68	87.45	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	231.47	204.13	214.42	194.35	193.26	172.41	165.18	184.14	186.17	202.79	211.47	225.72	
Total = Sum(219a) _{1...12} =													2385.51 (219)

Annual totals

Space heating fuel used, main system 1	kWh/year	2380.24 kWh/year
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Water heating fuel used	2385.51
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Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside	267.81 (230a)
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central heating pump:	30 (230c)
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Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.81 (231)
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Electricity for lighting	345.49 (232)
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12a. CO2 emissions – Individual heating systems including micro-CHP

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	514.13 (261)
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Space heating (secondary)	(215) x	0.519	=	0 (263)
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Water heating	(219) x	0.216	=	515.27 (264)
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Space and water heating	(261) + (262) + (263) + (264) =			1029.4 (265)
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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	154.57 (267)
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Electricity for lighting	(232) x	0.519	=	179.31 (268)
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Total CO2, kg/year	sum of (265)...(271) =			1363.28 (272)
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Dwelling CO2 Emission Rate	(272) ÷ (4) =			17.04 (273)
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EI rating (section 14)				85 (274)
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DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Stroma Number:
Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.10

Property Address: D1 2-3-2

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80 (1a) x	2.8 (2a) =	224 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	224 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)		
Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35		
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]x(8), otherwise (18) = (16)		0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used		
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.36 (21)

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

Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42
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Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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d) If natural ventilation or whole house positive input ventilation from loft

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

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m2K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Doors			2.2	1	2.2		
Windows Type 1			2.97	x1/[1/(1.4)+ 0.04] =	3.94		
Windows Type 2			5.93	x1/[1/(1.4)+ 0.04] =	7.86		
Windows Type 3			2.97	x1/[1/(1.4)+ 0.04] =	3.94		
Windows Type 4			5.93	x1/[1/(1.4)+ 0.04] =	7.86		
Walls Type1	22.8	8.9	13.9	x 0.18 =	2.5		
Walls Type2	4.5	2.2	2.3	x 0.18 =	0.41		
Walls Type3	22.8	8.9	13.9	x 0.18 =	2.5		
Walls Type4	27.4	0	27.4	x 0.18 =	4.93		
Roof	80	0	80	x 0.13 =	10.4		
Total area of elements, m ²			157.5				
Party wall			22.96	x 0 =	0		
Party floor			80				
Internal wall **			70.56				

* 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) = 46.55 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 9019.24 (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

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can be used instead of a detailed calculation.

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

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

Ventilation heat loss calculated monthly

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.54	44.24	43.96	42.6	42.35	41.17	41.17	40.95	41.62	42.35	42.86	43.4	(38)

Heat transfer coefficient, W/K

(39)m=	112.31	112.02	111.73	110.37	110.12	108.94	108.94	108.72	109.39	110.12	110.63	111.17	
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Heat loss parameter (HLP), W/m²K

(40)m=	1.4	1.4	1.4	1.38	1.38	1.36	1.36	1.36	1.37	1.38	1.38	1.39	
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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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	101.96	98.25	94.55	90.84	87.13	83.42	83.42	87.13	90.84	94.55	98.25	101.96	

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

Total = Sum(44)_{1...12} = 1112.32 (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=	151.21	132.25	136.47	118.97	114.16	98.51	91.28	104.75	106	123.53	134.85	146.44	
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Total = Sum(45)_{1...12} = 1458.42 (45)

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

(46)m=	22.68	19.84	20.47	17.85	17.12	14.78	13.69	15.71	15.9	18.53	20.23	21.97	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
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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)
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Energy lost from water storage, kWh/year	(48) x (49) = 0	(50)
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b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
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If community heating see section 4.3

Volume factor from Table 2a	0	(52)
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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=	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

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

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

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

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

(61)m=	50.96	45.22	48.18	44.8	44.4	41.14	42.51	44.4	44.8	48.18	48.45	50.96	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.17	177.47	184.65	163.77	158.56	139.65	133.8	149.15	150.8	171.71	183.3	197.39	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

(64)m=	202.17	177.47	184.65	163.77	158.56	139.65	133.8	149.15	150.8	171.71	183.3	197.39	
	Output from water heater (annual) _{1...12}											2012.43	(64)

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

(65)m=	63.02	55.28	57.42	50.76	49.06	43.04	40.98	45.93	46.44	53.12	56.95	61.43	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.14	123.14	123.14	123.14	123.14	123.14	123.14	123.14	123.14	123.14	123.14	123.14	(66)

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

(67)m=	19.56	17.38	14.13	10.7	8	6.75	7.3	9.48	12.73	16.16	18.86	20.11	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	219.44	221.72	215.98	203.76	188.34	173.85	164.17	161.89	167.63	179.84	195.27	209.76	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	(69)
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Pumps and fans gains (Table 5a)

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

(71)m=	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	-98.51	(71)
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Water heating gains (Table 5)

(72)m=	84.7	82.26	77.18	70.5	65.94	59.78	55.08	61.73	64.51	71.4	79.1	82.57	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	386.65	384.3	370.23	347.9	325.22	303.32	289.49	296.05	307.81	330.35	356.17	375.38	(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.

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Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.97	x	36.79	x	0.63	x	0.7	=	33.4	(77)
Southeast 0.9x	0.77	x	5.93	x	36.79	x	0.63	x	0.7	=	66.68	(77)
Southeast 0.9x	0.77	x	2.97	x	62.67	x	0.63	x	0.7	=	56.89	(77)
Southeast 0.9x	0.77	x	5.93	x	62.67	x	0.63	x	0.7	=	113.58	(77)
Southeast 0.9x	0.77	x	2.97	x	85.75	x	0.63	x	0.7	=	77.84	(77)
Southeast 0.9x	0.77	x	5.93	x	85.75	x	0.63	x	0.7	=	155.41	(77)
Southeast 0.9x	0.77	x	2.97	x	106.25	x	0.63	x	0.7	=	96.44	(77)
Southeast 0.9x	0.77	x	5.93	x	106.25	x	0.63	x	0.7	=	192.56	(77)
Southeast 0.9x	0.77	x	2.97	x	119.01	x	0.63	x	0.7	=	108.02	(77)
Southeast 0.9x	0.77	x	5.93	x	119.01	x	0.63	x	0.7	=	215.68	(77)
Southeast 0.9x	0.77	x	2.97	x	118.15	x	0.63	x	0.7	=	107.24	(77)
Southeast 0.9x	0.77	x	5.93	x	118.15	x	0.63	x	0.7	=	214.12	(77)
Southeast 0.9x	0.77	x	2.97	x	113.91	x	0.63	x	0.7	=	103.39	(77)
Southeast 0.9x	0.77	x	5.93	x	113.91	x	0.63	x	0.7	=	206.44	(77)
Southeast 0.9x	0.77	x	2.97	x	104.39	x	0.63	x	0.7	=	94.75	(77)
Southeast 0.9x	0.77	x	5.93	x	104.39	x	0.63	x	0.7	=	189.19	(77)
Southeast 0.9x	0.77	x	2.97	x	92.85	x	0.63	x	0.7	=	84.28	(77)
Southeast 0.9x	0.77	x	5.93	x	92.85	x	0.63	x	0.7	=	168.27	(77)
Southeast 0.9x	0.77	x	2.97	x	69.27	x	0.63	x	0.7	=	62.87	(77)
Southeast 0.9x	0.77	x	5.93	x	69.27	x	0.63	x	0.7	=	125.53	(77)
Southeast 0.9x	0.77	x	2.97	x	44.07	x	0.63	x	0.7	=	40	(77)
Southeast 0.9x	0.77	x	5.93	x	44.07	x	0.63	x	0.7	=	79.87	(77)
Southeast 0.9x	0.77	x	2.97	x	31.49	x	0.63	x	0.7	=	28.58	(77)
Southeast 0.9x	0.77	x	5.93	x	31.49	x	0.63	x	0.7	=	57.06	(77)
Northwest 0.9x	0.77	x	2.97	x	11.28	x	0.63	x	0.7	=	10.24	(81)
Northwest 0.9x	0.77	x	5.93	x	11.28	x	0.63	x	0.7	=	20.45	(81)
Northwest 0.9x	0.77	x	2.97	x	22.97	x	0.63	x	0.7	=	20.85	(81)
Northwest 0.9x	0.77	x	5.93	x	22.97	x	0.63	x	0.7	=	41.62	(81)
Northwest 0.9x	0.77	x	2.97	x	41.38	x	0.63	x	0.7	=	37.56	(81)
Northwest 0.9x	0.77	x	5.93	x	41.38	x	0.63	x	0.7	=	74.99	(81)
Northwest 0.9x	0.77	x	2.97	x	67.96	x	0.63	x	0.7	=	61.68	(81)
Northwest 0.9x	0.77	x	5.93	x	67.96	x	0.63	x	0.7	=	123.16	(81)
Northwest 0.9x	0.77	x	2.97	x	91.35	x	0.63	x	0.7	=	82.91	(81)
Northwest 0.9x	0.77	x	5.93	x	91.35	x	0.63	x	0.7	=	165.54	(81)
Northwest 0.9x	0.77	x	2.97	x	97.38	x	0.63	x	0.7	=	88.39	(81)
Northwest 0.9x	0.77	x	5.93	x	97.38	x	0.63	x	0.7	=	176.49	(81)
Northwest 0.9x	0.77	x	2.97	x	91.1	x	0.63	x	0.7	=	82.69	(81)
Northwest 0.9x	0.77	x	5.93	x	91.1	x	0.63	x	0.7	=	165.1	(81)
Northwest 0.9x	0.77	x	2.97	x	72.63	x	0.63	x	0.7	=	65.92	(81)

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Northwest 0.9x	0.77	x	5.93	x	72.63	x	0.63	x	0.7	=	131.62	(81)
Northwest 0.9x	0.77	x	2.97	x	50.42	x	0.63	x	0.7	=	45.77	(81)
Northwest 0.9x	0.77	x	5.93	x	50.42	x	0.63	x	0.7	=	91.38	(81)
Northwest 0.9x	0.77	x	2.97	x	28.07	x	0.63	x	0.7	=	25.48	(81)
Northwest 0.9x	0.77	x	5.93	x	28.07	x	0.63	x	0.7	=	50.87	(81)
Northwest 0.9x	0.77	x	2.97	x	14.2	x	0.63	x	0.7	=	12.89	(81)
Northwest 0.9x	0.77	x	5.93	x	14.2	x	0.63	x	0.7	=	25.73	(81)
Northwest 0.9x	0.77	x	2.97	x	9.21	x	0.63	x	0.7	=	8.36	(81)
Northwest 0.9x	0.77	x	5.93	x	9.21	x	0.63	x	0.7	=	16.7	(81)

Solar gains in watts, calculated for each month												(83)m = Sum(74)m ... (82)m	
(83)m=	130.77	232.94	345.79	473.84	572.16	586.24	557.62	481.48	389.7	264.75	158.48	110.71	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	517.41	617.23	716.02	821.74	897.38	889.57	847.11	777.53	697.5	595.09	514.65	486.08	(84)

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.98	0.95	0.86	0.7	0.54	0.61	0.84	0.97	0.99	1

(86)

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

(87)m=

19.47	19.66	19.97	20.37	20.72	20.92	20.98	20.97	20.81	20.36	19.84	19.44
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(87)

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

(88)m=

19.76	19.76	19.77	19.78	19.78	19.79	19.79	19.79	19.79	19.78	19.78	19.77
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(88)

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

(89)m=

1	0.99	0.98	0.93	0.81	0.6	0.41	0.47	0.77	0.96	0.99	1
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(89)

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

(90)m=

17.75	18.03	18.48	19.06	19.51	19.74	19.79	19.78	19.64	19.05	18.31	17.72
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(90)

fLA = Living area ÷ (4) =

0.37

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2													
(92)m=	18.38	18.63	19.02	19.54	19.95	20.17	20.22	20.22	20.07	19.53	18.87	18.35	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m=	18.38	18.63	19.02	19.54	19.95	20.17	20.22	20.22	20.07	19.53	18.87	18.35	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains, h_m :												
(94) $m=$	0.99	0.99	0.97	0.93	0.82	0.64	0.46	0.52	0.79	0.95	0.99	1

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

(95) $m=$	514.55	609.92	696.04	760.6	734.64	565.91	387.12	402.25	548.61	566.93	509.11	484
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Monthly average external temperature from Table 8

(96) $m=$	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
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Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97) $m=$	1581.53	1537.66	1399.17	1174.28	908.77	607.01	394.55	414.81	653.01	983.33	1301.81	1572.83
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TER WorkSheet: New dwelling design stage

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

(98)m=	793.84	623.44	523.13	297.85	129.56	0	0	0	0	309.8	570.75	810.09	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													4058.45 (98)

Space heating requirement in kWh/m²/year	50.73 (99)
--	------------

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

Space heating:

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

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

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

Efficiency of main space heating system 1	93.4 (206)
---	------------

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

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

Space heating requirement (calculated above)

793.84	623.44	523.13	297.85	129.56	0	0	0	0	309.8	570.75	810.09
--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------

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

849.93	667.49	560.1	318.9	138.71	0	0	0	0	331.69	611.08	867.33	
Total (kWh/year) =Sum(211) _{1...5,10...12} =											4345.24	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

202.17	177.47	184.65	163.77	158.56	139.65	133.8	149.15	150.8	171.71	183.3	197.39
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Efficiency of water heater	80.3 (216)
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(217)m=	88.15	87.95	87.53	86.54	84.55	80.3	80.3	80.3	80.3	86.52	87.72	88.23	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.34	201.79	210.96	189.25	187.54	173.91	166.62	185.74	187.79	198.47	208.97	223.74	
Total = Sum(219a) _{1...12} =													2364.12 (219)

Annual totals

Space heating fuel used, main system 1	kWh/year	4345.24 kWh/year
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Water heating fuel used	2364.12 kWh/year
-------------------------	------------------

Electricity for pumps, fans and electric keep-hot

central heating pump:	30 (230c)
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boiler with a fan-assisted flue	45 (230e)
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Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75 (231)
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Electricity for lighting	345.51 (232)
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12a. CO2 emissions – Individual heating systems including micro-CHP

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	938.57 (261)
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Space heating (secondary)	(215) x	0.519	=	0 (263)
---------------------------	---------	-------	---	---------

Water heating	(219) x	0.216	=	510.65 (264)
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Space and water heating	(261) + (262) + (263) + (264) =			1449.22 (265)
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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
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Electricity for lighting	(232) x	0.519	=	179.32 (268)
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Total CO2, kg/year	sum of (265)...(271) =			1667.47 (272)
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TER =				20.84 (273)
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DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name:

Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: E 1-2-2

Address :

5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	95.6 (1a) x	2.8 (2a) =	267.68 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	95.6 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	267.68 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			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

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration 0.25 - [0.2 x (14) ÷ 100] =

Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

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

Number of sides sheltered

Shelter factor (20) = 1 - [0.075 x (19)] =

Infiltration rate incorporating shelter factor (21) = (18) x (20) =

Infiltration rate modified for monthly wind speed

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

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

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

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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(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)
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d) If natural ventilation or whole house positive input ventilation from loft

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Windows Type 1			1.79	x 1/[1/(1.4) + 0.04] =	2.37		(27)
Windows Type 2			2.99	x 1/[1/(1.4) + 0.04] =	3.96		(27)
Windows Type 3			5.86	x 1/[1/(1.4) + 0.04] =	7.77		(27)
Windows Type 4			2.99	x 1/[1/(1.4) + 0.04] =	3.96		(27)
Windows Type 5			2.99	x 1/[1/(1.4) + 0.04] =	3.96		(27)
Windows Type 6			2.99	x 1/[1/(1.4) + 0.04] =	3.96		(27)
Windows Type 7			2.99	x 1/[1/(1.4) + 0.04] =	3.96		(27)
Walls Type1	30.7	10.64	20.06	x 0.2 =	4.01		(29)
Walls Type2	32.8	0	32.8	x 0.2 =	6.56		(29)
Walls Type3	5	0	5	x 0.2 =	1		(29)
Walls Type4	5	11.96	-6.96	x 0.2 =	-1.39		(29)
Total area of elements, m ²			73.5				(31)
Party wall			21	x 0 =	0		(32)
Party wall			26.88	x 0 =	0		(32)
Party floor			95.6				(32a)
Party ceiling			95.6				(32b)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 40.14 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 18878.2 (34)

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

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

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can be used instead of a detailed calculation.

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

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

Ventilation heat loss calculated monthly

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	24.74	24.46	24.18	22.77	22.49	21.08	21.08	20.8	21.64	22.49	23.05	23.61	(38)

Heat transfer coefficient, W/K

(39)m=	73.56	73.28	73	71.59	71.31	69.9	69.9	69.62	70.47	71.31	71.87	72.44	
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Heat loss parameter (HLP), W/m²K

(40)m=	0.77	0.77	0.76	0.75	0.75	0.73	0.73	0.73	0.74	0.75	0.75	0.76	
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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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	108.02	104.1	100.17	96.24	92.31	88.38	88.38	92.31	96.24	100.17	104.1	108.02	

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

Total = Sum(44)₁...₁₂ = 1178.44 (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=	160.2	140.11	144.58	126.05	120.95	104.37	96.71	110.98	112.3	130.88	142.86	155.14	
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Total = Sum(45)₁...₁₂ = 1545.13 (45)

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

(46)m=	24.03	21.02	21.69	18.91	18.14	15.66	14.51	16.65	16.85	19.63	21.43	23.27	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water storage loss:

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

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):

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

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

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

If community heating see section 4.3

Volume factor from Table 2a

Temperature factor from Table 2b

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Energy lost from water storage, kWh/year

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

Water storage loss calculated for each month

(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

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

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

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

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

(61)m=	50.96	46.03	50.96	47.46	47.04	43.59	45.04	47.04	47.46	50.96	49.32	50.96	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.16	186.14	195.54	173.51	167.99	147.95	141.75	158.02	159.76	181.84	192.18	206.1	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

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

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

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

Output from water heater

(64)m=	211.16	186.14	195.54	173.51	167.99	147.95	141.75	158.02	159.76	181.84	192.18	206.1	
	Output from water heater (annual)₁...₁₂											2121.93	(64)

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

(65)m=	66.01	58.09	60.81	53.78	51.97	45.6	43.42	48.66	49.21	56.26	59.83	64.32	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	134.74	134.74	134.74	134.74	134.74	134.74	134.74	134.74	134.74	134.74	134.74	134.74	(66)

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

(67)m=	22.2	19.72	16.04	12.14	9.07	7.66	8.28	10.76	14.44	18.34	21.4	22.82	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	249.01	251.6	245.08	231.22	213.72	197.28	186.29	183.71	190.22	204.08	221.58	238.02	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.47	36.47	36.47	36.47	36.47	36.47	36.47	36.47	36.47	36.47	36.47	36.47	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

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

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

(71)m=	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	88.72	86.45	81.74	74.69	69.86	63.33	58.36	65.4	68.34	75.61	83.1	86.46	(72)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	------

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

(73)m=	426.35	424.18	409.28	384.47	359.08	334.69	319.35	326.29	339.43	364.46	392.5	413.72	(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.

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Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest0.9x	0.77	x	1.79	x	36.79	x	0.6	x	0.75	=	20.54	(79)
Southwest0.9x	0.77	x	2.99	x	36.79	x	0.6	x	0.75	=	34.31	(79)
Southwest0.9x	0.54	x	5.86	x	36.79	x	0.6	x	0.75	=	47.15	(79)
Southwest0.9x	0.77	x	1.79	x	62.67	x	0.6	x	0.75	=	34.99	(79)
Southwest0.9x	0.77	x	2.99	x	62.67	x	0.6	x	0.75	=	58.44	(79)
Southwest0.9x	0.54	x	5.86	x	62.67	x	0.6	x	0.75	=	80.32	(79)
Southwest0.9x	0.77	x	1.79	x	85.75	x	0.6	x	0.75	=	47.87	(79)
Southwest0.9x	0.77	x	2.99	x	85.75	x	0.6	x	0.75	=	79.96	(79)
Southwest0.9x	0.54	x	5.86	x	85.75	x	0.6	x	0.75	=	109.9	(79)
Southwest0.9x	0.77	x	1.79	x	106.25	x	0.6	x	0.75	=	59.31	(79)
Southwest0.9x	0.77	x	2.99	x	106.25	x	0.6	x	0.75	=	99.07	(79)
Southwest0.9x	0.54	x	5.86	x	106.25	x	0.6	x	0.75	=	136.17	(79)
Southwest0.9x	0.77	x	1.79	x	119.01	x	0.6	x	0.75	=	66.43	(79)
Southwest0.9x	0.77	x	2.99	x	119.01	x	0.6	x	0.75	=	110.97	(79)
Southwest0.9x	0.54	x	5.86	x	119.01	x	0.6	x	0.75	=	152.52	(79)
Southwest0.9x	0.77	x	1.79	x	118.15	x	0.6	x	0.75	=	65.95	(79)
Southwest0.9x	0.77	x	2.99	x	118.15	x	0.6	x	0.75	=	110.17	(79)
Southwest0.9x	0.54	x	5.86	x	118.15	x	0.6	x	0.75	=	151.42	(79)
Southwest0.9x	0.77	x	1.79	x	113.91	x	0.6	x	0.75	=	63.59	(79)
Southwest0.9x	0.77	x	2.99	x	113.91	x	0.6	x	0.75	=	106.21	(79)
Southwest0.9x	0.54	x	5.86	x	113.91	x	0.6	x	0.75	=	145.98	(79)
Southwest0.9x	0.77	x	1.79	x	104.39	x	0.6	x	0.75	=	58.27	(79)
Southwest0.9x	0.77	x	2.99	x	104.39	x	0.6	x	0.75	=	97.34	(79)
Southwest0.9x	0.54	x	5.86	x	104.39	x	0.6	x	0.75	=	133.78	(79)
Southwest0.9x	0.77	x	1.79	x	92.85	x	0.6	x	0.75	=	51.83	(79)
Southwest0.9x	0.77	x	2.99	x	92.85	x	0.6	x	0.75	=	86.58	(79)
Southwest0.9x	0.54	x	5.86	x	92.85	x	0.6	x	0.75	=	119	(79)
Southwest0.9x	0.77	x	1.79	x	69.27	x	0.6	x	0.75	=	38.67	(79)
Southwest0.9x	0.77	x	2.99	x	69.27	x	0.6	x	0.75	=	64.59	(79)
Southwest0.9x	0.54	x	5.86	x	69.27	x	0.6	x	0.75	=	88.77	(79)
Southwest0.9x	0.77	x	1.79	x	44.07	x	0.6	x	0.75	=	24.6	(79)
Southwest0.9x	0.77	x	2.99	x	44.07	x	0.6	x	0.75	=	41.09	(79)
Southwest0.9x	0.54	x	5.86	x	44.07	x	0.6	x	0.75	=	56.48	(79)
Southwest0.9x	0.77	x	1.79	x	31.49	x	0.6	x	0.75	=	17.58	(79)
Southwest0.9x	0.77	x	2.99	x	31.49	x	0.6	x	0.75	=	29.36	(79)
Southwest0.9x	0.54	x	5.86	x	31.49	x	0.6	x	0.75	=	40.35	(79)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.6	x	0.75	=	10.52	(81)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.6	x	0.75	=	10.52	(81)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.6	x	0.75	=	10.52	(81)

DER WorkSheet: New dwelling design stage

Northwest0.9x	0.77	x	2.99	x	11.28	x	0.6	x	0.75	=	10.52	(81)
Northwest0.9x	0.77	x	2.99	x	22.97	x	0.6	x	0.75	=	21.41	(81)
Northwest0.9x	0.77	x	2.99	x	22.97	x	0.6	x	0.75	=	21.41	(81)
Northwest0.9x	0.77	x	2.99	x	22.97	x	0.6	x	0.75	=	21.41	(81)
Northwest0.9x	0.77	x	2.99	x	41.38	x	0.6	x	0.75	=	38.58	(81)
Northwest0.9x	0.77	x	2.99	x	41.38	x	0.6	x	0.75	=	38.58	(81)
Northwest0.9x	0.77	x	2.99	x	41.38	x	0.6	x	0.75	=	38.58	(81)
Northwest0.9x	0.77	x	2.99	x	67.96	x	0.6	x	0.75	=	63.36	(81)
Northwest0.9x	0.77	x	2.99	x	67.96	x	0.6	x	0.75	=	63.36	(81)
Northwest0.9x	0.77	x	2.99	x	67.96	x	0.6	x	0.75	=	63.36	(81)
Northwest0.9x	0.77	x	2.99	x	91.35	x	0.6	x	0.75	=	85.17	(81)
Northwest0.9x	0.77	x	2.99	x	91.35	x	0.6	x	0.75	=	85.17	(81)
Northwest0.9x	0.77	x	2.99	x	91.35	x	0.6	x	0.75	=	85.17	(81)
Northwest0.9x	0.77	x	2.99	x	97.38	x	0.6	x	0.75	=	90.8	(81)
Northwest0.9x	0.77	x	2.99	x	97.38	x	0.6	x	0.75	=	90.8	(81)
Northwest0.9x	0.77	x	2.99	x	97.38	x	0.6	x	0.75	=	90.8	(81)
Northwest0.9x	0.77	x	2.99	x	97.38	x	0.6	x	0.75	=	90.8	(81)
Northwest0.9x	0.77	x	2.99	x	91.1	x	0.6	x	0.75	=	84.95	(81)
Northwest0.9x	0.77	x	2.99	x	91.1	x	0.6	x	0.75	=	84.95	(81)
Northwest0.9x	0.77	x	2.99	x	91.1	x	0.6	x	0.75	=	84.95	(81)
Northwest0.9x	0.77	x	2.99	x	91.1	x	0.6	x	0.75	=	84.95	(81)
Northwest0.9x	0.77	x	2.99	x	72.63	x	0.6	x	0.75	=	67.72	(81)
Northwest0.9x	0.77	x	2.99	x	72.63	x	0.6	x	0.75	=	67.72	(81)
Northwest0.9x	0.77	x	2.99	x	72.63	x	0.6	x	0.75	=	67.72	(81)
Northwest0.9x	0.77	x	2.99	x	72.63	x	0.6	x	0.75	=	67.72	(81)
Northwest0.9x	0.77	x	2.99	x	50.42	x	0.6	x	0.75	=	47.01	(81)
Northwest0.9x	0.77	x	2.99	x	50.42	x	0.6	x	0.75	=	47.01	(81)
Northwest0.9x	0.77	x	2.99	x	50.42	x	0.6	x	0.75	=	47.01	(81)
Northwest0.9x	0.77	x	2.99	x	50.42	x	0.6	x	0.75	=	47.01	(81)
Northwest0.9x	0.77	x	2.99	x	28.07	x	0.6	x	0.75	=	26.17	(81)
Northwest0.9x	0.77	x	2.99	x	28.07	x	0.6	x	0.75	=	26.17	(81)
Northwest0.9x	0.77	x	2.99	x	28.07	x	0.6	x	0.75	=	26.17	(81)
Northwest0.9x	0.77	x	2.99	x	28.07	x	0.6	x	0.75	=	26.17	(81)
Northwest0.9x	0.77	x	2.99	x	14.2	x	0.6	x	0.75	=	13.24	(81)
Northwest0.9x	0.77	x	2.99	x	14.2	x	0.6	x	0.75	=	13.24	(81)
Northwest0.9x	0.77	x	2.99	x	14.2	x	0.6	x	0.75	=	13.24	(81)
Northwest0.9x	0.77	x	2.99	x	14.2	x	0.6	x	0.75	=	13.24	(81)

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Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.6	x	0.75	=	8.59	(81)
Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.6	x	0.75	=	8.59	(81)
Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.6	x	0.75	=	8.59	(81)
Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.6	x	0.75	=	8.59	(81)

Solar gains in watts, calculated for each month	(83)m = Sum(74)m ... (82)m												(83)
(83)m=	144.08	259.4	392.06	548.01	670.62	690.76	655.56	560.27	445.46	296.71	175.12	121.66	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts													(84)
(84)m=	570.43	683.59	801.34	932.48	1029.7	1025.45	974.91	886.57	784.89	661.16	567.63	535.38	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21	(85)
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Utilisation factor for gains for living area, h1,m (see Table 9a)													(86)
(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	0.99	0.96	0.84	0.63	0.44	0.32	0.36	0.61	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)													(87)
(87)m=	20.3	20.47	20.7	20.92	20.99	21	21	21	20.99	20.86	20.54	20.28	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)													(88)
(88)m=	20.28	20.28	20.28	20.3	20.3	20.31	20.31	20.32	20.31	20.3	20.3	20.29	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)													(89)
(89)m=	1	0.99	0.95	0.81	0.59	0.39	0.27	0.31	0.55	0.9	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													(90)
(90)m=	19.34	19.58	19.91	20.21	20.29	20.31	20.31	20.32	20.3	20.15	19.7	19.31	(90)
fLA = Living area ÷ (4) =	0.33												(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2													(92)
(92)m=	19.66	19.87	20.17	20.44	20.52	20.54	20.54	20.54	20.53	20.38	19.97	19.63	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate													(93)
(93)m=	19.51	19.72	20.02	20.29	20.37	20.39	20.39	20.39	20.38	20.23	19.82	19.48	(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:													(94)
(94)m=	1	0.99	0.95	0.81	0.59	0.39	0.27	0.31	0.56	0.89	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m													(95)
(95)m=	567.95	673.63	758.76	756.78	611.95	404.37	264.84	277.79	439.56	591.21	560.39	533.79	(95)

Monthly average external temperature from Table 8													(96)
(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)
(97)m=	1118.74	1086.38	986.72	815.39	618.3	404.63	264.86	277.83	442.57	686.83	914.42	1106.79	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													(98)
(98)m=	409.79	277.37	169.6	42.2	4.73	0	0	0	0	71.14	254.9	426.31	(98)
Total per year (kWh/year) = Sum(98) _{1..5,9..12} =	1656.04												(98)

Space heating requirement in kWh/m²/year	17.32	(99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(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)													
409.79	277.37	169.6	42.2	4.73	0	0	0	0	71.14	254.9	426.31		
(211)m = {[[(98)m x (204)] } x 100 ÷ (206)													(211)
453.81	307.16	187.82	46.73	5.24	0	0	0	0	78.78	282.28	472.11		
Total (kWh/year) =Sum(211) _{1..5,10...12} =												1833.93	(211)

Space heating fuel (secondary), kWh/month													(215)
= {[(98)m x (201)] } x 100 ÷ (208)													(215)
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	(215)
Total (kWh/year) =Sum(215) _{1..5,10...12} =												0	(215)

Water heating

Output from water heater (calculated above)	211.16	186.14	195.54	173.51	167.99	147.95	141.75	158.02	159.76	181.84	192.18	206.1	
Efficiency of water heater	81												(216)
(217)m=	86.91	86.32	85.07	82.67	81.23	81	81	81	81	83.42	86.05	87.04	(217)
Fuel for water heating, kWh/month													(219)
(219)m = (64)m x 100 ÷ (217)m													(219)
(219)m=	242.97	215.64	229.86	209.89	206.81	182.66	175	195.09	197.24	217.99	223.33	236.78	(219)
Total = Sum(219a) _{1..12} =												2533.24	(219)

Annual totals	kWh/year	kWh/year
Space heating fuel used, main system 1	1833.93	
Water heating fuel used	2533.24	

Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside		320.04	(230a)
central heating pump:		30	(230c)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	350.04	(231)
Electricity for lighting		392.05	(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	= 396.13 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 547.18 (264)
Space and water heating	(261) + (262) + (263) + (264) =		943.31 (265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	181.67	(267)
Electricity for lighting	(232) x	0.519	=	203.47	(268)
Total CO2, kg/year	sum of (265)...(271) =			1328.45	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			13.9	(273)
El rating (section 14)				87	(274)

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User Details:

Assessor Name:

Stroma Number:

Software Name:

Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: E 1-2-2

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)
Ground floor	95.6	(1a) x	2.8	(2a) =	267.68 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	95.6	(4)			
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =				267.68 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =							30	÷ (5) =	0.11	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)										
Number of storeys in the dwelling (ns)									0	(9)
Additional infiltration								[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction									0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35										
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0									0	(12)
If no draught lobby, enter 0.05, else enter 0									0	(13)
Percentage of windows and doors draught stripped									0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =								0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =								0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area									5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)									0.36	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used										
Number of sides sheltered									2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =								0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =								0.31	(21)

Infiltration rate modified for monthly wind speed

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

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

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

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

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

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

(24a)m=

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

 (24a)

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

(24b)m=

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

 (24b)

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

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

(24c)m=

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

 (24c)

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

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

(24d)m=

0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57
------	------	------	------	------	------	------	------	------	------	------	------

 (24d)

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

(25)m=

0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m²K	A X U (W/K)	k-value kJ/m².K	A X k kJ/K
Windows Type 1			1.79	x1/[1/(1.4)+ 0.04] =	2.37		(27)
Windows Type 2			2.99	x1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 3			5.86	x1/[1/(1.4)+ 0.04] =	7.77		(27)
Windows Type 4			2.99	x1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 5			2.99	x1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 6			2.99	x1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 7			2.99	x1/[1/(1.4)+ 0.04] =	3.96		(27)
Walls Type1	30.7	10.64	20.06	x 0.18 =	3.61		(29)
Walls Type2	32.8	0	32.8	x 0.18 =	5.9		(29)
Walls Type3	5	0	5	x 0.18 =	0.9		(29)
Walls Type4	5	11.96	-6.96	x 0.18 =	-1.25		(29)
Total area of elements, m²			73.5				(31)
Party wall			21	x 0 =	0		(32)
Party wall			26.88	x 0 =	0		(32)
Party floor			95.6				(32a)
Party ceiling			95.6				(32b)

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

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

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

39.12

 (33)

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

18878.2

 (34)

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

250

 (35)

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

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can be used instead of a detailed calculation.

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

6.47

 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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

45.6

 (37)

Ventilation heat loss calculated monthly

(33) + (36) =

(38)m = 0.33 × (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
50.97	50.7	50.44	49.23	49	47.94	47.94	47.75	48.35	49	49.46	49.94

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

96.56	96.3	96.04	94.83	94.6	93.54	93.54	93.34	93.95	94.6	95.06	95.54
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 Average = Sum(39)_{1...12} /12=

94.82

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m=

1.01	1.01	1	0.99	0.99	0.98	0.98	0.98	0.98	0.99	0.99	1
------	------	---	------	------	------	------	------	------	------	------	---

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

0.99

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.69

 (42)

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

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

98.2

 (43)

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

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

(44)m=

108.02	104.1	100.17	96.24	92.31	88.38	88.38	92.31	96.24	100.17	104.1	108.02
--------	-------	--------	-------	-------	-------	-------	-------	-------	--------	-------	--------

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

1178.44

 (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=

160.2	140.11	144.58	126.05	120.95	104.37	96.71	110.98	112.3	130.88	142.86	155.14
-------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------

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

1545.13

 (45)

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

(46)m=

24.03	21.02	21.69	18.91	18.14	15.66	14.51	16.65	16.85	19.63	21.43	23.27
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

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

0

 (47)

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

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

Water storage loss:

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

0

 (48)

Temperature factor from Table 2b

0

 (49)

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

0

 (50)

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

0

 (51)

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

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 (54) $(47) \times (51) \times (52) \times (53) =$ 0

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

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

If cylinder contains dedicated solar storage, (57)m = (56)m × [(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= 50.96 46.03 50.96 47.46 47.04 43.59 45.04 47.04 47.46 50.96 49.32 50.96 (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= 211.16 186.14 195.54 173.51 167.99 147.95 141.75 158.02 159.76 181.84 192.18 206.1 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (63)

Output from water heater
(64)m= 211.16 186.14 195.54 173.51 167.99 147.95 141.75 158.02 159.76 181.84 192.18 206.1
Output from water heater (annual) 1..12 2121.93 (64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]
(65)m= 66.01 58.09 60.81 53.78 51.97 45.6 43.42 48.66 49.21 56.26 59.83 64.32 (65)

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

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

Metabolic gains (Table 5), Watts
(66)m= Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
134.74 134.74 134.74 134.74 134.74 134.74 134.74 134.74 134.74 134.74 134.74 134.74 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
(67)m= 22.2 19.72 16.03 12.14 9.07 7.66 8.28 10.76 14.44 18.34 21.4 22.81 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
(68)m= 249.01 251.6 245.08 231.22 213.72 197.28 186.29 183.71 190.22 204.08 221.58 238.02 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
(69)m= 36.47 36.47 36.47 36.47 36.47 36.47 36.47 36.47 36.47 36.47 36.47 36.47 (69)

Pumps and fans gains (Table 5a)
(70)m= 3 3 3 3 3 3 3 3 3 3 3 3 (70)

Losses e.g. evaporation (negative values) (Table 5)
(71)m= -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 (71)

Water heating gains (Table 5)
(72)m= 88.72 86.45 81.74 74.69 69.86 63.33 58.36 65.4 68.34 75.61 83.1 86.46 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m
(73)m= 426.35 424.18 409.28 384.47 359.08 334.69 319.35 326.29 339.42 364.45 392.5 413.72 (73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)
Southwest0.9x	0.77	x	1.79	x	36.79		0.63	x	0.7	=	20.13 (79)
Southwest0.9x	0.77	x	2.99	x	36.79		0.63	x	0.7	=	33.62 (79)
Southwest0.9x	0.54	x	5.86	x	36.79		0.63	x	0.7	=	46.21 (79)
Southwest0.9x	0.77	x	1.79	x	62.67		0.63	x	0.7	=	34.29 (79)
Southwest0.9x	0.77	x	2.99	x	62.67		0.63	x	0.7	=	57.27 (79)
Southwest0.9x	0.54	x	5.86	x	62.67		0.63	x	0.7	=	78.71 (79)
Southwest0.9x	0.77	x	1.79	x	85.75		0.63	x	0.7	=	46.91 (79)
Southwest0.9x	0.77	x	2.99	x	85.75		0.63	x	0.7	=	78.36 (79)
Southwest0.9x	0.54	x	5.86	x	85.75		0.63	x	0.7	=	107.7 (79)
Southwest0.9x	0.77	x	1.79	x	106.25		0.63	x	0.7	=	58.12 (79)
Southwest0.9x	0.77	x	2.99	x	106.25		0.63	x	0.7	=	97.09 (79)
Southwest0.9x	0.54	x	5.86	x	106.25		0.63	x	0.7	=	133.45 (79)
Southwest0.9x	0.77	x	1.79	x	119.01		0.63	x	0.7	=	65.1 (79)
Southwest0.9x	0.77	x	2.99	x	119.01		0.63	x	0.7	=	108.75 (79)
Southwest0.9x	0.54	x	5.86	x	119.01		0.63	x	0.7	=	149.47 (79)
Southwest0.9x	0.77	x	1.79	x	118.15		0.63	x	0.7	=	64.63 (79)
Southwest0.9x	0.77	x	2.99	x	118.15		0.63	x	0.7	=	107.96 (79)
Southwest0.9x	0.54	x	5.86	x	118.15		0.63	x	0.7	=	148.39 (79)
Southwest0.9x	0.77	x	1.79	x	113.91		0.63	x	0.7	=	62.31 (79)
Southwest0.9x	0.77	x	2.99	x	113.91		0.63	x	0.7	=	104.09 (79)
Southwest0.9x	0.54	x	5.86	x	113.91		0.63	x	0.7	=	143.06 (79)
Southwest0.9x	0.77	x	1.79	x	104.39		0.63	x	0.7	=	57.11 (79)
Southwest0.9x	0.77	x	2.99	x	104.39		0.63	x	0.7	=	95.39 (79)
Southwest0.9x	0.54	x	5.86	x	104.39		0.63	x	0.7	=	131.11 (79)
Southwest0.9x	0.77	x	1.79	x	92.85		0.63	x	0.7	=	50.79 (79)
Southwest0.9x	0.77	x	2.99	x	92.85		0.63	x	0.7	=	84.85 (79)
Southwest0.9x	0.54	x	5.86	x	92.85		0.63	x	0.7	=	116.62 (79)
Southwest0.9x	0.77	x	1.79	x	69.27		0.63	x	0.7	=	37.89 (79)
Southwest0.9x	0.77	x	2.99	x	69.27		0.63	x	0.7	=	63.3 (79)
Southwest0.9x	0.54	x	5.86	x	69.27		0.63	x	0.7	=	87 (79)
Southwest0.9x	0.77	x	1.79	x	44.07		0.63	x	0.7	=	24.11 (79)
Southwest0.9x	0.77	x	2.99	x	44.07		0.63	x	0.7	=	40.27 (79)
Southwest0.9x	0.54	x	5.86	x	44.07		0.63	x	0.7	=	55.35 (79)
Southwest0.9x	0.77	x	1.79	x	31.49		0.63	x	0.7	=	17.23 (79)
Southwest0.9x	0.77	x	2.99	x	31.49		0.63	x	0.7	=	28.77 (79)
Southwest0.9x	0.54	x	5.86	x	31.49		0.63	x	0.7	=	39.55 (79)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.63	x	0.7	=	10.31 (81)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.63	x	0.7	=	10.31 (81)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.63	x	0.7	=	10.31 (81)

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Northwest 0.9x	0.77	x	2.99	x	11.28	x	0.63	x	0.7	=	10.31	(81)
Northwest 0.9x	0.77	x	2.99	x	22.97	x	0.63	x	0.7	=	20.99	(81)
Northwest 0.9x	0.77	x	2.99	x	22.97	x	0.63	x	0.7	=	20.99	(81)
Northwest 0.9x	0.77	x	2.99	x	22.97	x	0.63	x	0.7	=	20.99	(81)
Northwest 0.9x	0.77	x	2.99	x	22.97	x	0.63	x	0.7	=	20.99	(81)
Northwest 0.9x	0.77	x	2.99	x	41.38	x	0.63	x	0.7	=	37.81	(81)
Northwest 0.9x	0.77	x	2.99	x	41.38	x	0.63	x	0.7	=	37.81	(81)
Northwest 0.9x	0.77	x	2.99	x	41.38	x	0.63	x	0.7	=	37.81	(81)
Northwest 0.9x	0.77	x	2.99	x	41.38	x	0.63	x	0.7	=	37.81	(81)
Northwest 0.9x	0.77	x	2.99	x	67.96	x	0.63	x	0.7	=	62.1	(81)
Northwest 0.9x	0.77	x	2.99	x	67.96	x	0.63	x	0.7	=	62.1	(81)
Northwest 0.9x	0.77	x	2.99	x	67.96	x	0.63	x	0.7	=	62.1	(81)
Northwest 0.9x	0.77	x	2.99	x	67.96	x	0.63	x	0.7	=	62.1	(81)
Northwest 0.9x	0.77	x	2.99	x	91.35	x	0.63	x	0.7	=	83.47	(81)
Northwest 0.9x	0.77	x	2.99	x	91.35	x	0.63	x	0.7	=	83.47	(81)
Northwest 0.9x	0.77	x	2.99	x	91.35	x	0.63	x	0.7	=	83.47	(81)
Northwest 0.9x	0.77	x	2.99	x	91.35	x	0.63	x	0.7	=	83.47	(81)
Northwest 0.9x	0.77	x	2.99	x	97.38	x	0.63	x	0.7	=	88.99	(81)
Northwest 0.9x	0.77	x	2.99	x	97.38	x	0.63	x	0.7	=	88.99	(81)
Northwest 0.9x	0.77	x	2.99	x	97.38	x	0.63	x	0.7	=	88.99	(81)
Northwest 0.9x	0.77	x	2.99	x	97.38	x	0.63	x	0.7	=	88.99	(81)
Northwest 0.9x	0.77	x	2.99	x	91.1	x	0.63	x	0.7	=	83.25	(81)
Northwest 0.9x	0.77	x	2.99	x	91.1	x	0.63	x	0.7	=	83.25	(81)
Northwest 0.9x	0.77	x	2.99	x	91.1	x	0.63	x	0.7	=	83.25	(81)
Northwest 0.9x	0.77	x	2.99	x	91.1	x	0.63	x	0.7	=	83.25	(81)
Northwest 0.9x	0.77	x	2.99	x	91.1	x	0.63	x	0.7	=	83.25	(81)
Northwest 0.9x	0.77	x	2.99	x	72.63	x	0.63	x	0.7	=	66.37	(81)
Northwest 0.9x	0.77	x	2.99	x	72.63	x	0.63	x	0.7	=	66.37	(81)
Northwest 0.9x	0.77	x	2.99	x	72.63	x	0.63	x	0.7	=	66.37	(81)
Northwest 0.9x	0.77	x	2.99	x	72.63	x	0.63	x	0.7	=	66.37	(81)
Northwest 0.9x	0.77	x	2.99	x	50.42	x	0.63	x	0.7	=	46.07	(81)
Northwest 0.9x	0.77	x	2.99	x	50.42	x	0.63	x	0.7	=	46.07	(81)
Northwest 0.9x	0.77	x	2.99	x	50.42	x	0.63	x	0.7	=	46.07	(81)
Northwest 0.9x	0.77	x	2.99	x	50.42	x	0.63	x	0.7	=	46.07	(81)
Northwest 0.9x	0.77	x	2.99	x	28.07	x	0.63	x	0.7	=	25.65	(81)
Northwest 0.9x	0.77	x	2.99	x	28.07	x	0.63	x	0.7	=	25.65	(81)
Northwest 0.9x	0.77	x	2.99	x	28.07	x	0.63	x	0.7	=	25.65	(81)
Northwest 0.9x	0.77	x	2.99	x	28.07	x	0.63	x	0.7	=	25.65	(81)
Northwest 0.9x	0.77	x	2.99	x	14.2	x	0.63	x	0.7	=	12.97	(81)
Northwest 0.9x	0.77	x	2.99	x	14.2	x	0.63	x	0.7	=	12.97	(81)
Northwest 0.9x	0.77	x	2.99	x	14.2	x	0.63	x	0.7	=	12.97	(81)

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Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.63	x	0.7	=	8.42	(81)
Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.63	x	0.7	=	8.42	(81)
Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.63	x	0.7	=	8.42	(81)
Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.63	x	0.7	=	8.42	(81)

Solar gains in watts, calculated for each month

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

(83)m=	141.2	254.22	384.22	537.05	657.21	676.94	642.45	549.07	436.55	290.77	171.62	119.22	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	567.55	678.4	793.49	921.52	1016.29	1011.63	961.8	875.36	775.98	655.23	564.12	532.94	(84)
--------	--------	-------	--------	--------	---------	---------	-------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21

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

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	0.99	0.98	0.93	0.78	0.58	0.43	0.49	0.77	0.96	1	1	

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

(87)m=	19.95	20.12	20.38	20.7	20.91	20.99	21	21	20.94	20.64	20.23	19.92	(87)
--------	-------	-------	-------	------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.07	20.08	20.08	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.09	20.08	(88)
--------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	------

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

(89)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(89)
	1	0.99	0.97	0.9	0.73	0.5	0.34	0.39	0.69	0.95	0.99	1	

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

(90)m=	18.66	18.91	19.3	19.75	20.01	20.09	20.1	20.1	20.06	19.68	19.09	18.63	(90)
--------	-------	-------	------	-------	-------	-------	------	------	-------	-------	-------	-------	------

fLA = Living area + (4) = 0.33 (91)

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

(92)m=	19.08	19.31	19.65	20.06	20.31	20.39	20.4	20.4	20.35	20	19.46	19.05	(92)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	----	-------	-------	------

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

(93)m=	19.08	19.31	19.65	20.06	20.31	20.39	20.4	20.4	20.35	20	19.46	19.05	(93)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	----	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.9	0.74	0.53	0.37	0.42	0.71	0.95	0.99	1	(94)
--------	---	------	------	-----	------	------	------	------	------	------	------	---	------

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

(95)m=	565.56	672.02	770.68	831.39	754.86	534.22	354.28	371.34	552.67	620.2	559.47	531.6	(95)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	------

Monthly average external temperature from Table 8

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

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

(97)m=	1427.54	1387.52	1263.1	1058.57	814.45	541.32	355.02	372.94	586.98	889.05	1175.38	1418.73	(97)
--------	---------	---------	--------	---------	--------	--------	--------	--------	--------	--------	---------	---------	------

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

(98)m=	641.31	480.82	366.36	163.58	44.34	0	0	0	0	200.02	443.45	660.02	(98)
--------	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	------

Total per year (kWh/year) = Sum(98)1...5,9...12 = 2999.89 (98)

Space heating requirement in kWh/m²/year

31.38 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

(201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1

(202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1

(204)

Efficiency of main space heating system 1

93.4

(206)

Efficiency of secondary/supplementary heating system, %

0

(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)												
641.31	480.82	366.36	163.58	44.34	0	0	0	0	200.02	443.45	660.02	

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

(211)

686.63	514.79	392.25	175.14	47.47	0	0	0	0	214.16	474.79	706.66	
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	--

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

3211.87

(211)

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

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

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

0

(215)

Water heating

Output from water heater (calculated above)

211.16	186.14	195.54	173.51	167.99	147.95	141.75	158.02	159.76	181.84	192.18	206.1	
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--

Efficiency of water heater

80.3

(216)

(217)m=

87.67	87.33	86.61	84.9	82.22	80.3	80.3	80.3	80.3	85.29	87.09	87.77	
-------	-------	-------	------	-------	------	------	------	------	-------	-------	-------	--

(217)

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

240.86	213.13	225.77	204.36	204.32	184.25	176.53	196.79	198.96	213.2	220.67	234.81	
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--

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

2513.64

(219)

Annual totals

Space heating fuel used, main system 1

kWh/year

3211.87

kWh/year

Water heating fuel used

2513.64

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

(231)

Electricity for lighting

392.01

(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	693.76 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	542.95 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1236.71 (265)

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Electricity for pumps, fans and electric keep-hot

(231) x

0.519

=

38.93

(267)

Electricity for lighting

(232) x

0.519

=

203.45

(268)

Total CO2, kg/year

sum of (265)...(271) =

1479.09

(272)

TER =

15.47

(273)

DRAFT

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name:

Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: E 2-6-3

Address :

5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	99.9 (1a) x	4.45 (2a) =	444.55 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.9 (4)		
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		444.55 (5)

2. Ventilation rate:

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

Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		
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		3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]x(8), otherwise (18) = (16)		0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m=	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)
---------	---	---	---	---	---	---	---	---	---	---	---	---	-------

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

(25)m=	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(25)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m2K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Windows Type 1			2.88	x1/[1/(1.4) + 0.04] =	3.82		(27)
Windows Type 2			2.88	x1/[1/(1.4) + 0.04] =	3.82		(27)
Windows Type 3			6	x1/[1/(1.4) + 0.04] =	7.95		(27)
Rooflights			4.32	x1/[1/(1.4) + 0.04] =	6.048		(27b)
Walls Type1	33.9	0	33.9	x 0.2 =	6.78		(29)
Walls Type2	35.2	5.76	29.44	x 0.2 =	5.89		(29)
Walls Type3	37.4	8.88	28.52	x 0.2 =	5.7		(29)
Roof	126	8.64	117.36	x 0.13 =	15.26		(30)
Total area of elements, m ²			232.5				(31)
Party wall			21	x 0 =	0		(32)
Party wall			15.96	x 0 =	0		(32)
Party floor			99.9				(32a)
Internal wall **			50.82				(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 64.49 (33)

Heat capacity Cm = S(A x k) (28)...(30) + (32) + (32a)...(32e) = 22645.92 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.21 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 73.71 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	43.19	42.68	42.17	39.63	39.12	36.57	36.57	36.07	37.59	39.12	40.14	41.15	

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

(39)m=	116.9	116.39	115.88	113.33	112.82	110.28	110.28	109.77	111.3	112.82	113.84	114.86	
--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--

Average = Sum(39)_{1...12} /12= 113.21 (39)

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

(40)m=	1.17	1.17	1.16	1.13	1.13	1.1	1.1	1.11	1.13	1.14	1.15	
--------	------	------	------	------	------	-----	-----	------	------	------	------	--

Average = Sum(40)_{1...12} /12= 1.13 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.74 (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 99.24 (43)

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

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

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

(44)m=	109.17	105.2	101.23	97.26	93.29	89.32	89.32	93.29	97.26	101.23	105.2	109.17	
--------	--------	-------	--------	-------	-------	-------	-------	-------	-------	--------	-------	--------	--

Total = Sum(44)_{1...12} = 1190.9 (44)

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

(45)m=	161.89	141.59	146.11	127.38	122.22	105.47	97.73	112.15	113.49	132.26	144.37	156.78	
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--

Total = Sum(45)_{1...12} = 1561.46 (45)

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

(46)m=	24.28	21.24	21.92	19.11	18.33	15.82	14.66	16.82	17.02	19.84	21.66	23.52	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	50.96	46.03	50.96	47.96	47.54	44.05	45.52	47.54	47.96	50.96	49.32	50.96	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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

(62)m=	212.85	187.62	197.07	175.34	169.76	149.52	143.25	159.69	161.45	183.22	193.69	207.74	
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

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	
--------	---	---	---	---	---	---	---	---	---	---	---	---	--

Output from water heater

(64)m=	212.85	187.62	197.07	175.34	169.76	149.52	143.25	159.69	161.45	183.22	193.69	207.74	
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

Output from water heater (annual)_{1...12} 2141.2 (64)

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

(65)m=	66.57	58.59	61.32	54.34	52.52	46.08	43.88	49.17	49.73	56.72	60.33	64.87	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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=	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	

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

(67)m=	22.84	20.28	16.5	12.49	9.34	7.88	8.52	11.07	14.86	18.86	22.02	23.47	
--------	-------	-------	------	-------	------	------	------	-------	-------	-------	-------	-------	--

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

(68)m=	256.17	258.82	252.13	237.87	219.86	202.95	191.64	188.98	195.68	209.94	227.94	244.86	
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

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

(69)m=	36.69	36.69	36.69	36.69	36.69	36.69	36.69	36.69	36.69	36.69	36.69	36.69	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

Pumps and fans gains (Table 5a)

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

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

(71)m=	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	--

Water heating gains (Table 5)

(72)m=	89.47	87.18	82.42	75.48	70.6	64	58.97	66.1	69.06	76.23	83.8	87.19	
--------	-------	-------	-------	-------	------	----	-------	------	-------	-------	------	-------	--

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

(73)m=	435.56	433.37	418.12	392.91	366.88	341.91	326.21	333.23	346.68	372.12	400.84	422.6	
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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.

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Orientation:	Access Factor	Area			Flux			g _L			FF			Gains	
	Table 6d		m ²		Table 6a		Table 6b		Table 6c				(W)		
East	0.9x	2	x	2.88	x	19.64	x	0.6	x	0.8	=	37.63	(76)		
East	0.9x	2	x	2.88	x	38.42	x	0.6	x	0.8	=	73.61	(76)		
East	0.9x	2	x	2.88	x	63.27	x	0.6	x	0.8	=	121.23	(76)		
East	0.9x	2	x	2.88	x	92.28	x	0.6	x	0.8	=	176.81	(76)		
East	0.9x	2	x	2.88	x	113.09	x	0.6	x	0.8	=	216.69	(76)		
East	0.9x	2	x	2.88	x	115.77	x	0.6	x	0.8	=	221.82	(76)		
East	0.9x	2	x	2.88	x	110.22	x	0.6	x	0.8	=	211.18	(76)		
East	0.9x	2	x	2.88	x	94.68	x	0.6	x	0.8	=	181.4	(76)		
East	0.9x	2	x	2.88	x	73.59	x	0.6	x	0.8	=	141	(76)		
East	0.9x	2	x	2.88	x	45.59	x	0.6	x	0.8	=	87.35	(76)		
East	0.9x	2	x	2.88	x	24.49	x	0.6	x	0.8	=	46.92	(76)		
East	0.9x	2	x	2.88	x	16.15	x	0.6	x	0.8	=	30.95	(76)		
West	0.9x	0.77	x	2.88	x	19.64	x	0.6	x	0.8	=	18.82	(80)		
West	0.9x	0.77	x	6	x	19.64	x	0.6	x	0.8	=	39.2	(80)		
West	0.9x	0.77	x	2.88	x	38.42	x	0.6	x	0.8	=	36.81	(80)		
West	0.9x	0.77	x	6	x	38.42	x	0.6	x	0.8	=	76.68	(80)		
West	0.9x	0.77	x	2.88	x	63.27	x	0.6	x	0.8	=	60.62	(80)		
West	0.9x	0.77	x	6	x	63.27	x	0.6	x	0.8	=	126.28	(80)		
West	0.9x	0.77	x	2.88	x	92.28	x	0.6	x	0.8	=	88.4	(80)		
West	0.9x	0.77	x	6	x	92.28	x	0.6	x	0.8	=	184.18	(80)		
West	0.9x	0.77	x	2.88	x	113.09	x	0.6	x	0.8	=	108.34	(80)		
West	0.9x	0.77	x	6	x	113.09	x	0.6	x	0.8	=	225.71	(80)		
West	0.9x	0.77	x	2.88	x	115.77	x	0.6	x	0.8	=	110.91	(80)		
West	0.9x	0.77	x	6	x	115.77	x	0.6	x	0.8	=	231.06	(80)		
West	0.9x	0.77	x	2.88	x	110.22	x	0.6	x	0.8	=	105.59	(80)		
West	0.9x	0.77	x	6	x	110.22	x	0.6	x	0.8	=	219.98	(80)		
West	0.9x	0.77	x	2.88	x	94.68	x	0.6	x	0.8	=	90.7	(80)		
West	0.9x	0.77	x	6	x	94.68	x	0.6	x	0.8	=	188.96	(80)		
West	0.9x	0.77	x	2.88	x	73.59	x	0.6	x	0.8	=	70.5	(80)		
West	0.9x	0.77	x	6	x	73.59	x	0.6	x	0.8	=	146.87	(80)		
West	0.9x	0.77	x	2.88	x	45.59	x	0.6	x	0.8	=	43.67	(80)		
West	0.9x	0.77	x	6	x	45.59	x	0.6	x	0.8	=	90.99	(80)		
West	0.9x	0.77	x	2.88	x	24.49	x	0.6	x	0.8	=	23.46	(80)		
West	0.9x	0.77	x	6	x	24.49	x	0.6	x	0.8	=	48.88	(80)		
West	0.9x	0.77	x	2.88	x	16.15	x	0.6	x	0.8	=	15.47	(80)		
West	0.9x	0.77	x	6	x	16.15	x	0.6	x	0.8	=	32.24	(80)		
Rooflights	0.9x	1	x	4.32	x	26	x	0.6	x	0.8	=	97.04	(82)		
Rooflights	0.9x	1	x	4.32	x	54	x	0.6	x	0.8	=	201.55	(82)		
Rooflights	0.9x	1	x	4.32	x	96	x	0.6	x	0.8	=	358.32	(82)		

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	4.32	x	150	x	0.6	x	0.8	=	559.87	(82)
Rooflights 0.9x	1	x	4.32	x	192	x	0.6	x	0.8	=	716.64	(82)
Rooflights 0.9x	1	x	4.32	x	200	x	0.6	x	0.8	=	746.5	(82)
Rooflights 0.9x	1	x	4.32	x	189	x	0.6	x	0.8	=	705.44	(82)
Rooflights 0.9x	1	x	4.32	x	157	x	0.6	x	0.8	=	586	(82)
Rooflights 0.9x	1	x	4.32	x	115	x	0.6	x	0.8	=	429.24	(82)
Rooflights 0.9x	1	x	4.32	x	66	x	0.6	x	0.8	=	246.34	(82)
Rooflights 0.9x	1	x	4.32	x	33	x	0.6	x	0.8	=	123.17	(82)
Rooflights 0.9x	1	x	4.32	x	21	x	0.6	x	0.8	=	78.38	(82)

Solar gains in watts, calculated for each month

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

(83)m=	192.69	388.66	666.45	1009.26	1267.38	1310.28	1242.19	1047.06	787.6	468.36	242.43	157.04	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	628.25	822.02	1084.57	1402.17	1634.26	1652.19	1568.39	1380.28	1134.29	840.48	643.27	579.64	(84)
--------	--------	--------	---------	---------	---------	---------	---------	---------	---------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.96	0.83	0.62	0.42	0.31	0.36	0.64	0.94	0.99	1	(86)

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

(87)m=	19.76	20.01	20.4	20.8	20.96	21	21	21	20.97	20.64	20.11	19.73	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.94	19.95	19.95	19.97	19.98	20	20	20	19.99	19.98	19.97	19.96	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.94	0.79	0.56	0.36	0.24	0.29	0.56	0.92	0.99	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.29	18.66	19.22	19.76	19.94	20	20	20	19.97	19.58	18.83	18.26	(90)
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fLA = Living area ÷ (4) = 0.31 (91)

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

(92)m=	18.75	19.08	19.59	20.09	20.26	20.31	20.31	20.31	20.28	19.91	19.23	18.72	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.6	18.93	19.44	19.94	20.11	20.16	20.16	20.16	20.13	19.76	19.08	18.57	(93)
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8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.98	0.94	0.78	0.56	0.37	0.25	0.3	0.57	0.91	0.99	1	(94)

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

(95)m=	625.17	808.36	1014.94	1099.91	923.28	610.74	392.52	412.6	651.97	764.16	635.62	577.69	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W = [(93)m – (96)m]

(97)m=	1671.96	1632.96	1499.06	1250.84	949.13	612.99	392.74	413.14	671.02	1033.54	1363.8	1650.93	(97)
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DER WorkSheet: New dwelling design stage

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

(98)m=	778.81	554.13	360.19	108.67	19.23	0	0	0	0	200.42	524.29	798.49	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													3344.24 (98)

Space heating requirement in kWh/m²/year	33.48 (99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system	0 (201)
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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
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Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
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Efficiency of main space heating system 1	90.3 (206)
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Efficiency of secondary/supplementary heating system, %	0 (208)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

778.81	554.13	360.19	108.67	19.23	0	0	0	0	200.42	524.29	798.49
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

862.47	613.65	398.88	120.34	21.3	0	0	0	0	221.95	580.61	884.27		
Total (kWh/year) =Sum(211) _{1...5,10...12} =												3703.47	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

212.85	187.62	197.07	175.34	169.76	149.52	143.25	159.69	161.45	183.22	193.69	207.74
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Efficiency of water heater	81 (216)
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(217)m=	88.13	87.75	86.78	84.32	81.86	81	81	81	81	85.61	87.59	88.21	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	241.52	213.81	227.1	207.94	207.39	184.59	176.85	197.15	199.32	214.03	221.14	235.51	
Total = Sum(219a) _{1...12} =													2526.34 (219)

Annual totals

Space heating fuel used, main system 1	kWh/year	kWh/year
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Water heating fuel used	3703.47	2526.34
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Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside	531.51	(230a)
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central heating pump:	30	(230c)
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Total electricity for the above, kWh/year	sum of (230a)...(230g) =	561.51 (231)
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Electricity for lighting	403.32 (232)
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12a. CO2 emissions – Individual heating systems including micro-CHP

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	799.95 (261)
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Space heating (secondary)	(215) x	0.519	=	0 (263)
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Water heating	(219) x	0.216	=	545.69 (264)
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Space and water heating	(261) + (262) + (263) + (264) =			1345.64 (265)
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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	291.42 (267)
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Electricity for lighting	(232) x	0.519	=	209.32 (268)
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Total CO2, kg/year	sum of (265)...(271) =			1846.38 (272)
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Dwelling CO2 Emission Rate	(272) ÷ (4) =			18.48 (273)
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EI rating (section 14)				83 (274)
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DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Stroma Number: Stroma FSAP 2012 Software Version: Version: 1.0.4.10

Property Address: E 2-6-3

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	99.9 (1a) x	4.45 (2a) =	444.55 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.9 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	444.55 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30 ÷ (5) = 0.07 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>	
Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration [(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>	
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)	0.32 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>	
Number of sides sheltered	1 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor (21) = (18) x (20) =	0.29 (21)

Infiltration rate modified for monthly wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Monthly average wind speed from Table 7	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	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
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TER WorkSheet: New dwelling design stage

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

0.37	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.35
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Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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d) If natural ventilation or whole house positive input ventilation from loft

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

(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m2K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Windows Type 1			2.88	x1/[1/(1.4)+ 0.04] =	3.82		
Windows Type 2			2.88	x1/[1/(1.4)+ 0.04] =	3.82		
Windows Type 3			6	x1/[1/(1.4)+ 0.04] =	7.95		
Rooflights			4.32	x1/[1/(1.7) + 0.04] =	7.344		
Walls Type1	33.9	0	33.9	x 0.18 =	6.1		
Walls Type2	35.2	5.76	29.44	x 0.18 =	5.3		
Walls Type3	37.4	8.88	28.52	x 0.18 =	5.13		
Roof	126	8.64	117.36	x 0.13 =	15.26		
Total area of elements, m ²			232.5				
Party wall			21	x 0 =	0		
Party wall			15.96	x 0 =	0		
Party floor			99.9				
Internal wall **			50.82				

* 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) = 64.95 (33)

Heat capacity Cm = S(A x k) (28)...(30) + (32) + (32a)...(32e) = 22645.92 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 9.52 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 74.47 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	83.64	83.24	82.84	81.01	80.66	79.06	79.06	78.76	79.68	80.66	81.36	82.09	(38)

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

(39)m=	158.1	157.7	157.31	155.47	155.13	153.53	153.53	153.23	154.15	155.13	155.83	156.55	
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Heat loss parameter (HLP), W/m²K Average = Sum(39)_{1...12} / 12 = 155.47 (39)

(40)m = (39)m ÷ (4)

(40)m=	1.58	1.58	1.57	1.56	1.55	1.54	1.54	1.53	1.54	1.55	1.56	1.57	
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Average = Sum(40)_{1...12} / 12 = 1.56 (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 2.74 (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 99.24 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	109.17	105.2	101.23	97.26	93.29	89.32	89.32	93.29	97.26	101.23	105.2	109.17	

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

Total = Sum(44)_{1...12} = 1190.9 (44)

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

(45)m = 161.89 141.59 146.11 127.38 122.22 105.47 97.73 112.15 113.49 132.26 144.37 156.78

Total = Sum(45)_{1...12} = 1561.46 (45)

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

(46)m = 24.28 21.24 21.92 19.11 18.33 15.82 14.66 16.82 17.02 19.84 21.66 23.52 (46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

(61)m = 50.96 46.03 50.96 47.96 47.54 44.05 45.52 47.54 47.96 50.96 49.32 50.96 (61)

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

(62)m = 212.85 187.62 197.07 175.34 169.76 149.52 143.25 159.69 161.45 183.22 193.69 207.74 (62)

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

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

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

Output from water heater

(64)m = 212.85 187.62 197.07 175.34 169.76 149.52 143.25 159.69 161.45 183.22 193.69 207.74

Output from water heater (annual)_{1...12} = 2141.2 (64)

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

(65)m = 66.57 58.59 61.32 54.34 52.52 46.08 43.88 49.17 49.73 56.72 60.33 64.87 (65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	(66)

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

(67)m = 22.84 20.28 16.5 12.49 9.34 7.88 8.52 11.07 14.86 18.86 22.02 23.47 (67)

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

(68)m = 256.17 258.82 252.13 237.87 219.86 202.95 191.64 188.98 195.68 209.94 227.94 244.86 (68)

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

(69)m = 36.69 36.69 36.69 36.69 36.69 36.69 36.69 36.69 36.69 36.69 36.69 36.69 (69)

Pumps and fans gains (Table 5a)

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

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

(71)m = -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 (71)

Water heating gains (Table 5)

(72)m = 89.47 87.18 82.42 75.48 70.6 64 58.97 66.1 69.06 76.23 83.8 87.19 (72)

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

(73)m = 435.56 433.37 418.12 392.91 366.88 341.91 326.21 333.23 346.68 372.12 400.84 422.6 (73)

6. Solar gains:

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

TER WorkSheet: New dwelling design stage

Orientation:	Access Factor		Area		Flux		g_		FF		Gains	
	Table 6d		m²		Table 6a		Table 6b		Table 6c		(W)	
East	0.9x	2	x	2.88	x	19.64	x	0.63	x	0.7	=	34.57 (76)
East	0.9x	2	x	2.88	x	38.42	x	0.63	x	0.7	=	67.63 (76)
East	0.9x	2	x	2.88	x	63.27	x	0.63	x	0.7	=	111.38 (76)
East	0.9x	2	x	2.88	x	92.28	x	0.63	x	0.7	=	162.44 (76)
East	0.9x	2	x	2.88	x	113.09	x	0.63	x	0.7	=	199.08 (76)
East	0.9x	2	x	2.88	x	115.77	x	0.63	x	0.7	=	203.79 (76)
East	0.9x	2	x	2.88	x	110.22	x	0.63	x	0.7	=	194.02 (76)
East	0.9x	2	x	2.88	x	94.68	x	0.63	x	0.7	=	166.66 (76)
East	0.9x	2	x	2.88	x	73.59	x	0.63	x	0.7	=	129.54 (76)
East	0.9x	2	x	2.88	x	45.59	x	0.63	x	0.7	=	80.25 (76)
East	0.9x	2	x	2.88	x	24.49	x	0.63	x	0.7	=	43.11 (76)
East	0.9x	2	x	2.88	x	16.15	x	0.63	x	0.7	=	28.43 (76)
West	0.9x	0.77	x	2.88	x	19.64	x	0.63	x	0.7	=	17.29 (80)
West	0.9x	0.77	x	6	x	19.64	x	0.63	x	0.7	=	36.01 (80)
West	0.9x	0.77	x	2.88	x	38.42	x	0.63	x	0.7	=	33.82 (80)
West	0.9x	0.77	x	6	x	38.42	x	0.63	x	0.7	=	70.45 (80)
West	0.9x	0.77	x	2.88	x	63.27	x	0.63	x	0.7	=	55.69 (80)
West	0.9x	0.77	x	6	x	63.27	x	0.63	x	0.7	=	116.02 (80)
West	0.9x	0.77	x	2.88	x	92.28	x	0.63	x	0.7	=	81.22 (80)
West	0.9x	0.77	x	6	x	92.28	x	0.63	x	0.7	=	169.21 (80)
West	0.9x	0.77	x	2.88	x	113.09	x	0.63	x	0.7	=	99.54 (80)
West	0.9x	0.77	x	6	x	113.09	x	0.63	x	0.7	=	207.38 (80)
West	0.9x	0.77	x	2.88	x	115.77	x	0.63	x	0.7	=	101.9 (80)
West	0.9x	0.77	x	6	x	115.77	x	0.63	x	0.7	=	212.29 (80)
West	0.9x	0.77	x	2.88	x	110.22	x	0.63	x	0.7	=	97.01 (80)
West	0.9x	0.77	x	6	x	110.22	x	0.63	x	0.7	=	202.1 (80)
West	0.9x	0.77	x	2.88	x	94.68	x	0.63	x	0.7	=	83.33 (80)
West	0.9x	0.77	x	6	x	94.68	x	0.63	x	0.7	=	173.61 (80)
West	0.9x	0.77	x	2.88	x	73.59	x	0.63	x	0.7	=	64.77 (80)
West	0.9x	0.77	x	6	x	73.59	x	0.63	x	0.7	=	134.94 (80)
West	0.9x	0.77	x	2.88	x	45.59	x	0.63	x	0.7	=	40.13 (80)
West	0.9x	0.77	x	6	x	45.59	x	0.63	x	0.7	=	83.6 (80)
West	0.9x	0.77	x	2.88	x	24.49	x	0.63	x	0.7	=	21.55 (80)
West	0.9x	0.77	x	6	x	24.49	x	0.63	x	0.7	=	44.91 (80)
West	0.9x	0.77	x	2.88	x	16.15	x	0.63	x	0.7	=	14.22 (80)
West	0.9x	0.77	x	6	x	16.15	x	0.63	x	0.7	=	29.62 (80)
Rooflights	0.9x	1	x	4.32	x	26	x	0.63	x	0.7	=	89.16 (82)
Rooflights	0.9x	1	x	4.32	x	54	x	0.63	x	0.7	=	185.18 (82)
Rooflights	0.9x	1	x	4.32	x	96	x	0.63	x	0.7	=	329.2 (82)

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Rooflights 0.9x	1	x	4.32	x	150	x	0.63	x	0.7	=	514.38	(82)
Rooflights 0.9x	1	x	4.32	x	192	x	0.63	x	0.7	=	658.41	(82)
Rooflights 0.9x	1	x	4.32	x	200	x	0.63	x	0.7	=	685.84	(82)
Rooflights 0.9x	1	x	4.32	x	189	x	0.63	x	0.7	=	648.12	(82)
Rooflights 0.9x	1	x	4.32	x	157	x	0.63	x	0.7	=	538.39	(82)
Rooflights 0.9x	1	x	4.32	x	115	x	0.63	x	0.7	=	394.36	(82)
Rooflights 0.9x	1	x	4.32	x	66	x	0.63	x	0.7	=	226.33	(82)
Rooflights 0.9x	1	x	4.32	x	33	x	0.63	x	0.7	=	113.16	(82)
Rooflights 0.9x	1	x	4.32	x	21	x	0.63	x	0.7	=	72.01	(82)

Solar gains in watts, calculated for each month												(83)m = Sum(74)m ... (82)m	
(83)m=	177.03	357.08	612.3	927.26	1164.41	1203.82	1141.26	961.98	723.61	430.3	222.73	144.28	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	612.59	790.45	1030.42	1320.17	1531.28	1545.73	1467.47	1295.21	1070.29	802.42	623.57	566.88	(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	0.91	0.77	0.59	0.45	0.52	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=

19.23	19.47	19.89	20.41	20.78	20.94	20.99	20.97	20.82	20.27	19.65	19.2
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(87)

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

(88)m=

19.63	19.63	19.63	19.65	19.65	19.66	19.66	19.66	19.66	19.65	19.64	19.64
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(88)

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

(89)m=

1	0.99	0.97	0.88	0.7	0.49	0.32	0.38	0.7	0.95	0.99	1
---	------	------	------	-----	------	------	------	-----	------	------	---

(89)

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

(90)m=

17.31	17.66	18.26	18.99	19.45	19.63	19.66	19.65	19.52	18.83	17.93	17.27
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(90)

fLA = Living area ÷ (4) =

0.31

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2													
(92)m=	17.91	18.23	18.77	19.44	19.87	20.04	20.07	20.07	19.93	19.28	18.47	17.87	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m=	17.91	18.23	18.77	19.44	19.87	20.04	20.07	20.07	19.93	19.28	18.47	17.87	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, h_m :

(94)m=	0.99	0.99	0.96	0.87	0.72	0.52	0.36	0.43	0.72	0.94	0.99	1
--------	------	------	------	------	------	------	------	------	------	------	------	---

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

(95)m=	609.42	779.83	988.03	1155.08	1098.51	801.13	527.23	550.68	775.5	757.71	617.12	564.7
--------	--------	--------	--------	---------	---------	--------	--------	--------	-------	--------	--------	-------

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
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

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

(97)m=	2152.4	2102	1930.68	1638.23	1266.81	835.15	533.11	561.96	898.19	1346.17	1771.66	2140.48
--------	--------	------	---------	---------	---------	--------	--------	--------	--------	---------	---------	---------

TER WorkSheet: New dwelling design stage

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

(98)m=

1147.98	888.5	701.33	347.87	125.21	0	0	0	0	437.81	831.27	1172.38
---------	-------	--------	--------	--------	---	---	---	---	--------	--------	---------

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

5652.35

(98)

Space heating requirement in kWh/m²/year

56.58

(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system

0

(201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1

(202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1

(204)

Efficiency of main space heating system 1

93.4

(206)

Efficiency of secondary/supplementary heating system, %

0

(208)

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

Space heating requirement (calculated above)

1147.98	888.5	701.33	347.87	125.21	0	0	0	0	437.81	831.27	1172.38
---------	-------	--------	--------	--------	---	---	---	---	--------	--------	---------

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

(211)

1229.1	951.29	750.89	372.45	134.06	0	0	0	0	468.75	890.01	1255.23
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	---------

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

6051.77

(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=

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

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

0

(215)

Water heating

Output from water heater (calculated above)

212.85	187.62	197.07	175.34	169.76	149.52	143.25	159.69	161.45	183.22	193.69	207.74
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

80.3

(216)

(217)m=

88.66	88.46	87.97	86.74	84.3	80.3	80.3	80.3	80.3	87.17	88.3	88.72
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(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

240.08	212.09	224.01	202.14	201.38	186.2	178.39	198.87	201.06	210.2	219.35	234.15
--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	--------	--------

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

2507.93

(219)

Annual totals

Space heating fuel used, main system 1	kWh/year	kWh/year
	6051.77	

Water heating fuel used	2507.93
-------------------------	---------

Electricity for pumps, fans and electric keep-hot

central heating pump:

30

(230c)

boiler with a fan-assisted flue

45

(230e)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

75

(231)

Electricity for lighting

403.32

(232)

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

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	1307.18	(261)
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Space heating (secondary)	(215) x	0.519	=	0	(263)
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Water heating	(219) x	0.216	=	541.71	(264)
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Space and water heating	(261) + (262) + (263) + (264) =			1848.89	(265)
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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
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Electricity for lighting	(232) x	0.519	=	209.32	(268)
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Total CO2, kg/year	sum of (265)...(271) =			2097.14	(272)
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TER =				20.99	(273)
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DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: E 4-2-18

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	69.7 (1a) x	2.8 (2a) =	195.16 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.7 (4)		
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		195.16 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>		
Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		
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		3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]x(8), otherwise (18) = (16)		0.15 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>		
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.14 (21)

Infiltration rate modified for monthly wind speed

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

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

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

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

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m=	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(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	0	0	0	0	0	0	0	0	0	0	0	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28	(25)
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m2K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Doors			2.4	1.4	3.36		
Windows Type 1			6	1.4	7.95		
Windows Type 2			2.88	1.4	3.82		
Windows Type 3			2.88	1.4	3.82		
Windows Type 4			6	1.4	7.95		
Walls Type1	21.3	8.88	12.42	0.2	2.48		
Walls Type2	21	8.88	12.12	0.2	2.42		
Walls Type3	25.8	2.4	23.4	0.2	4.68		
Total area of elements, m ²			68.1				
Party wall			25.76	0	0		
Party floor			69.7				
Party ceiling			69.7				
Internal wall **			52.5				

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

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

Fabric heat loss, W/K = S (A x u) (26)...(30) + (32) = 36.49 (33)

Heat capacity Cm = S(A x k) (28)...(30) + (32) + (32a)...(32e) = 20005.6 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 7.81 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 44.31 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	18.96	18.74	18.51	17.4	17.17	16.06	16.06	15.83	16.5	17.17	17.62	18.07	

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

(39)m=	63.27	63.04	62.82	61.7	61.48	60.36	60.36	60.14	60.81	61.48	61.93	62.37	
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Heat loss parameter (HLP), W/m²K Average = Sum(39)_{1...12} /12= 61.65 (39)

(40)m = (39)m ÷ (4) (40)

(40)m=	0.91	0.9	0.9	0.89	0.88	0.87	0.87	0.86	0.87	0.88	0.89	0.89	
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Average = Sum(40)_{1...12} /12= 0.88 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.24 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.37 (43)

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

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

(44)m=	96.11	92.61	89.12	85.62	82.13	78.63	78.63	82.13	85.62	89.12	92.61	96.11	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

Total = Sum(44)_{1...12} = 1048.46 (44)

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

(45)m=	142.53	124.66	128.63	112.15	107.61	92.86	86.04	98.74	99.92	116.44	127.11	138.03	
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Total = Sum(45)_{1...12} = 1374.7 (45)

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

(46)m=	21.38	18.7	19.29	16.82	16.14	13.93	12.91	14.81	14.99	17.47	19.07	20.7	
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Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	
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Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

(61)m=	48.98	42.63	45.41	42.23	41.85	38.78	40.07	41.85	42.23	45.41	45.67	48.98	
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Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01	
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

(64)m=	191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01	
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Output from water heater (annual)_{1...12} 1898.79 (64)

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

(65)m=	59.63	52.1	54.12	47.84	46.24	40.57	38.63	43.29	43.78	50.07	53.68	58.14	
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	

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

(67)m=	17.53	15.57	12.66	9.58	7.16	6.05	6.54	8.5	11.4	14.48	16.9	18.01	
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	196.6	198.64	193.5	182.55	168.74	155.75	147.08	145.04	150.18	161.12	174.94	187.92	
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	
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Pumps and fans gains (Table 5a)

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

(71)m=	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	
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Water heating gains (Table 5)

(72)m=	80.15	77.54	72.75	66.45	62.15	56.35	51.92	58.19	60.8	67.3	74.56	78.14	
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	353.86	351.32	338.48	318.17	297.64	277.73	265.11	271.3	281.97	302.48	325.97	343.66	
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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.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.54	x	2.88	x	36.79	x	0.6	x	0.8	=	24.72	(77)
Southeast 0.9x	0.77	x	6	x	36.79	x	0.6	x	0.8	=	73.43	(77)
Southeast 0.9x	0.54	x	2.88	x	62.67	x	0.6	x	0.8	=	42.11	(77)
Southeast 0.9x	0.77	x	6	x	62.67	x	0.6	x	0.8	=	125.09	(77)
Southeast 0.9x	0.54	x	2.88	x	85.75	x	0.6	x	0.8	=	57.61	(77)
Southeast 0.9x	0.77	x	6	x	85.75	x	0.6	x	0.8	=	171.15	(77)
Southeast 0.9x	0.54	x	2.88	x	106.25	x	0.6	x	0.8	=	71.38	(77)
Southeast 0.9x	0.77	x	6	x	106.25	x	0.6	x	0.8	=	212.06	(77)
Southeast 0.9x	0.54	x	2.88	x	119.01	x	0.6	x	0.8	=	79.96	(77)
Southeast 0.9x	0.77	x	6	x	119.01	x	0.6	x	0.8	=	237.53	(77)
Southeast 0.9x	0.54	x	2.88	x	118.15	x	0.6	x	0.8	=	79.38	(77)
Southeast 0.9x	0.77	x	6	x	118.15	x	0.6	x	0.8	=	235.81	(77)
Southeast 0.9x	0.54	x	2.88	x	113.91	x	0.6	x	0.8	=	76.53	(77)
Southeast 0.9x	0.77	x	6	x	113.91	x	0.6	x	0.8	=	227.34	(77)
Southeast 0.9x	0.54	x	2.88	x	104.39	x	0.6	x	0.8	=	70.13	(77)
Southeast 0.9x	0.77	x	6	x	104.39	x	0.6	x	0.8	=	208.35	(77)
Southeast 0.9x	0.54	x	2.88	x	92.85	x	0.6	x	0.8	=	62.38	(77)
Southeast 0.9x	0.77	x	6	x	92.85	x	0.6	x	0.8	=	185.32	(77)
Southeast 0.9x	0.54	x	2.88	x	69.27	x	0.6	x	0.8	=	46.54	(77)
Southeast 0.9x	0.77	x	6	x	69.27	x	0.6	x	0.8	=	138.25	(77)
Southeast 0.9x	0.54	x	2.88	x	44.07	x	0.6	x	0.8	=	29.61	(77)
Southeast 0.9x	0.77	x	6	x	44.07	x	0.6	x	0.8	=	87.96	(77)
Southeast 0.9x	0.54	x	2.88	x	31.49	x	0.6	x	0.8	=	21.16	(77)
Southeast 0.9x	0.77	x	6	x	31.49	x	0.6	x	0.8	=	62.84	(77)
Northwest 0.9x	0.77	x	6	x	11.28	x	0.6	x	0.8	=	22.52	(81)
Northwest 0.9x	0.77	x	2.88	x	11.28	x	0.6	x	0.8	=	10.81	(81)
Northwest 0.9x	0.77	x	6	x	22.97	x	0.6	x	0.8	=	45.84	(81)
Northwest 0.9x	0.77	x	2.88	x	22.97	x	0.6	x	0.8	=	22	(81)
Northwest 0.9x	0.77	x	6	x	41.38	x	0.6	x	0.8	=	82.59	(81)
Northwest 0.9x	0.77	x	2.88	x	41.38	x	0.6	x	0.8	=	39.64	(81)
Northwest 0.9x	0.77	x	6	x	67.96	x	0.6	x	0.8	=	135.63	(81)
Northwest 0.9x	0.77	x	2.88	x	67.96	x	0.6	x	0.8	=	65.1	(81)
Northwest 0.9x	0.77	x	6	x	91.35	x	0.6	x	0.8	=	182.31	(81)
Northwest 0.9x	0.77	x	2.88	x	91.35	x	0.6	x	0.8	=	87.51	(81)
Northwest 0.9x	0.77	x	6	x	97.38	x	0.6	x	0.8	=	194.36	(81)
Northwest 0.9x	0.77	x	2.88	x	97.38	x	0.6	x	0.8	=	93.29	(81)
Northwest 0.9x	0.77	x	6	x	91.1	x	0.6	x	0.8	=	181.82	(81)
Northwest 0.9x	0.77	x	2.88	x	91.1	x	0.6	x	0.8	=	87.28	(81)
Northwest 0.9x	0.77	x	6	x	72.63	x	0.6	x	0.8	=	144.95	(81)

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Northwest 0.9x	0.77	x	2.88	x	72.63	x	0.6	x	0.8	=	69.58	(81)
Northwest 0.9x	0.77	x	6	x	50.42	x	0.6	x	0.8	=	100.63	(81)
Northwest 0.9x	0.77	x	2.88	x	50.42	x	0.6	x	0.8	=	48.3	(81)
Northwest 0.9x	0.77	x	6	x	28.07	x	0.6	x	0.8	=	56.02	(81)
Northwest 0.9x	0.77	x	2.88	x	28.07	x	0.6	x	0.8	=	26.89	(81)
Northwest 0.9x	0.77	x	6	x	14.2	x	0.6	x	0.8	=	28.33	(81)
Northwest 0.9x	0.77	x	2.88	x	14.2	x	0.6	x	0.8	=	13.6	(81)
Northwest 0.9x	0.77	x	6	x	9.21	x	0.6	x	0.8	=	18.39	(81)
Northwest 0.9x	0.77	x	2.88	x	9.21	x	0.6	x	0.8	=	8.83	(81)

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

(83)m=	131.48	235.03	350.99	484.18	587.3	602.85	572.97	493.01	396.63	267.69	159.5	111.22	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	485.34	586.36	689.47	802.35	884.94	880.57	838.09	764.31	678.6	570.17	485.48	454.88	(84)
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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.98	0.95	0.83	0.63	0.44	0.32	0.36	0.61	0.91	0.99	1	(86)

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

(87)m=	20.19	20.38	20.64	20.88	20.98	21	21	21	20.99	20.83	20.46	20.16	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.18	20.18	20.2	20.2	20.2	20.19	20.18	20.18	20.17	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.79	0.58	0.38	0.26	0.3	0.54	0.88	0.98	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.08	19.36	19.72	20.06	20.17	20.2	20.2	20.2	20.18	20	19.49	19.05	(90)
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fLA = Living area ÷ (4) = 0.39 (91)

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

(92)m=	19.52	19.76	20.08	20.38	20.49	20.51	20.51	20.51	20.5	20.32	19.87	19.48	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.37	19.61	19.93	20.23	20.34	20.36	20.36	20.36	20.35	20.17	19.72	19.33	(93)
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8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.93	0.8	0.59	0.39	0.27	0.31	0.55	0.88	0.98	0.99	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	481.43	572.81	641.67	638.71	522.01	347.18	227.06	238.28	375.67	499.08	475.6	452.27	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W = [(93)m – (96)m]

(97)m=	953.45	927.65	843.91	699.26	530.96	347.76	227.1	238.38	380.06	588.53	781.54	944.02	(97)
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DER WorkSheet: New dwelling design stage

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

(98)m=	351.18	238.46	150.47	43.59	6.66	0	0	0	0	66.55	220.28	365.86	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													1443.04 (98)

Space heating requirement in kWh/m²/year	20.7 (99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system	0 (201)
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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
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Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
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Efficiency of main space heating system 1	90.3 (206)
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Efficiency of secondary/supplementary heating system, %	0 (208)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

351.18	238.46	150.47	43.59	6.66	0	0	0	0	66.55	220.28	365.86
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(211)m = {[(98)m x (204)] } x 100 ÷ (206)	(211)
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388.9	264.07	166.63	48.28	7.37	0	0	0	0	73.7	243.94	405.17		
Total (kWh/year) =Sum(211) _{1...5,10...12} =												1598.06	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01
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Efficiency of water heater	81 (216)
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(217)m=	86.78	86.22	85.06	82.88	81.36	81	81	81	81	83.51	85.96	86.92	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.67	194.02	204.61	186.26	183.71	162.51	155.7	173.57	175.48	193.83	201	215.14	
Total = Sum(219a) _{1...12} =													2266.49 (219)

Annual totals

Space heating fuel used, main system 1	kWh/year	1598.06 kWh/year
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Water heating fuel used	2266.49 kWh/year
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Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside	233.33 (230a)
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central heating pump:	30 (230c)
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Total electricity for the above, kWh/year	sum of (230a)...(230g) =	263.33 (231)
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Electricity for lighting	309.53 (232)
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12a. CO2 emissions – Individual heating systems including micro-CHP

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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DER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	345.18 (261)
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Space heating (secondary)	(215) x	0.519	=	0 (263)
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Water heating	(219) x	0.216	=	489.56 (264)
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Space and water heating	(261) + (262) + (263) + (264) =			834.74 (265)
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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	136.67 (267)
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Electricity for lighting	(232) x	0.519	=	160.64 (268)
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Total CO2, kg/year	sum of (265)...(271) =			1132.06 (272)
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Dwelling CO2 Emission Rate	(272) ÷ (4) =			16.24 (273)
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EI rating (section 14)				87 (274)
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DRAFT

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name:

Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: E 4-2-18

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	69.7 (1a) x	2.8 (2a) =	195.16 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	195.16 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.1 (8)
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]x(8), otherwise (18) = (16)			0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33 (21)

Infiltration rate modified for monthly wind speed

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

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

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

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

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

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

0 (23b)

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

0 (23c)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Doors			2.4	1	2.4		
Windows Type 1			5.08	x1/[1/(1.4)+0.04]	6.73		
Windows Type 2			2.44	x1/[1/(1.4)+0.04]	3.23		
Windows Type 3			2.44	x1/[1/(1.4)+0.04]	3.23		
Windows Type 4			5.08	x1/[1/(1.4)+0.04]	6.73		
Walls Type1	21.3	7.52	13.78	x 0.18	2.48		
Walls Type2	21	7.52	13.48	x 0.18	2.43		
Walls Type3	25.8	2.4	23.4	x 0.18	4.21		
Total area of elements, m ²			68.1				
Party wall			25.76	x 0	0		
Party floor			69.7				
Party ceiling			69.7				
Internal wall **			52.5				

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

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

Fabric heat loss, W/K = S (A x u) (26)...(30) + (32) = 31.46 (33)

Heat capacity Cm = S(A x k) (28)...(30) + (32) + (32a)...(32e) = 20372.8 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 4.74 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 36.2 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	37.77	37.55	37.34	36.34	36.16	35.29	35.29	35.13	35.62	36.16	36.53	36.93	(38)

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

(39)m=	73.97	73.75	73.54	72.54	72.36	71.49	71.49	71.33	71.82	72.36	72.73	73.13	
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Average = Sum(39)_{1...12} /12= 72.54 (39)

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

(40)m=	1.06	1.06	1.06	1.04	1.04	1.03	1.03	1.02	1.03	1.04	1.04	1.05	
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Average = Sum(40)_{1...12} /12= 1.04 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.24 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.37 (43)

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

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

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

(44)m=	96.11	92.61	89.12	85.62	82.13	78.63	78.63	82.13	85.62	89.12	92.61	96.11	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

Total = Sum(44)_{1...12} = 1048.46 (44)

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

(45)m=	142.53	124.66	128.63	112.15	107.61	92.86	86.04	98.74	99.92	116.44	127.11	138.03	
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Total = Sum(45)_{1...12} = 1374.7 (45)

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

(46)m=	21.38	18.7	19.29	16.82	16.14	13.93	12.91	14.81	14.99	17.47	19.07	20.7	(46)
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Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

(61)m=	48.98	42.63	45.41	42.23	41.85	38.78	40.07	41.85	42.23	45.41	45.67	48.98	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

Output from water heater

(64)m=	191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01	
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Output from water heater (annual)_{1...12} 1898.79 (64)

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

(65)m=	59.63	52.1	54.12	47.84	46.24	40.57	38.63	43.29	43.78	50.07	53.68	58.14	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	(66)

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

(67)m=	17.58	15.61	12.7	9.61	7.19	6.07	6.56	8.52	11.44	14.52	16.95	18.07	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	196.6	198.64	193.5	182.55	168.74	155.75	147.08	145.04	150.18	161.12	174.94	187.92	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	(69)
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Pumps and fans gains (Table 5a)

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

(71)m=	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	(71)
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Water heating gains (Table 5)

(72)m=	80.15	77.54	72.75	66.45	62.15	56.35	51.92	58.19	60.8	67.3	74.56	78.14	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	------

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

(73)m=	353.91	351.37	338.52	318.2	297.66	277.75	265.13	271.33	282	302.53	326.03	343.72	(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.

TER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.54	x	2.44	x	36.79	x	0.63	x	0.7	=	19.24	(77)
Southeast 0.9x	0.77	x	5.08	x	36.79	x	0.63	x	0.7	=	57.12	(77)
Southeast 0.9x	0.54	x	2.44	x	62.67	x	0.63	x	0.7	=	32.78	(77)
Southeast 0.9x	0.77	x	5.08	x	62.67	x	0.63	x	0.7	=	97.3	(77)
Southeast 0.9x	0.54	x	2.44	x	85.75	x	0.63	x	0.7	=	44.84	(77)
Southeast 0.9x	0.77	x	5.08	x	85.75	x	0.63	x	0.7	=	133.13	(77)
Southeast 0.9x	0.54	x	2.44	x	106.25	x	0.63	x	0.7	=	55.56	(77)
Southeast 0.9x	0.77	x	5.08	x	106.25	x	0.63	x	0.7	=	164.96	(77)
Southeast 0.9x	0.54	x	2.44	x	119.01	x	0.63	x	0.7	=	62.24	(77)
Southeast 0.9x	0.77	x	5.08	x	119.01	x	0.63	x	0.7	=	184.77	(77)
Southeast 0.9x	0.54	x	2.44	x	118.15	x	0.63	x	0.7	=	61.79	(77)
Southeast 0.9x	0.77	x	5.08	x	118.15	x	0.63	x	0.7	=	183.43	(77)
Southeast 0.9x	0.54	x	2.44	x	113.91	x	0.63	x	0.7	=	59.57	(77)
Southeast 0.9x	0.77	x	5.08	x	113.91	x	0.63	x	0.7	=	176.85	(77)
Southeast 0.9x	0.54	x	2.44	x	104.39	x	0.63	x	0.7	=	54.59	(77)
Southeast 0.9x	0.77	x	5.08	x	104.39	x	0.63	x	0.7	=	162.07	(77)
Southeast 0.9x	0.54	x	2.44	x	92.85	x	0.63	x	0.7	=	48.56	(77)
Southeast 0.9x	0.77	x	5.08	x	92.85	x	0.63	x	0.7	=	144.15	(77)
Southeast 0.9x	0.54	x	2.44	x	69.27	x	0.63	x	0.7	=	36.22	(77)
Southeast 0.9x	0.77	x	5.08	x	69.27	x	0.63	x	0.7	=	107.54	(77)
Southeast 0.9x	0.54	x	2.44	x	44.07	x	0.63	x	0.7	=	23.05	(77)
Southeast 0.9x	0.77	x	5.08	x	44.07	x	0.63	x	0.7	=	68.42	(77)
Southeast 0.9x	0.54	x	2.44	x	31.49	x	0.63	x	0.7	=	16.47	(77)
Southeast 0.9x	0.77	x	5.08	x	31.49	x	0.63	x	0.7	=	48.89	(77)
Northwest 0.9x	0.77	x	5.08	x	11.28	x	0.63	x	0.7	=	17.52	(81)
Northwest 0.9x	0.77	x	2.44	x	11.28	x	0.63	x	0.7	=	8.41	(81)
Northwest 0.9x	0.77	x	5.08	x	22.97	x	0.63	x	0.7	=	35.66	(81)
Northwest 0.9x	0.77	x	2.44	x	22.97	x	0.63	x	0.7	=	17.13	(81)
Northwest 0.9x	0.77	x	5.08	x	41.38	x	0.63	x	0.7	=	64.24	(81)
Northwest 0.9x	0.77	x	2.44	x	41.38	x	0.63	x	0.7	=	30.86	(81)
Northwest 0.9x	0.77	x	5.08	x	67.96	x	0.63	x	0.7	=	105.5	(81)
Northwest 0.9x	0.77	x	2.44	x	67.96	x	0.63	x	0.7	=	50.67	(81)
Northwest 0.9x	0.77	x	5.08	x	91.35	x	0.63	x	0.7	=	141.82	(81)
Northwest 0.9x	0.77	x	2.44	x	91.35	x	0.63	x	0.7	=	68.12	(81)
Northwest 0.9x	0.77	x	5.08	x	97.38	x	0.63	x	0.7	=	151.19	(81)
Northwest 0.9x	0.77	x	2.44	x	97.38	x	0.63	x	0.7	=	72.62	(81)
Northwest 0.9x	0.77	x	5.08	x	91.1	x	0.63	x	0.7	=	141.44	(81)
Northwest 0.9x	0.77	x	2.44	x	91.1	x	0.63	x	0.7	=	67.93	(81)
Northwest 0.9x	0.77	x	5.08	x	72.63	x	0.63	x	0.7	=	112.75	(81)

TER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.44	x	72.63	x	0.63	x	0.7	=	54.16	(81)
Northwest 0.9x	0.77	x	5.08	x	50.42	x	0.63	x	0.7	=	78.28	(81)
Northwest 0.9x	0.77	x	2.44	x	50.42	x	0.63	x	0.7	=	37.6	(81)
Northwest 0.9x	0.77	x	5.08	x	28.07	x	0.63	x	0.7	=	43.57	(81)
Northwest 0.9x	0.77	x	2.44	x	28.07	x	0.63	x	0.7	=	20.93	(81)
Northwest 0.9x	0.77	x	5.08	x	14.2	x	0.63	x	0.7	=	22.04	(81)
Northwest 0.9x	0.77	x	2.44	x	14.2	x	0.63	x	0.7	=	10.59	(81)
Northwest 0.9x	0.77	x	5.08	x	9.21	x	0.63	x	0.7	=	14.31	(81)
Northwest 0.9x	0.77	x	2.44	x	9.21	x	0.63	x	0.7	=	6.87	(81)

Solar gains in watts, calculated for each month												(83)m = Sum(74)m ... (82)m	
(83)m=	102.3	182.86	273.07	376.7	456.94	469.03	445.78	383.57	308.59	208.27	124.09	86.53	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	456.21	534.23	611.6	694.9	754.59	746.77	710.92	654.9	590.59	510.79	450.12	430.25	(84)

7. Mean internal temperature (heating season)

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

21

(85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.98	0.93	0.79	0.6	0.44	0.5	0.76	0.96	0.99	1

(86)

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

(87)m=

19.93	20.1	20.36	20.68	20.9	20.98	21	20.99	20.94	20.64	20.23	19.9
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(87)

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

(88)m=

20.03	20.04	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.04
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(88)

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

(89)m=

1	0.99	0.97	0.9	0.74	0.52	0.35	0.4	0.69	0.94	0.99	1
---	------	------	-----	------	------	------	-----	------	------	------	---

(89)

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

(90)m=

18.61	18.86	19.23	19.68	19.96	20.05	20.06	20.06	20.01	19.64	19.05	18.58
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(90)

fLA = Living area ÷ (4) =

0.39

(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2													
(92)m=	19.13	19.34	19.67	20.07	20.33	20.42	20.43	20.43	20.38	20.03	19.51	19.1	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m=	19.13	19.34	19.67	20.07	20.33	20.42	20.43	20.43	20.38	20.03	19.51	19.1	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains, h_m :												
(94) $m=$	0.99	0.99	0.97	0.9	0.76	0.55	0.38	0.44	0.71	0.94	0.99	1

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

(95) $m=$	453.79	527.63	591.62	626.8	570	408.42	272.87	285.66	421.51	479.58	444.93	428.54
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Monthly average external temperature from Table 8

(96) $m=$	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2
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Heat loss rate for mean internal temperature, L_m , $W = [(39)m \times [(93)m - (96)m]]$

(97) $m=$	1096.86	1065.32	968.79	810.54	624.21	415.9	273.74	287.37	450.77	682.52	902.74	1089.42
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TER WorkSheet: New dwelling design stage

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

(98)m=	478.45	361.33	280.61	132.29	40.33	0	0	0	0	150.98	329.62	491.7	
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													2265.32 (98)

Space heating requirement in kWh/m²/year	32.5 (99)
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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

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

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

Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
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Efficiency of main space heating system 1	93.4 (206)
---	------------

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

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

Space heating requirement (calculated above)

478.45	361.33	280.61	132.29	40.33	0	0	0	0	150.98	329.62	491.7
--------	--------	--------	--------	-------	---	---	---	---	--------	--------	-------

(211)m = {[(98)m x (204)] } x 100 ÷ (206)	512.26	386.86	300.44	141.64	43.18	0	0	0	0	161.65	352.91	526.44	(211)
---	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	-------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 2425.39 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01
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Efficiency of water heater	80.3 (216)
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(217)m=	87.26	86.94	86.25	84.67	82.25	80.3	80.3	80.3	80.3	84.88	86.65	87.37	(217)
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Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	219.46	192.41	201.8	182.33	181.71	163.93	157.06	175.08	177.01	190.7	199.4	214.03	
Total = Sum(219a) _{1...12} =													2254.91 (219)

Annual totals

Space heating fuel used, main system 1	kWh/year	2425.39 kWh/year
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Water heating fuel used	2254.91 kWh/year
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Electricity for pumps, fans and electric keep-hot

central heating pump:	30 (230c)
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boiler with a fan-assisted flue	45 (230e)
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Total electricity for the above, kWh/year	sum of (230a)...(230g) =	75 (231)
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Electricity for lighting	310.48 (232)
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12a. CO2 emissions – Individual heating systems including micro-CHP

Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	523.89 (261)
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Space heating (secondary)	(215) x	0.519	=	0 (263)
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Water heating	(219) x	0.216	=	487.06 (264)
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Space and water heating	(261) + (262) + (263) + (264) =			1010.95 (265)
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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93 (267)
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Electricity for lighting	(232) x	0.519	=	161.14 (268)
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Total CO2, kg/year	sum of (265)...(271) =			1211.01 (272)
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TER =				17.37 (273)
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DRAFT

PART L1A 2013 SAP WORKSHEETS (BE GREEN)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: B1-14-1

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	65.9 (1a) x	2.8 (2a) =	184.52 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.9 (4)		
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		184.52 (5)

2. Ventilation rate:

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
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			3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0.15 (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) =		0.13 (21)

Infiltration rate modified for monthly wind speed

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

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

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

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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

76.5 (23c)

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

(24a)m= 0.28 0.28 0.27 0.26 0.25 0.24 0.24 0.24 0.24 0.25 0.26 0.27 (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.28 0.28 0.27 0.26 0.25 0.24 0.24 0.24 0.24 0.25 0.26 0.27 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m2K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Windows Type 1			3.12	x1/[1/(1.4)+0.04] =	4.14		(27)
Windows Type 2			3.12	x1/[1/(1.4)+0.04] =	4.14		(27)
Windows Type 3			6.5	x1/[1/(1.4)+0.04] =	8.62		(27)
Windows Type 4			3.12	x1/[1/(1.4)+0.04] =	4.14		(27)
Windows Type 5			6.5	x1/[1/(1.4)+0.04] =	8.62		(27)
Walls Type1	34.2	15.86	18.34	x 0.2 =	3.67		(29)
Walls Type2	10.6	6.5	4.1	x 0.2 =	0.82		(29)
Total area of elements, m ²			44.8				(31)
Party wall			29.4	x 0 =	0		(32)
Party wall			63	x 0 =	0		(32)
Party floor			74.3				(32a)
Party ceiling			74.3				(32b)
Internal wall **			50.4				(32c)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 34.13 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 18705 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 6.87 (36)

DER WorkSheet: New dwelling design stage

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 41 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	17.05	16.86	16.67	15.69	15.5	14.53	14.53	14.34	14.92	15.5	15.89	16.28	(38)

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

(39)m=	58.05	57.86	57.67	56.7	56.5	55.53	55.53	55.34	55.92	56.5	56.89	57.28	
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Average = Sum(39)_{1...12} /12= 56.65 (39)

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

(40)m=	0.88	0.88	0.88	0.86	0.86	0.84	0.84	0.84	0.85	0.86	0.86	0.87	
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Average = Sum(40)_{1...12} /12= 0.86 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.14 (42)

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

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.09 (43)

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

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

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

(44)m=	93.6	90.19	86.79	83.39	79.98	76.58	76.58	79.98	83.39	86.79	90.19	93.6	
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Total = Sum(44)_{1...12} = 1021.05 (44)

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

(45)m=	138.8	121.4	125.27	109.21	104.79	90.43	83.79	96.16	97.3	113.4	123.78	134.42	
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Total = Sum(45)_{1...12} = 1338.76 (45)

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

(46)m=	20.82	18.21	18.79	16.38	15.72	13.56	12.57	14.42	14.6	17.01	18.57	20.16	(46)
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Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

DER WorkSheet: New dwelling design stage

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

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

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
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Primary circuit loss (annual) from Table 3 0 (58)

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

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

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

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

(61)m=	47.7	41.51	44.23	41.12	40.76	37.76	39.02	40.76	41.12	44.23	44.48	47.7	(61)
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Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	186.5	162.91	169.5	150.33	145.55	128.19	122.82	136.91	138.43	157.63	168.26	182.12	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

(64)m=	186.5	162.91	169.5	150.33	145.55	128.19	122.82	136.91	138.43	157.63	168.26	182.12	
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Output from water heater (annual)_{1...12} 1849.14 (64)

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

(65)m=	58.08	50.74	52.71	46.59	45.03	39.51	37.62	42.16	42.63	48.76	52.28	56.62	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	(66)

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

(67)m=	16.72	14.85	12.08	9.14	6.83	5.77	6.23	8.1	10.88	13.81	16.12	17.18	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	187.55	189.49	184.59	174.15	160.97	148.58	140.31	138.36	143.26	153.7	166.88	179.27	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	(69)
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Pumps and fans gains (Table 5a)

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

(71)m=	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	(71)
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Water heating gains (Table 5)

(72)m=	78.06	75.51	70.85	64.71	60.53	54.87	50.56	56.67	59.21	65.54	72.61	76.1	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.46	337.99	325.65	306.14	286.47	267.36	255.24	261.27	271.5	291.2	313.75	330.7	(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.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor		Area		Flux		g_		FF		Gains
	Table 6d		m²		Table 6a		Table 6b		Table 6c		(W)
North	0.9x	0.77	x	3.12	x	10.63	x	0.6	x	0.8	= 11.04 (74)
North	0.9x	0.77	x	3.12	x	10.63	x	0.6	x	0.8	= 11.04 (74)
North	0.9x	0.77	x	6.5	x	10.63	x	0.6	x	0.8	= 22.99 (74)
North	0.9x	0.77	x	3.12	x	10.63	x	0.6	x	0.8	= 11.04 (74)
North	0.9x	0.77	x	3.12	x	20.32	x	0.6	x	0.8	= 21.09 (74)
North	0.9x	0.77	x	3.12	x	20.32	x	0.6	x	0.8	= 21.09 (74)
North	0.9x	0.77	x	6.5	x	20.32	x	0.6	x	0.8	= 43.94 (74)
North	0.9x	0.77	x	3.12	x	20.32	x	0.6	x	0.8	= 21.09 (74)
North	0.9x	0.77	x	3.12	x	34.53	x	0.6	x	0.8	= 35.84 (74)
North	0.9x	0.77	x	3.12	x	34.53	x	0.6	x	0.8	= 35.84 (74)
North	0.9x	0.77	x	6.5	x	34.53	x	0.6	x	0.8	= 74.66 (74)
North	0.9x	0.77	x	3.12	x	34.53	x	0.6	x	0.8	= 35.84 (74)
North	0.9x	0.77	x	3.12	x	55.46	x	0.6	x	0.8	= 57.56 (74)
North	0.9x	0.77	x	3.12	x	55.46	x	0.6	x	0.8	= 57.56 (74)
North	0.9x	0.77	x	6.5	x	55.46	x	0.6	x	0.8	= 119.92 (74)
North	0.9x	0.77	x	3.12	x	55.46	x	0.6	x	0.8	= 57.56 (74)
North	0.9x	0.77	x	3.12	x	74.72	x	0.6	x	0.8	= 77.54 (74)
North	0.9x	0.77	x	3.12	x	74.72	x	0.6	x	0.8	= 77.54 (74)
North	0.9x	0.77	x	6.5	x	74.72	x	0.6	x	0.8	= 161.55 (74)
North	0.9x	0.77	x	3.12	x	74.72	x	0.6	x	0.8	= 77.54 (74)
North	0.9x	0.77	x	3.12	x	79.99	x	0.6	x	0.8	= 83.01 (74)
North	0.9x	0.77	x	3.12	x	79.99	x	0.6	x	0.8	= 83.01 (74)
North	0.9x	0.77	x	6.5	x	79.99	x	0.6	x	0.8	= 172.94 (74)
North	0.9x	0.77	x	3.12	x	79.99	x	0.6	x	0.8	= 83.01 (74)
North	0.9x	0.77	x	3.12	x	74.68	x	0.6	x	0.8	= 77.5 (74)
North	0.9x	0.77	x	3.12	x	74.68	x	0.6	x	0.8	= 77.5 (74)
North	0.9x	0.77	x	6.5	x	74.68	x	0.6	x	0.8	= 161.46 (74)
North	0.9x	0.77	x	3.12	x	74.68	x	0.6	x	0.8	= 77.5 (74)
North	0.9x	0.77	x	3.12	x	59.25	x	0.6	x	0.8	= 61.49 (74)
North	0.9x	0.77	x	3.12	x	59.25	x	0.6	x	0.8	= 61.49 (74)
North	0.9x	0.77	x	6.5	x	59.25	x	0.6	x	0.8	= 128.1 (74)
North	0.9x	0.77	x	3.12	x	59.25	x	0.6	x	0.8	= 61.49 (74)
North	0.9x	0.77	x	3.12	x	41.52	x	0.6	x	0.8	= 43.09 (74)
North	0.9x	0.77	x	3.12	x	41.52	x	0.6	x	0.8	= 43.09 (74)
North	0.9x	0.77	x	6.5	x	41.52	x	0.6	x	0.8	= 89.77 (74)
North	0.9x	0.77	x	3.12	x	41.52	x	0.6	x	0.8	= 43.09 (74)
North	0.9x	0.77	x	3.12	x	24.19	x	0.6	x	0.8	= 25.1 (74)
North	0.9x	0.77	x	3.12	x	24.19	x	0.6	x	0.8	= 25.1 (74)
North	0.9x	0.77	x	6.5	x	24.19	x	0.6	x	0.8	= 52.3 (74)

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North	0.9x	0.77	x	3.12	x	24.19	x	0.6	x	0.8	=	25.1	(74)
North	0.9x	0.77	x	3.12	x	13.12	x	0.6	x	0.8	=	13.61	(74)
North	0.9x	0.77	x	3.12	x	13.12	x	0.6	x	0.8	=	13.61	(74)
North	0.9x	0.77	x	6.5	x	13.12	x	0.6	x	0.8	=	28.36	(74)
North	0.9x	0.77	x	3.12	x	13.12	x	0.6	x	0.8	=	13.61	(74)
North	0.9x	0.77	x	3.12	x	8.86	x	0.6	x	0.8	=	9.2	(74)
North	0.9x	0.77	x	3.12	x	8.86	x	0.6	x	0.8	=	9.2	(74)
North	0.9x	0.77	x	6.5	x	8.86	x	0.6	x	0.8	=	19.17	(74)
North	0.9x	0.77	x	3.12	x	8.86	x	0.6	x	0.8	=	9.2	(74)
West	0.9x	0.77	x	6.5	x	19.64	x	0.6	x	0.8	=	42.47	(80)
West	0.9x	0.77	x	6.5	x	38.42	x	0.6	x	0.8	=	83.07	(80)
West	0.9x	0.77	x	6.5	x	63.27	x	0.6	x	0.8	=	136.81	(80)
West	0.9x	0.77	x	6.5	x	92.28	x	0.6	x	0.8	=	199.52	(80)
West	0.9x	0.77	x	6.5	x	113.09	x	0.6	x	0.8	=	244.52	(80)
West	0.9x	0.77	x	6.5	x	115.77	x	0.6	x	0.8	=	250.31	(80)
West	0.9x	0.77	x	6.5	x	110.22	x	0.6	x	0.8	=	238.31	(80)
West	0.9x	0.77	x	6.5	x	94.68	x	0.6	x	0.8	=	204.7	(80)
West	0.9x	0.77	x	6.5	x	73.59	x	0.6	x	0.8	=	159.11	(80)
West	0.9x	0.77	x	6.5	x	45.59	x	0.6	x	0.8	=	98.57	(80)
West	0.9x	0.77	x	6.5	x	24.49	x	0.6	x	0.8	=	52.95	(80)
West	0.9x	0.77	x	6.5	x	16.15	x	0.6	x	0.8	=	34.92	(80)

Solar gains in watts, calculated for each month

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

(83)m= 98.56 190.28 318.98 492.14 638.7 672.29 632.28 517.27 378.14 226.19 122.15 81.69 (83)

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

(84)m= 439.03 528.27 644.63 798.28 925.17 939.65 887.52 778.54 649.63 517.38 435.91 412.38 (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)

(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.99	0.95	0.79	0.56	0.38	0.28	0.33	0.59	0.91	0.99	1

 (86)

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

(87)m= 20.2 20.39 20.66 20.92 20.99 21 21 21 20.99 20.83 20.46 20.17 (87)

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

(88)m= 20.18 20.19 20.19 20.2 20.2 20.22 20.22 20.22 20.21 20.2 20.2 20.19 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m= 0.99 0.98 0.93 0.75 0.52 0.33 0.23 0.27 0.52 0.88 0.99 1 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m= 19.12 19.39 19.78 20.12 20.2 20.22 20.22 20.22 20.21 20.02 19.5 19.08 (90)

fLA = Living area ÷ (4) = 0.28 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

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(92)m= 19.43 19.67 20.03 20.34 20.42 20.44 20.44 20.44 20.43 20.25 19.78 19.39 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m= 19.28 19.52 19.88 20.19 20.27 20.29 20.29 20.29 20.28 20.1 19.63 19.24 (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
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Utilisation factor for gains, hm:

(94)m= 0.99 0.98 0.93 0.75 0.52 0.34 0.23 0.28 0.53 0.88 0.98 1 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m= 435.98 517.57 597.72 601.69 480.61 315.71 204.83 215.26 342.74 455.34 428.28 410.34 (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= 869.43 845.86 771.45 640.3 484.31 315.88 204.84 215.29 345.51 536.56 712.57 861.56 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m= 322.49 220.61 129.25 27.79 2.75 0 0 0 0 60.43 204.69 335.71 (98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1303.72 (98)

Space heating requirement in kWh/m²/year 19.78 (99)

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.3 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

322.49	220.61	129.25	27.79	2.75	0	0	0	0	60.43	204.69	335.71
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

357.13	244.31	143.13	30.78	3.05	0	0	0	0	66.93	226.67	371.77
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Total (kWh/year) =Sum(211)_{1...5,10...12} = 1443.77 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m= 0 0 0 0 0 0 0 0 0 0 0 0 (215)

Total (kWh/year) =Sum(215)_{1...5,10...12} = 0 (215)

Water heating

Output from water heater (calculated above)

186.5	162.91	169.5	150.33	145.55	128.19	122.82	136.91	138.43	157.63	168.26	182.12
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Efficiency of water heater 81 (216)

(217)m= 86.65 86.1 84.78 82.32 81.16 81 81 81 81 83.38 85.85 86.8 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 215.22 189.21 199.93 182.62 179.35 158.26 151.63 169.03 170.9 189.04 195.99 209.82 (219)

Total = Sum(219a)_{1...12} = 2211 (219)

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Annual totals

Space heating fuel used, main system 1

kWh/year kWh/year
1443.77

Water heating fuel used

2211

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside 220.61 (230a)

central heating pump: 30 (230c)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 250.61 (231)

Electricity for lighting 295.28 (232)

Electricity generated by PVs -345.45 (233)

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 =	311.85 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	477.57 (264)
Space and water heating	(261) + (262) + (263) + (264) =		789.43 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	130.07 (267)
Electricity for lighting	(232) x	0.519 =	153.25 (268)
Energy saving/generation technologies Item 1		0.519 =	-179.29 (269)
Total CO2, kg/year		sum of (265)...(271) =	893.46 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	13.56 (273)
El rating (section 14)			89 (274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Stroma Number: Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.10

Property Address: B1-14-1

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m²)	Av. Height(m)	Volume(m³)
Ground floor	65.9 (1a) x	2.8 (2a) =	184.52 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	65.9 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	184.52 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]x(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (21)

Infiltration rate modified for monthly wind speed												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.37	0.34	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36
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Calculate effective air change rate for the applicable case

If mechanical ventilation:	0 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	0 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
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b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0
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c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.3	x1/[1/(1.4)+0.04] =	3.05		
Windows Type 2			2.3	x1/[1/(1.4)+0.04] =	3.05		
Windows Type 3			4.79	x1/[1/(1.4)+0.04] =	6.35		
Windows Type 4			2.3	x1/[1/(1.4)+0.04] =	3.05		
Windows Type 5			4.79	x1/[1/(1.4)+0.04] =	6.35		
Walls Type1	34.2	11.69	22.51	x 0.18 =	4.05		
Walls Type2	10.6	4.79	5.81	x 0.18 =	1.05		
Total area of elements, m²			44.8				
Party wall			29.4	x 0 =	0		
Party wall			63	x 0 =	0		
Party floor			74.3				
Party ceiling			74.3				
Internal wall **			50.4				

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2
** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x u)	(26)...(30) + (32) =	26.95 (33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	19498.8 (34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250 (35)
Thermal bridges : S (L x Y) calculated using Appendix K		5.47 (36)

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if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) = 32.41 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (38)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.04	34.86	34.69	33.86	33.71	33	33	32.86	33.27	33.71	34.02	34.35	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m (39)

(39)m=	67.45	67.27	67.1	66.28	66.12	65.41	65.41	65.27	65.68	66.12	66.43	66.76	
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

Heat loss parameter (HLP), W/m²K Average = Sum(39)_{1...12} / 12 = 66.27 (39)

(40)m = (39)m ÷ (4) (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.02	1.01	1	0.99	0.99	0.99	1	1	1.01	1.01	
--------	------	------	------	------	---	------	------	------	---	---	------	------	--

Average = Sum(40)_{1...12} / 12 = 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.14 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA - 13.9)²)] + 0.0013 x (TFA - 13.9)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.09 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	93.6	90.19	86.79	83.39	79.98	76.58	76.58	79.98	83.39	86.79	90.19	93.6	
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	--

Total = Sum(44)_{1...12} = 1021.05 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	138.8	121.4	125.27	109.21	104.79	90.43	83.79	96.16	97.3	113.4	123.78	134.42	
--------	-------	-------	--------	--------	--------	-------	-------	-------	------	-------	--------	--------	--

Total = Sum(45)_{1...12} = 1338.76 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	20.82	18.21	18.79	16.38	15.72	13.56	12.57	14.42	14.6	17.01	18.57	20.16	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

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Water storage loss calculated for each month ((56)m = (55) x (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m

(61)m=	47.7	41.51	44.23	41.12	40.76	37.76	39.02	40.76	41.12	44.23	44.48	47.7	(61)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	186.5	162.91	169.5	150.33	145.55	128.19	122.82	136.91	138.43	157.63	168.26	182.12	(62)
--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	186.5	162.91	169.5	150.33	145.55	128.19	122.82	136.91	138.43	157.63	168.26	182.12	
--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

Output from water heater (annual)_{1...12} 1849.14 (64)

Heat gains from water heating, kWh/month 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	58.08	50.74	52.71	46.59	45.03	39.51	37.62	42.16	42.63	48.76	52.28	56.62	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	107.13	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	16.72	14.85	12.08	9.14	6.83	5.77	6.23	8.1	10.88	13.81	16.12	17.18	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	187.55	189.49	184.59	174.15	160.97	148.58	140.31	138.36	143.26	153.7	166.88	179.27	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	33.71	(69)
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Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	-85.71	(71)
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Water heating gains (Table 5)

(72)m=	78.06	75.51	70.85	64.71	60.53	54.87	50.56	56.67	59.21	65.54	72.61	76.1	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	340.46	337.99	325.65	306.14	286.47	267.36	255.24	261.27	271.5	291.2	313.75	330.7	(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.

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Orientation:	Access Factor Table 6d			Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.3	x	10.63	x	0.63	x	0.7	=	7.47	(74)
North	0.9x	0.77	x	2.3	x	10.63	x	0.63	x	0.7	=	7.47	(74)
North	0.9x	0.77	x	4.79	x	10.63	x	0.63	x	0.7	=	15.57	(74)
North	0.9x	0.77	x	2.3	x	10.63	x	0.63	x	0.7	=	7.47	(74)
North	0.9x	0.77	x	2.3	x	20.32	x	0.63	x	0.7	=	14.28	(74)
North	0.9x	0.77	x	2.3	x	20.32	x	0.63	x	0.7	=	14.28	(74)
North	0.9x	0.77	x	4.79	x	20.32	x	0.63	x	0.7	=	29.75	(74)
North	0.9x	0.77	x	2.3	x	20.32	x	0.63	x	0.7	=	14.28	(74)
North	0.9x	0.77	x	2.3	x	34.53	x	0.63	x	0.7	=	24.27	(74)
North	0.9x	0.77	x	2.3	x	34.53	x	0.63	x	0.7	=	24.27	(74)
North	0.9x	0.77	x	4.79	x	34.53	x	0.63	x	0.7	=	50.55	(74)
North	0.9x	0.77	x	2.3	x	34.53	x	0.63	x	0.7	=	24.27	(74)
North	0.9x	0.77	x	2.3	x	55.46	x	0.63	x	0.7	=	38.99	(74)
North	0.9x	0.77	x	2.3	x	55.46	x	0.63	x	0.7	=	38.99	(74)
North	0.9x	0.77	x	4.79	x	55.46	x	0.63	x	0.7	=	81.19	(74)
North	0.9x	0.77	x	2.3	x	55.46	x	0.63	x	0.7	=	38.99	(74)
North	0.9x	0.77	x	2.3	x	74.72	x	0.63	x	0.7	=	52.52	(74)
North	0.9x	0.77	x	2.3	x	74.72	x	0.63	x	0.7	=	52.52	(74)
North	0.9x	0.77	x	4.79	x	74.72	x	0.63	x	0.7	=	109.38	(74)
North	0.9x	0.77	x	2.3	x	74.72	x	0.63	x	0.7	=	52.52	(74)
North	0.9x	0.77	x	2.3	x	79.99	x	0.63	x	0.7	=	56.22	(74)
North	0.9x	0.77	x	2.3	x	79.99	x	0.63	x	0.7	=	56.22	(74)
North	0.9x	0.77	x	4.79	x	79.99	x	0.63	x	0.7	=	117.09	(74)
North	0.9x	0.77	x	2.3	x	79.99	x	0.63	x	0.7	=	56.22	(74)
North	0.9x	0.77	x	2.3	x	74.68	x	0.63	x	0.7	=	52.49	(74)
North	0.9x	0.77	x	2.3	x	74.68	x	0.63	x	0.7	=	52.49	(74)
North	0.9x	0.77	x	4.79	x	74.68	x	0.63	x	0.7	=	109.32	(74)
North	0.9x	0.77	x	2.3	x	74.68	x	0.63	x	0.7	=	52.49	(74)
North	0.9x	0.77	x	2.3	x	59.25	x	0.63	x	0.7	=	41.64	(74)
North	0.9x	0.77	x	2.3	x	59.25	x	0.63	x	0.7	=	41.64	(74)
North	0.9x	0.77	x	4.79	x	59.25	x	0.63	x	0.7	=	86.73	(74)
North	0.9x	0.77	x	2.3	x	59.25	x	0.63	x	0.7	=	41.64	(74)
North	0.9x	0.77	x	2.3	x	41.52	x	0.63	x	0.7	=	29.18	(74)
North	0.9x	0.77	x	2.3	x	41.52	x	0.63	x	0.7	=	29.18	(74)
North	0.9x	0.77	x	4.79	x	41.52	x	0.63	x	0.7	=	60.78	(74)
North	0.9x	0.77	x	2.3	x	41.52	x	0.63	x	0.7	=	29.18	(74)
North	0.9x	0.77	x	2.3	x	24.19	x	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	2.3	x	24.19	x	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	4.79	x	24.19	x	0.63	x	0.7	=	35.41	(74)

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North	0.9x	0.77	x	2.3	x	24.19	x	0.63	x	0.7	=	17	(74)
North	0.9x	0.77	x	2.3	x	13.12	x	0.63	x	0.7	=	9.22	(74)
North	0.9x	0.77	x	2.3	x	13.12	x	0.63	x	0.7	=	9.22	(74)
North	0.9x	0.77	x	4.79	x	13.12	x	0.63	x	0.7	=	19.2	(74)
North	0.9x	0.77	x	2.3	x	13.12	x	0.63	x	0.7	=	9.22	(74)
North	0.9x	0.77	x	2.3	x	8.86	x	0.63	x	0.7	=	6.23	(74)
North	0.9x	0.77	x	2.3	x	8.86	x	0.63	x	0.7	=	6.23	(74)
North	0.9x	0.77	x	4.79	x	8.86	x	0.63	x	0.7	=	12.98	(74)
North	0.9x	0.77	x	2.3	x	8.86	x	0.63	x	0.7	=	6.23	(74)
West	0.9x	0.77	x	4.79	x	19.64	x	0.63	x	0.7	=	28.75	(80)
West	0.9x	0.77	x	4.79	x	38.42	x	0.63	x	0.7	=	56.24	(80)
West	0.9x	0.77	x	4.79	x	63.27	x	0.63	x	0.7	=	92.62	(80)
West	0.9x	0.77	x	4.79	x	92.28	x	0.63	x	0.7	=	135.09	(80)
West	0.9x	0.77	x	4.79	x	113.09	x	0.63	x	0.7	=	165.55	(80)
West	0.9x	0.77	x	4.79	x	115.77	x	0.63	x	0.7	=	169.47	(80)
West	0.9x	0.77	x	4.79	x	110.22	x	0.63	x	0.7	=	161.35	(80)
West	0.9x	0.77	x	4.79	x	94.68	x	0.63	x	0.7	=	138.59	(80)
West	0.9x	0.77	x	4.79	x	73.59	x	0.63	x	0.7	=	107.73	(80)
West	0.9x	0.77	x	4.79	x	45.59	x	0.63	x	0.7	=	66.74	(80)
West	0.9x	0.77	x	4.79	x	24.49	x	0.63	x	0.7	=	35.85	(80)
West	0.9x	0.77	x	4.79	x	16.15	x	0.63	x	0.7	=	23.64	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ... (82)m
(83)m= 66.74 128.84 215.99 333.24 432.49 455.23 428.14 350.26 256.05 153.16 82.71 55.31 (83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts
(84)m= 407.2 466.83 541.64 639.38 718.96 722.6 683.38 611.53 527.54 444.35 396.46 386.01 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)
(86)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.99	0.98	0.93	0.78	0.57	0.42	0.49	0.78	0.97	0.99	1

 (86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)
(87)m=

19.95	20.1	20.36	20.69	20.92	20.99	21	21	20.94	20.62	20.23	19.92
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 (87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)
(88)m=

20.06	20.07	20.07	20.08	20.08	20.09	20.09	20.09	20.09	20.08	20.08	20.07
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 (88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)
(89)m=

1	0.99	0.98	0.9	0.72	0.49	0.33	0.39	0.7	0.95	0.99	1
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 (89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)
(90)m=

18.66	18.88	19.25	19.73	20	20.08	20.09	20.09	20.04	19.64	19.07	18.63
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 (90)

fLA = Living area ÷ (4) = 0.28 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

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(92)m= 19.03 19.22 19.57 20 20.26 20.34 20.35 20.35 20.29 19.92 19.4 19 (92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m= 19.03 19.22 19.57 20 20.26 20.34 20.35 20.35 20.29 19.92 19.4 19 (93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, hm:

(94)m= 1 0.99 0.97 0.9 0.73 0.51 0.36 0.42 0.72 0.95 0.99 1 (94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m= 405.45 462.43 526.68 576.3 526.54 370.91 244.6 256.52 380.69 422.04 392.86 384.75 (95)

Monthly average external temperature from Table 8

(96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m= 993.23 963.49 876.66 735.83 566.17 375.38 245.07 257.63 406.81 616.39 817.14 987.76 (97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m= 437.31 336.71 260.39 114.86 29.48 0 0 0 0 144.59 305.48 448.64 (98)

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2077.46 (98)

Space heating requirement in kWh/m²/year

(99)m= 31.52 (99)

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system

(201)m= 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) =

(202)m= 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =

(204)m= 1 (204)

Efficiency of main space heating system 1

(206)m= 93.4 (206)

Efficiency of secondary/supplementary heating system, %

(208)m= 0 (208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Space heating requirement (calculated above)

(211)m= 437.31 336.71 260.39 114.86 29.48 0 0 0 0 144.59 305.48 448.64 (211)

Space heating fuel (secondary), kWh/month

(215)m= 0 0 0 0 0 0 0 0 0 0 0 0 (215)

Total (kWh/year) =Sum(215)_{1...5,10...12} = 0 (215)

Water heating

Output from water heater (calculated above)

186.5	162.91	169.5	150.33	145.55	128.19	122.82	136.91	138.43	157.63	168.26	182.12
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Efficiency of water heater 80.3 (216)

(217)m= 87.12 86.84 86.13 84.38 81.84 80.3 80.3 80.3 80.3 84.83 86.53 87.23 (217)

Fuel for water heating, kWh/month

(219)m= 214.06 187.6 196.79 178.16 177.85 159.64 152.95 170.5 172.39 185.8 194.45 208.77 (219)

Total = Sum(219a)_{1...12} = 2198.96 (219)

TER WorkSheet: New dwelling design stage

Annual totals

Space heating fuel used, main system 1

kWh/year kWh/year
2224.26

Water heating fuel used

2198.96

Electricity for pumps, fans and electric keep-hot

central heating pump: 30 (230c)

boiler with a fan-assisted flue 45 (230e)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 75 (231)

Electricity for lighting 295.28 (232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	= 480.44 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 474.98 (264)
Space and water heating	(261) + (262) + (263) + (264) =		955.42 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 153.25 (268)
Total CO2, kg/year	sum of (265)...(271) =		1147.59 (272)
TER =			17.41 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Stroma Number: Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.4.10

Property Address: B1-15-4

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	36.5 (1a) x	4.7 (2a) =	171.55 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	36.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.55 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
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 a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Percentage of windows and doors draught stripped			0 (12)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (13)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (14)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			0 (15)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)			0 (16)
Number of sides sheltered			0.15 (17)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.15 (18)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		2 (19)
Infiltration rate modified for monthly wind speed			0.85 (20)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4											
(22a)m =	1.27	1.25	1.23	1.1	1.08	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15
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Calculate effective air change rate for the applicable case

If mechanical ventilation:	0.5 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]	
(24a)m =	0.28 0.28 0.27 0.26 0.25 0.24 0.24 0.24 0.24 0.25 0.26 0.27 (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)m ² x 0.5]	
(24d)m =	0 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m =	0.28 0.28 0.27 0.26 0.25 0.24 0.24 0.24 0.24 0.25 0.26 0.27 (25)
---------	--

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m2K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Windows Type 1			6.5	x1/[1/(1.4)+0.04] =	8.62		(27)
Windows Type 2			3.12	x1/[1/(1.4)+0.04] =	4.14		(27)
Windows Type 3			6.5	x1/[1/(1.4)+0.04] =	8.62		(27)
Walls Type1	29.6	6.5	23.1	x 0.2 =	4.62		(29)
Walls Type2	27.3	9.62	17.68	x 0.2 =	3.54		(29)
Roof	36.5	0	36.5	x 0.13 =	4.74		(30)
Total area of elements, m ²			93.4				(31)
Party wall			29.4	x 0 =	0		(32)
Party wall			63	x 0 =	0		(32)
Party floor			74.3				(32a)
Party ceiling			74.3				(32b)
Internal wall **			50.4				(32c)

* for windows and roof windows, use effective window U-value calculated using formula 1/[1/U-value+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U)	(26)...(30) + (32) =	34.27 (33)
Heat capacity Cm = S(A x k)	((28)...(30) + (32) + (32a)...(32e) =	21509.4 (34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	Indicative Value: Medium	250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	4.81 (36)
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if details of thermal bridging are not known (36) = 0.15 x (31)

DER WorkSheet: New dwelling design stage

Total fabric heat loss

(33) + (36) =

39.09

(37)

Ventilation heat loss calculated monthly

(38)m = 0.33 × (25)m × (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
15.85	15.67	15.49	14.59	14.41	13.51	13.51	13.33	13.87	14.41	14.77	15.13

(38)m=

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

54.94	54.76	54.58	53.68	53.5	52.6	52.6	52.41	52.96	53.5	53.86	54.22
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(39)m=

Average = Sum(39)_{1...12} /12=

53.63

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

1.51	1.5	1.5	1.47	1.47	1.44	1.44	1.44	1.45	1.47	1.48	1.49
------	-----	-----	------	------	------	------	------	------	------	------	------

(40)m=

Average = Sum(40)_{1...12} /12=

1.47

(40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)m=

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N

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

1.32

(42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

65.47

(43)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
72.02	69.4	66.78	64.16	61.54	58.93	58.93	61.54	64.16	66.78	69.4	72.02

(44)m=

Total = Sum(44)_{1...12} =

785.67

(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

106.8	93.41	96.39	84.04	80.64	69.58	64.48	73.99	74.87	87.26	95.25	103.43
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(45)_{1...12} =

1030.14

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

16.02	14.01	14.46	12.61	12.1	10.44	9.67	11.1	11.23	13.09	14.29	15.51
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(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0

(54)

Enter (50) or (54) in (55)

0

(55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

((56)m = (55) × (41)m

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)m=

(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=

36.7	31.94	34.03	31.64	31.36	29.06	30.03	31.36	31.64	34.03	34.23	36.7
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

(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=

143.5	125.35	130.42	115.68	112	98.64	94.51	105.35	106.52	121.29	129.47	140.13
-------	--------	--------	--------	-----	-------	-------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRS applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

143.5	125.35	130.42	115.68	112	98.64	94.51	105.35	106.52	121.29	129.47	140.13
-------	--------	--------	--------	-----	-------	-------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

1422.86

(64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

44.69	39.04	40.56	35.85	34.65	30.4	28.95	32.44	32.81	37.52	40.23	43.57
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

(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
65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84

(66)m=

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

10.06	8.94	7.27	5.5	4.11	3.47	3.75	4.88	6.54	8.31	9.7	10.34
-------	------	------	-----	------	------	------	------	------	------	-----	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

112.84	114.01	111.06	104.78	96.85	89.4	84.42	83.25	86.2	92.48	100.41	107.86
--------	--------	--------	--------	-------	------	-------	-------	------	-------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

60.06	58.1	54.51	49.8	46.57	42.22	38.91	43.6	45.56	50.43	55.87	58.56
-------	------	-------	------	-------	-------	-------	------	-------	-------	-------	-------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

228.72	226.8	218.59	205.83	193.29	180.84	172.83	177.48	184.06	196.97	211.73	222.51
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(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	3.12	x	19.64	x	0.6	x	0.8	=	20.38 (76)
East	0.9x	1	x	6.5	x	19.64	x	0.6	x	0.8	=	42.47 (76)
East	0.9x	1	x	3.12	x	38.42	x	0.6	x	0.8	=	39.87 (76)
East	0.9x	1	x	6.5	x	38.42	x	0.6	x	0.8	=	83.07 (76)
East	0.9x	1	x	3.12	x	63.27	x	0.6	x	0.8	=	65.67 (76)
East	0.9x	1	x	6.5	x	63.27	x	0.6	x	0.8	=	136.81 (76)
East	0.9x	1	x	3.12	x	92.28	x	0.6	x	0.8	=	95.77 (76)
East	0.9x	1	x	6.5	x	92.28	x	0.6	x	0.8	=	199.52 (76)
East	0.9x	1	x	3.12	x	113.09	x	0.6	x	0.8	=	117.37 (76)
East	0.9x	1	x	6.5	x	113.09	x	0.6	x	0.8	=	244.52 (76)
East	0.9x	1	x	3.12	x	115.77	x	0.6	x	0.8	=	120.15 (76)
East	0.9x	1	x	6.5	x	115.77	x	0.6	x	0.8	=	250.31 (76)
East	0.9x	1	x	3.12	x	110.22	x	0.6	x	0.8	=	114.39 (76)
East	0.9x	1	x	6.5	x	110.22	x	0.6	x	0.8	=	238.31 (76)
East	0.9x	1	x	3.12	x	94.68	x	0.6	x	0.8	=	98.26 (76)
East	0.9x	1	x	6.5	x	94.68	x	0.6	x	0.8	=	204.7 (76)
East	0.9x	1	x	3.12	x	73.59	x	0.6	x	0.8	=	76.37 (76)
East	0.9x	1	x	6.5	x	73.59	x	0.6	x	0.8	=	159.11 (76)
East	0.9x	1	x	3.12	x	45.59	x	0.6	x	0.8	=	47.31 (76)
East	0.9x	1	x	6.5	x	45.59	x	0.6	x	0.8	=	98.57 (76)
East	0.9x	1	x	3.12	x	24.49	x	0.6	x	0.8	=	25.42 (76)
East	0.9x	1	x	6.5	x	24.49	x	0.6	x	0.8	=	52.95 (76)
East	0.9x	1	x	3.12	x	16.15	x	0.6	x	0.8	=	16.76 (76)
East	0.9x	1	x	6.5	x	16.15	x	0.6	x	0.8	=	34.92 (76)
South	0.9x	0.77	x	6.5	x	46.75	x	0.6	x	0.8	=	101.09 (78)
South	0.9x	0.77	x	6.5	x	76.57	x	0.6	x	0.8	=	165.55 (78)
South	0.9x	0.77	x	6.5	x	97.53	x	0.6	x	0.8	=	210.88 (78)
South	0.9x	0.77	x	6.5	x	110.23	x	0.6	x	0.8	=	238.34 (78)
South	0.9x	0.77	x	6.5	x	114.87	x	0.6	x	0.8	=	248.37 (78)
South	0.9x	0.77	x	6.5	x	110.55	x	0.6	x	0.8	=	239.02 (78)
South	0.9x	0.77	x	6.5	x	108.01	x	0.6	x	0.8	=	233.54 (78)
South	0.9x	0.77	x	6.5	x	104.89	x	0.6	x	0.8	=	226.8 (78)
South	0.9x	0.77	x	6.5	x	101.89	x	0.6	x	0.8	=	220.29 (78)
South	0.9x	0.77	x	6.5	x	82.59	x	0.6	x	0.8	=	178.56 (78)
South	0.9x	0.77	x	6.5	x	55.42	x	0.6	x	0.8	=	119.82 (78)
South	0.9x	0.77	x	6.5	x	40.4	x	0.6	x	0.8	=	87.35 (78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ... (82)m

(83)m=	163.93	288.5	413.36	533.64	610.27	609.49	586.24	529.76	455.78	324.45	198.19	139.03
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Total gains – internal and solar (84)m = (73)m + (83)m, watts

(84)m=	392.65	515.3	631.95	739.47	803.56	790.33	759.06	707.24	639.84	521.42	409.92	361.54
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DER WorkSheet: New dwelling design stage

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21	(85)
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Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.98	0.95	0.88	0.75	0.58	0.42	0.3	0.34	0.55	0.83	0.96	0.99

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	20.05	20.43	20.77	20.93	20.99	21	21	20.96	20.7	20.14	19.66
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.68	19.69	19.69	19.71	19.71	19.73	19.73	19.74	19.72	19.71	19.71	19.7
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.94	0.85	0.7	0.51	0.34	0.22	0.25	0.46	0.78	0.95	0.98
--------	------	------	------	-----	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.05	18.53	19.05	19.48	19.66	19.73	19.73	19.73	19.7	19.42	18.67	17.98
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

fLA = Living area ÷ (4) =

0.86	(91)
------	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.84	20.24	20.59	20.76	20.81	20.82	20.82	20.79	20.53	19.94	19.43
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.69	20.09	20.44	20.61	20.66	20.67	20.67	20.64	20.38	19.79	19.28
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

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=	0.97	0.94	0.86	0.73	0.56	0.4	0.28	0.31	0.52	0.81	0.95	0.98
--------	------	------	------	------	------	-----	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m x (84)m

(95)m=	382.48	482.48	545.03	538.92	452.84	314.74	213.52	222.78	333.62	420.97	388.57	354.42
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

Heat loss rate for mean internal temperature, Lm, W = [(39)m x [(93)m – (96)m]

(97)m=	826.1	810.09	741.98	619.62	476.51	318.94	214.27	223.97	346.26	522.98	683.32	817.39
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	330.05	220.15	146.53	58.1	17.61	0	0	0	0	75.89	212.22	344.46
--------	--------	--------	--------	------	-------	---	---	---	---	-------	--------	--------

Total per year (kWh/year) = Sum(98)_{1..5,9..12} =

1405.02	(98)
---------	------

Space heating requirement in kWh/m²/year

38.49	(99)
-------	------

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system

0	(201)
---	-------

Fraction of space heat from main system(s) (202) = 1 – (201) =

1	(202)
---	-------

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =

1	(204)
---	-------

Efficiency of main space heating system 1

90.3	(206)
------	-------

Efficiency of secondary/supplementary heating system, %

0	(208)
---	-------

DER WorkSheet: New dwelling design stage

JanFebMarAprMayJunJulAugSepOctNovDec

kWh/year

Space heating requirement (calculated above)

330.05220.15146.5358.117.61000075.89212.22344.46

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

365.51243.8162.2764.3519.5000084.05235.01381.46

Total (kWh/year) =Sum(211)_{1...5,10...12} =

1555.94 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=

0000000000000

Total (kWh/year) =Sum(215)_{1...5,10...12} =

0 (215)

Water heating

Output from water heater (calculated above)

143.5125.35130.42115.6811298.6494.51105.35106.52121.29129.47140.13

Efficiency of water heater

81 (216)

(217)m=

87.2686.6985.6783.8982.158181818184.3486.5487.4

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=

164.45144.6152.24137.9136.33121.78116.67130.06131.5143.8149.62160.34

Total = Sum(219a)_{1...12} =

1689.3 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

1555.94

Water heating fuel used

1689.3

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

205.11 (230a)

central heating pump:

30 (230c)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

235.11 (231)

Electricity for lighting

177.66 (232)

Electricity generated by PVs

-193.45 (233)

12a. CO2 emissions – Individual heating systems including micro-CHP

DER WorkSheet: New dwelling design stage

Dwelling CO2 Emission Rate

(272) ÷ (4) =

22.32 (273)

El rating (section 14)

87 (274)

DRAFT

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	336.08 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	364.89 (264)
Space and water heating	(261) + (262) + (263) + (264) =		700.97 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	122.02 (267)
Electricity for lighting	(232) x	0.519 =	92.21 (268)
Energy saving/generation technologies Item 1		0.519 =	-100.4 (269)
Total CO2, kg/year		sum of (265)...(271) =	814.8 (272)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: Stroma Number: Stroma FSAP 2012 Software Version: Version: 1.0.4.10

Property Address: B1-15-4

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	36.5 (1a) x	4.7 (2a) =	171.55 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	36.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	171.55 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20 ÷ (5) = 0.12 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>	
Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration [(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>	
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)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>	
Number of sides sheltered	2 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor (21) = (18) x (20) =	0.31 (21)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
--------	-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
---------	------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.38	0.34	0.33	0.3	0.3	0.29	0.31	0.33	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
---------	---	---	---	---	---	---	---	---	---	---	---	---

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
---------	---	---	---	---	---	---	---	---	---	---	---	---

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
---------	---	---	---	---	---	---	---	---	---	---	---	---

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
---------	------	------	------	------	------	------	------	------	------	------	------	------

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
--------	------	------	------	------	------	------	------	------	------	------	------	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m2K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Windows Type 1			3.68	x1/[1/(1.4)+ 0.04] =	4.88		
Windows Type 2			1.77	x1/[1/(1.4)+ 0.04] =	2.35		
Windows Type 3			3.68	x1/[1/(1.4)+ 0.04] =	4.88		
Walls Type1	29.6	3.68	25.92	x 0.18 =	4.67		
Walls Type2	27.3	5.45	21.85	x 0.18 =	3.93		
Roof	36.5	0	36.5	x 0.13 =	4.74		
Total area of elements, m ²			93.4				
Party wall			29.4	x 0 =	0		
Party wall			63	x 0 =	0		
Party floor			74.3				
Party ceiling			74.3				
Internal wall **			50.4				

* for windows and roof windows, use effective window U-value calculated using formula 1/[1/(U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 25.45 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 22453.05 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.45 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

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Total fabric heat loss

(33) + (36) =

36.9

(37)

Ventilation heat loss calculated monthly

(38)m = 0.33 × (25)m × (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
32.77	32.6	32.43	31.63	31.48	30.79	30.79	30.66	31.05	31.48	31.78	32.1

(38)m=

(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

69.67	69.5	69.33	68.53	68.38	67.68	67.68	67.56	67.95	68.38	68.68	69
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----

(39)m=

Average = Sum(39)_{1...12} /12=

68.53

(39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

1.91	1.9	1.9	1.88	1.87	1.85	1.85	1.85	1.86	1.87	1.88	1.89
------	-----	-----	------	------	------	------	------	------	------	------	------

(40)m=

Average = Sum(40)_{1...12} /12=

1.88

(40)

Number of days in month (Table 1a)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)m=

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N

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

1.32

(42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

65.47

(43)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
72.02	69.4	66.78	64.16	61.54	58.93	58.93	61.54	64.16	66.78	69.4	72.02

(44)m=

Total = Sum(44)_{1...12} =

785.67

(44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

106.8	93.41	96.39	84.04	80.64	69.58	64.48	73.99	74.87	87.26	95.25	103.43
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

Total = Sum(45)_{1...12} =

1030.14

(45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

16.02	14.01	14.46	12.61	12.1	10.44	9.67	11.1	11.23	13.09	14.29	15.51
-------	-------	-------	-------	------	-------	------	------	-------	-------	-------	-------

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

(47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

(48)

Temperature factor from Table 2b

0

(49)

Energy lost from water storage, kWh/year

(48) x (49) =

0

(50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

(51)

If community heating see section 4.3

Volume factor from Table 2a

0

(52)

Temperature factor from Table 2b

0

(53)

Energy lost from water storage, kWh/year

(47) x (51) x (52) x (53) =

0

(54)

Enter (50) or (54) in (55)

0

(55)

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Water storage loss calculated for each month

((56)m = (55) × (41)m

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(56)m=

(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=

36.7	31.94	34.03	31.64	31.36	29.06	30.03	31.36	31.64	34.03	34.23	36.7
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

(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=

143.5	125.35	130.42	115.68	112	98.64	94.51	105.35	106.52	121.29	129.47	140.13
-------	--------	--------	--------	-----	-------	-------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRS applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

143.5	125.35	130.42	115.68	112	98.64	94.51	105.35	106.52	121.29	129.47	140.13
-------	--------	--------	--------	-----	-------	-------	--------	--------	--------	--------	--------

Output from water heater (annual)_{1...12}

1422.86

(64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=

44.69	39.04	40.56	35.85	34.65	30.4	28.95	32.44	32.81	37.52	40.23	43.57
-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------

(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
65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84	65.84

(66)m=

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

10.06	8.94	7.27	5.5	4.11	3.47	3.75	4.88	6.54	8.31	9.7	10.34
-------	------	------	-----	------	------	------	------	------	------	-----	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

112.84	114.01	111.06	104.78	96.85	89.4	84.42	83.25	86.2	92.48	100.41	107.86
--------	--------	--------	--------	-------	------	-------	-------	------	-------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58	29.58
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67	-52.67
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

60.06	58.1	54.51	49.8	46.57	42.22	38.91	43.6	45.56	50.43	55.87	58.56
-------	------	-------	------	-------	-------	-------	------	-------	-------	-------	-------

(72)

Total internal gains =

(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

228.72	226.8	218.59	205.83	193.29	180.84	172.83	177.48	184.06	196.97	211.73	222.51
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

TER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	1	x	1.77	x	19.64	x	0.63	x	0.7	=	10.62	(76)
East	0.9x	1	x	3.68	x	19.64	x	0.63	x	0.7	=	22.09	(76)
East	0.9x	1	x	1.77	x	38.42	x	0.63	x	0.7	=	20.78	(76)
East	0.9x	1	x	3.68	x	38.42	x	0.63	x	0.7	=	43.21	(76)
East	0.9x	1	x	1.77	x	63.27	x	0.63	x	0.7	=	34.23	(76)
East	0.9x	1	x	3.68	x	63.27	x	0.63	x	0.7	=	71.16	(76)
East	0.9x	1	x	1.77	x	92.28	x	0.63	x	0.7	=	49.92	(76)
East	0.9x	1	x	3.68	x	92.28	x	0.63	x	0.7	=	103.78	(76)
East	0.9x	1	x	1.77	x	113.09	x	0.63	x	0.7	=	61.18	(76)
East	0.9x	1	x	3.68	x	113.09	x	0.63	x	0.7	=	127.19	(76)
East	0.9x	1	x	1.77	x	115.77	x	0.63	x	0.7	=	62.62	(76)
East	0.9x	1	x	3.68	x	115.77	x	0.63	x	0.7	=	130.2	(76)
East	0.9x	1	x	1.77	x	110.22	x	0.63	x	0.7	=	59.62	(76)
East	0.9x	1	x	3.68	x	110.22	x	0.63	x	0.7	=	123.96	(76)
East	0.9x	1	x	1.77	x	94.68	x	0.63	x	0.7	=	51.21	(76)
East	0.9x	1	x	3.68	x	94.68	x	0.63	x	0.7	=	106.48	(76)
East	0.9x	1	x	1.77	x	73.59	x	0.63	x	0.7	=	39.81	(76)
East	0.9x	1	x	3.68	x	73.59	x	0.63	x	0.7	=	82.76	(76)
East	0.9x	1	x	1.77	x	45.59	x	0.63	x	0.7	=	24.66	(76)
East	0.9x	1	x	3.68	x	45.59	x	0.63	x	0.7	=	51.27	(76)
East	0.9x	1	x	1.77	x	24.49	x	0.63	x	0.7	=	13.25	(76)
East	0.9x	1	x	3.68	x	24.49	x	0.63	x	0.7	=	27.54	(76)
East	0.9x	1	x	1.77	x	16.15	x	0.63	x	0.7	=	8.74	(76)
East	0.9x	1	x	3.68	x	16.15	x	0.63	x	0.7	=	18.16	(76)
South	0.9x	0.77	x	3.68	x	46.75	x	0.63	x	0.7	=	52.58	(78)
South	0.9x	0.77	x	3.68	x	76.57	x	0.63	x	0.7	=	86.11	(78)
South	0.9x	0.77	x	3.68	x	97.53	x	0.63	x	0.7	=	109.69	(78)
South	0.9x	0.77	x	3.68	x	110.23	x	0.63	x	0.7	=	123.98	(78)
South	0.9x	0.77	x	3.68	x	114.87	x	0.63	x	0.7	=	129.19	(78)
South	0.9x	0.77	x	3.68	x	110.55	x	0.63	x	0.7	=	124.33	(78)
South	0.9x	0.77	x	3.68	x	108.01	x	0.63	x	0.7	=	121.48	(78)
South	0.9x	0.77	x	3.68	x	104.89	x	0.63	x	0.7	=	117.97	(78)
South	0.9x	0.77	x	3.68	x	101.89	x	0.63	x	0.7	=	114.59	(78)
South	0.9x	0.77	x	3.68	x	82.59	x	0.63	x	0.7	=	92.88	(78)
South	0.9x	0.77	x	3.68	x	55.42	x	0.63	x	0.7	=	62.33	(78)
South	0.9x	0.77	x	3.68	x	40.4	x	0.63	x	0.7	=	45.43	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ... (82)m

(83)m=	85.29	150.11	215.08	277.68	317.56	317.15	305.05	275.66	237.16	168.81	103.11	72.34
--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	314.01	376.91	433.67	483.51	510.85	498	477.88	453.14	421.21	365.79	314.84	294.85
--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

21

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.98	0.97	0.93	0.85	0.72	0.57	0.62	0.82	0.95	0.99	0.99

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.07	19.31	19.67	20.14	20.54	20.83	20.94	20.93	20.72	20.17	19.54	19.04
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.05	20.06	20.06	20.07	20.07	20.07	20.07	20.06	20.06	20.05
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.91	0.82	0.65	0.47	0.52	0.76	0.93	0.98	0.99
--------	------	------	------	------	------	------	------	------	------	------	------	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.27	18.5	18.87	19.33	19.71	19.97	20.05	20.04	19.88	19.37	18.74	18.24
--------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

fLA = Living area ÷ (4) =

0.86

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.96	19.2	19.56	20.03	20.43	20.71	20.82	20.81	20.6	20.06	19.43	18.93
--------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.96	19.2	19.56	20.03	20.43	20.71	20.82	20.81	20.6	20.06	19.43	18.93
--------	-------	------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(94)m=	0.99	0.98	0.96	0.91	0.83	0.7	0.55	0.6	0.8	0.93	0.98	0.99

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	310.17	368.39	414.98	441.53	425.32	348.98	264.63	270.03	334.96	341.97	308.32	291.9
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

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
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m – (96)m]

(97)m=	1021.62	993.64	905.67	762.46	597	413.71	285.74	297.64	441.74	647.04	846.69	1016.1
--------	---------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--------	--------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	529.32	420.17	365.07	231.07	127.73	0	0	0	0	226.97	387.63	538.8
--------	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	-------

Total per year (kWh/year) = Sum(98)_{1..5,9..12} =

2826.77

Space heating requirement in kWh/m²/year

77.45

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system

0

Fraction of space heat from main system(s) (202) = 1 – (201) =

1

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =

1

Efficiency of main space heating system 1

93.4

Efficiency of secondary/supplementary heating system, %

0

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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)													
529.32	420.17	365.07	231.07	127.73	0	0	0	0	226.97	387.63	538.8		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													
566.73	449.86	390.87	247.4	136.75	0	0	0	0	243.01	415.02	576.88		
Total (kWh/year) =Sum(211) _{1...5,10...12} =												3026.52	(211)
Space heating fuel (secondary), kWh/month													
= {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215) _{1...5,10...12} =												0	(215)
Water heating													
Output from water heater (calculated above)													
143.5	125.35	130.42	115.68	112	98.64	94.51	105.35	106.52	121.29	129.47	140.13		
Efficiency of water heater												80.3	(216)
(217)m=	88.04	87.86	87.5	86.76	85.38	80.3	80.3	80.3	80.3	86.61	87.64	88.11	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	163	142.67	149.05	133.33	131.17	122.84	117.69	131.2	132.65	140.05	147.73	159.04	
Total = Sum(219a) _{1...12} =												1670.42	(219)
Annual totals													
Space heating fuel used, main system 1												3026.52	
Water heating fuel used												1670.42	
Electricity for pumps, fans and electric keep-hot													
central heating pump:												30	(230c)
boiler with a fan-assisted flue												45	(230e)
Total electricity for the above, kWh/year												75	(231)
Electricity for lighting												177.66	(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	= 653.73 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.216	= 360.81 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1014.54 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 38.93 (267)
Electricity for lighting	(232) x	0.519	= 92.21 (268)
Total CO2, kg/year		sum of (265)...(271) =	1145.67 (272)
TER =			31.39 (273)

DER WorkSheet: New dwelling design stage

User Details:			
Assessor Name:	Stroma FSAP 2012	Stroma Number:	Version: 1.0.4.10
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.4.10
Property Address: D1 1-12-2			
Address : 5 Clarendon Road, Wood Green, London, N22 6XJ			
1. Overall dwelling dimensions:			

	Area(m²)	Av. Height(m)	Volume(m³)
Ground floor	60 (1a) x	2.8 (2a) =	168 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	168 (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				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (8)
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	3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)	0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used	
Number of sides sheltered	3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.12 (21)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25
------	------	------	------	------	------	------	------	------	------	------	------

 (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
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 (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	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.23	0.23	0.24	0.25	0.25
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.98	$x1/[1/(1.4)+0.04]$	3.95		
Windows Type 2			2.45	$x1/[1/(1.4)+0.04]$	3.25		
Windows Type 3			6.02	$x1/[1/(1.4)+0.04]$	7.98		
Windows Type 4			3	$x1/[1/(1.4)+0.04]$	3.98		
Walls Type1	6.6	0	6.6	x 0.2	1.32		
Walls Type2	19.6	3	16.6	x 0.2	3.32		
Walls Type3	26.8	11.45	15.35	x 0.2	3.07		
Roof	60	0	60	x 0.13	7.8		
Total area of elements, m²			113				
Party wall			4.2	x 0	0		
Party wall			43.4	x 0	0		
Party floor			60				
Internal wall **			70.56				

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) =

34.67

 (33)Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) =

7466.74

 (34)Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium

250

 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

6.17

 (36)

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If details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) =

40.84

 (37)

Ventilation heat loss calculated monthly

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
14.73	14.57	14.41	13.6	13.44	12.64	12.64	12.48	12.96	13.44	13.76	14.09

 (38)

Heat transfer coefficient, W/K

(39)m=

55.57	55.41	55.24	54.44	54.28	53.47	53.47	53.31	53.79	54.28	54.6	54.92
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 (39)m = (37) + (38)m
Average = Sum(39)_{1...12} /12=

54.4

 (39)

Heat loss parameter (HLP), W/m²K

(40)m=

0.93	0.92	0.92	0.91	0.9	0.89	0.89	0.89	0.9	0.9	0.91	0.92
------	------	------	------	-----	------	------	------	-----	-----	------	------

 (40)m = (39)m ÷ (4)
Average = Sum(40)_{1...12} /12=

0.91

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
89.39	86.14	82.89	79.64	76.39	73.14	73.14	76.39	79.64	82.89	86.14	89.39

 (44)
Total = Sum(44)_{1...12} =

975.17

 (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=

132.56	115.94	119.64	104.31	100.08	86.36	80.03	91.83	92.93	108.3	118.22	128.38
--------	--------	--------	--------	--------	-------	-------	-------	-------	-------	--------	--------

 (45)
Total = Sum(45)_{1...12} =

1278.6

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

19.88	17.39	17.95	15.65	15.01	12.95	12	13.78	13.94	16.25	17.73	19.26
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 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)Temperature factor from Table 2b

0

 (49)Energy lost from water storage, kWh/year (48) x (49) =

0

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

 (51)

If community heating see section 4.3

Volume factor from Table 2a

0

 (52)Temperature factor from Table 2b

0

 (53)Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

0

 (54)Enter (50) or (54) in (55)

0

 (55)

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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 × [(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= 45.55 39.65 42.24 39.27 38.93 36.07 37.27 38.93 39.27 42.24 42.48 45.55 (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= 178.12 155.59 161.88 143.58 139.01 122.43 117.3 130.76 132.21 150.54 160.7 173.93 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (63)

Output from water heater

(64)m= 178.12 155.59 161.88 143.58 139.01 122.43 117.3 130.76 132.21 150.54 160.7 173.93 (64)

Output from water heater (annual) 1766.05

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m= 55.47 48.46 50.34 44.5 43.01 37.73 35.93 40.27 40.72 46.57 49.93 54.07 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m= Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 99.08 99.08 99.08 99.08 99.08 99.08 99.08 99.08 99.08 99.08 99.08 99.08 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m= 15.42 13.69 11.13 8.43 6.3 5.32 5.75 7.47 10.03 12.73 14.86 15.84 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m= 172.95 174.74 170.22 160.59 148.44 137.02 129.38 127.59 132.11 141.74 153.89 165.32 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m= 32.91 32.91 32.91 32.91 32.91 32.91 32.91 32.91 32.91 32.91 32.91 32.91 (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= -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 (71)

Water heating gains (Table 5)

(72)m= 74.55 72.12 67.66 61.81 57.81 52.41 48.29 54.12 56.55 62.59 69.35 72.68 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m= 318.64 316.27 304.74 286.55 268.27 250.47 239.15 244.91 254.42 272.79 293.83 309.57 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.98	x	36.79	x	0.6	x	0.75	=	34.19	(77)
Southeast 0.9x	0.77	x	2.45	x	36.79	x	0.6	x	0.75	=	28.11	(77)
Southeast 0.9x	0.54	x	6.02	x	36.79	x	0.6	x	0.75	=	48.44	(77)
Southeast 0.9x	0.77	x	2.98	x	62.67	x	0.6	x	0.75	=	58.24	(77)
Southeast 0.9x	0.77	x	2.45	x	62.67	x	0.6	x	0.75	=	47.88	(77)
Southeast 0.9x	0.54	x	6.02	x	62.67	x	0.6	x	0.75	=	82.51	(77)
Southeast 0.9x	0.77	x	2.98	x	85.75	x	0.6	x	0.75	=	79.69	(77)
Southeast 0.9x	0.77	x	2.45	x	85.75	x	0.6	x	0.75	=	65.52	(77)
Southeast 0.9x	0.54	x	6.02	x	85.75	x	0.6	x	0.75	=	112.9	(77)
Southeast 0.9x	0.77	x	2.98	x	106.25	x	0.6	x	0.75	=	98.74	(77)
Southeast 0.9x	0.77	x	2.45	x	106.25	x	0.6	x	0.75	=	81.18	(77)
Southeast 0.9x	0.54	x	6.02	x	106.25	x	0.6	x	0.75	=	139.89	(77)
Southeast 0.9x	0.77	x	2.98	x	119.01	x	0.6	x	0.75	=	110.6	(77)
Southeast 0.9x	0.77	x	2.45	x	119.01	x	0.6	x	0.75	=	90.93	(77)
Southeast 0.9x	0.54	x	6.02	x	119.01	x	0.6	x	0.75	=	156.69	(77)
Southeast 0.9x	0.77	x	2.98	x	118.15	x	0.6	x	0.75	=	109.8	(77)
Southeast 0.9x	0.77	x	2.45	x	118.15	x	0.6	x	0.75	=	90.27	(77)
Southeast 0.9x	0.54	x	6.02	x	118.15	x	0.6	x	0.75	=	155.55	(77)
Southeast 0.9x	0.77	x	2.98	x	113.91	x	0.6	x	0.75	=	105.86	(77)
Southeast 0.9x	0.77	x	2.45	x	113.91	x	0.6	x	0.75	=	87.03	(77)
Southeast 0.9x	0.54	x	6.02	x	113.91	x	0.6	x	0.75	=	149.97	(77)
Southeast 0.9x	0.77	x	2.98	x	104.39	x	0.6	x	0.75	=	97.01	(77)
Southeast 0.9x	0.77	x	2.45	x	104.39	x	0.6	x	0.75	=	79.76	(77)
Southeast 0.9x	0.54	x	6.02	x	104.39	x	0.6	x	0.75	=	137.44	(77)
Southeast 0.9x	0.77	x	2.98	x	92.85	x	0.6	x	0.75	=	86.29	(77)
Southeast 0.9x	0.77	x	2.45	x	92.85	x	0.6	x	0.75	=	70.94	(77)
Southeast 0.9x	0.54	x	6.02	x	92.85	x	0.6	x	0.75	=	122.25	(77)
Southeast 0.9x	0.77	x	2.98	x	69.27	x	0.6	x	0.75	=	64.37	(77)
Southeast 0.9x	0.77	x	2.45	x	69.27	x	0.6	x	0.75	=	52.92	(77)
Southeast 0.9x	0.54	x	6.02	x	69.27	x	0.6	x	0.75	=	91.2	(77)
Southeast 0.9x	0.77	x	2.98	x	44.07	x	0.6	x	0.75	=	40.96	(77)
Southeast 0.9x	0.77	x	2.45	x	44.07	x	0.6	x	0.75	=	33.67	(77)
Southeast 0.9x	0.54	x	6.02	x	44.07	x	0.6	x	0.75	=	58.02	(77)
Southeast 0.9x	0.77	x	2.98	x	31.49	x	0.6	x	0.75	=	29.26	(77)
Southeast 0.9x	0.77	x	2.45	x	31.49	x	0.6	x	0.75	=	24.06	(77)
Southeast 0.9x	0.54	x	6.02	x	31.49	x	0.6	x	0.75	=	41.46	(77)
Southwest 0.9x	0.54	x	3	x	36.79		0.6	x	0.75	=	24.14	(79)
Southwest 0.9x	0.54	x	3	x	62.67		0.6	x	0.75	=	41.12	(79)
Southwest 0.9x	0.54	x	3	x	85.75		0.6	x	0.75	=	56.26	(79)

DER WorkSheet: New dwelling design stage

Southwest0.9x	0.54	x	3	x	106.25	0.6	x	0.75	=	69.71	(79)
Southwest0.9x	0.54	x	3	x	119.01	0.6	x	0.75	=	78.08	(79)
Southwest0.9x	0.54	x	3	x	118.15	0.6	x	0.75	=	77.52	(79)
Southwest0.9x	0.54	x	3	x	113.91	0.6	x	0.75	=	74.74	(79)
Southwest0.9x	0.54	x	3	x	104.39	0.6	x	0.75	=	68.49	(79)
Southwest0.9x	0.54	x	3	x	92.85	0.6	x	0.75	=	60.92	(79)
Southwest0.9x	0.54	x	3	x	69.27	0.6	x	0.75	=	45.45	(79)
Southwest0.9x	0.54	x	3	x	44.07	0.6	x	0.75	=	28.91	(79)
Southwest0.9x	0.54	x	3	x	31.49	0.6	x	0.75	=	20.66	(79)

Solar gains in watts, calculated for each month	(83)m = Sum(74)m ... (82)m											(83)
(83)m=	134.89	229.76	314.37	389.52	436.3	433.14	417.59	382.7	340.4	253.94	161.56	115.44
Total gains – internal and solar (84)m = (73)m + (83)m , watts												(84)
(84)m=	453.52	546.04	619.11	676.07	704.57	683.61	656.74	627.61	594.82	526.73	455.39	425

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)												(86)
(86)m=	0.99	0.98	0.94	0.85	0.69	0.5	0.36	0.39	0.61	0.89	0.98	1
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)												(87)
(87)m=	20.22	20.42	20.64	20.86	20.97	21	21	21	20.99	20.84	20.49	20.18
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)												(88)
(88)m=	20.15	20.15	20.15	20.16	20.16	20.17	20.17	20.18	20.17	20.16	20.16	20.15
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)												(89)
(89)m=	0.99	0.97	0.93	0.81	0.63	0.43	0.29	0.32	0.54	0.85	0.98	0.99
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)												(90)
(90)m=	19.12	19.4	19.72	20.01	20.13	20.17	20.17	20.18	20.16	20	19.51	19.07
Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2												(92)
(92)m=	19.62	19.86	20.14	20.4	20.51	20.55	20.55	20.55	20.54	20.38	19.96	19.57
Apply adjustment to the mean internal temperature from Table 4e, where appropriate												(93)
(93)m=	19.47	19.71	19.99	20.25	20.36	20.4	20.4	20.4	20.39	20.23	19.81	19.42

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												(94)
(94)m=	0.99	0.97	0.92	0.82	0.65	0.45	0.31	0.34	0.56	0.86	0.97	0.99
Useful gains, hmGm , W = (94)m x (84)m												(95)
(95)m=	448.37	529.31	572.07	552.78	456.24	308.73	203.1	213.13	333.64	450.99	442.69	421.51
Monthly average external temperature from Table 8												(96)
(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
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]												(97)
(97)m=	842.84	820.64	745.27	617.72	470.2	309.99	203.2	213.3	338.21	522.73	693.86	836.18

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	293.49	195.77	128.86	46.76	10.39	0	0	0	0	53.37	180.84	308.52	Total per year (kWh/year) = Sum(98)1...5,9...12 =	1217.99	(98)
Space heating requirement in kWh/m²/year														20.3	(99)

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system													0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =												1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =												1	(204)
Efficiency of main space heating system 1													90.3	(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)													
293.49	195.77	128.86	46.76	10.39	0	0	0	0	53.37	180.84	308.52		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													
325.01	216.8	142.7	51.78	11.5	0	0	0	0	59.11	200.27	341.66		
Total (kWh/year) =Sum(211)										=		1348.83	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215) _{1...5,10...12} =													0	(215)

Water heating

Output from water heater (calculated above)															
178.12	155.59	161.88	143.58	139.01	122.43	117.3	130.76	132.21	150.54	160.7	173.93				
Efficiency of water heater												81	(216)		
(217)m=	86.55	85.93	84.87	83.1	81.58	81	81	81	81	83.24	85.67	86.71	(217)		
Fuel for water heating, kWh/month															
(219)m = (64)m x 100 ÷ (217)m															
(219)m=	205.8	181.06	190.73	172.77	170.39	151.15	144.81	161.43	163.22	180.84	187.58	200.59			
												Total = Sum(219a) _{1..12} =		2110.38	(219)

Annual totals

Space heating fuel used, main system 1												kWh/year	1348.83	
Water heating fuel used												kWh/year	2110.38	
Electricity for pumps, fans and electric keep-hot														
mechanical ventilation - balanced, extract or positive input from outside												200.86	(230a)	
central heating pump:												30	(230c)	
Total electricity for the above, kWh/year												sum of (230a)...(230g) =	230.86	(231)
Electricity for lighting													272.24	(232)
Electricity generated by PVs													-317.81	(233)

12a. CO2 emissions – Individual heating systems including micro-CHP

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	291.35	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	455.84	(264)
Space and water heating	(261) + (262) + (263) + (264) =				747.19	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	119.82	(267)
Electricity for lighting	(232) x		0.519	=	141.29	(268)
Energy saving/generation technologies Item 1			0.519	=	-164.94	(269)
Total CO2, kg/year		sum of (265)...(271) =			843.35	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			14.06	(273)
El rating (section 14)					89	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name:

Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: D1 1-12-2

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	60 (1a) x	2.8 (2a) =	168 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	60 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	168 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 x 40 =	0 (6a)
Number of open flues	0	0	0	0 x 20 =	0 (6b)
Number of intermittent fans				2 x 10 =	20 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 ÷ (5) = 0.12 (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 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.29 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.36	0.36	0.35	0.31	0.31	0.27	0.27	0.26	0.29	0.31	0.32	0.34
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.98	x1/[1/(1.4)+ 0.04] =	3.95		(27)
Windows Type 2			2.45	x1/[1/(1.4)+ 0.04] =	3.25		(27)
Windows Type 3			6.02	x1/[1/(1.4)+ 0.04] =	7.98		(27)
Windows Type 4			3	x1/[1/(1.4)+ 0.04] =	3.98		(27)
Walls Type1	6.6	0	6.6	x 0.18 =	1.19		(29)
Walls Type2	19.6	3	16.6	x 0.18 =	2.99		(29)
Walls Type3	26.8	11.45	15.35	x 0.18 =	2.76		(29)
Roof	60	0	60	x 0.13 =	7.8		(30)
Total area of elements, m²			113				(31)
Party wall			4.2	x 0 =	0		(32)
Party wall			43.4	x 0 =	0		(32)
Party floor			60				(32a)
Internal wall **			70.56				(32c)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) =

33.9

 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) =

7466.74

 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium

250

 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

14.6

 (36)

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If details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) =

48.49

 (37)

Ventilation heat loss calculated monthly

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31.41	31.26	31.12	30.46	30.34	29.77	29.77	29.66	29.99	30.34	30.59	30.85

 (38)

Heat transfer coefficient, W/K

(39)m=

79.9	79.76	79.62	78.96	78.83	78.26	78.26	78.15	78.48	78.83	79.08	79.34
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 (39)m = (37) + (38)m
Average = Sum(39)_{1...12} /12=

78.96

 (39)

Heat loss parameter (HLP), W/m²K

(40)m=

1.33	1.33	1.33	1.32	1.31	1.3	1.3	1.3	1.31	1.31	1.32	1.32
------	------	------	------	------	-----	-----	-----	------	------	------	------

 (40)m = (39)m ÷ (4)
Average = Sum(40)_{1...12} /12=

1.32

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

1.98

 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

81.26

 (43)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)
(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
89.39	86.14	82.89	79.64	76.39	73.14	73.14	76.39	79.64	82.89	86.14	89.39

 (44)
Total = Sum(44)_{1...12} =

975.17

 (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=

132.56	115.94	119.64	104.31	100.08	86.36	80.03	91.83	92.93	108.3	118.22	128.38
--------	--------	--------	--------	--------	-------	-------	-------	-------	-------	--------	--------

 (45)
Total = Sum(45)_{1...12} =

1278.6

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

19.88	17.39	17.95	15.65	15.01	12.95	12	13.78	13.94	16.25	17.73	19.26
-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year (48) x (49) =

0

 (50)

b) If manufacturer's declared cylinder loss factor is not known:
Hot water storage loss factor from Table 2 (kWh/litre/day)

0

 (51)

If community heating see section 4.3

Volume factor from Table 2a

0

 (52)

Temperature factor from Table 2b

0

 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

0

 (54)

Enter (50) or (54) in (55)

0

 (55)

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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 × [(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= 45.55 39.65 42.24 39.27 38.93 36.07 37.27 38.93 39.27 42.24 42.48 45.55 (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= 178.12 155.59 161.88 143.58 139.01 122.43 117.3 130.76 132.21 150.54 160.7 173.93 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (63)

Output from water heater

(64)m= 178.12 155.59 161.88 143.58 139.01 122.43 117.3 130.76 132.21 150.54 160.7 173.93 (64)

Output from water heater (annual) 1766.05

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m= 55.47 48.46 50.34 44.5 43.01 37.73 35.93 40.27 40.72 46.57 49.93 54.07 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m= Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 99.08 99.08 99.08 99.08 99.08 99.08 99.08 99.08 99.08 99.08 99.08 99.08 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m= 15.45 13.72 11.16 8.45 6.32 5.33 5.76 7.49 10.05 12.76 14.9 15.88 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m= 172.95 174.74 170.22 160.59 148.44 137.02 129.38 127.59 132.11 141.74 153.89 165.32 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m= 32.91 32.91 32.91 32.91 32.91 32.91 32.91 32.91 32.91 32.91 32.91 32.91 (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= -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 -79.27 (71)

Water heating gains (Table 5)

(72)m= 74.55 72.12 67.66 61.81 57.81 52.41 48.29 54.12 56.55 62.59 69.35 72.68 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m= 318.67 316.31 304.77 286.57 268.29 250.48 239.16 244.93 254.44 272.82 293.86 309.6 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.98	x	36.79	x	0.63	x	0.7	=	33.51	(77)
Southeast 0.9x	0.77	x	2.45	x	36.79	x	0.63	x	0.7	=	27.55	(77)
Southeast 0.9x	0.54	x	6.02	x	36.79	x	0.63	x	0.7	=	47.47	(77)
Southeast 0.9x	0.77	x	2.98	x	62.67	x	0.63	x	0.7	=	57.08	(77)
Southeast 0.9x	0.77	x	2.45	x	62.67	x	0.63	x	0.7	=	46.93	(77)
Southeast 0.9x	0.54	x	6.02	x	62.67	x	0.63	x	0.7	=	80.86	(77)
Southeast 0.9x	0.77	x	2.98	x	85.75	x	0.63	x	0.7	=	78.1	(77)
Southeast 0.9x	0.77	x	2.45	x	85.75	x	0.63	x	0.7	=	64.21	(77)
Southeast 0.9x	0.54	x	6.02	x	85.75	x	0.63	x	0.7	=	110.64	(77)
Southeast 0.9x	0.77	x	2.98	x	106.25	x	0.63	x	0.7	=	96.77	(77)
Southeast 0.9x	0.77	x	2.45	x	106.25	x	0.63	x	0.7	=	79.56	(77)
Southeast 0.9x	0.54	x	6.02	x	106.25	x	0.63	x	0.7	=	137.09	(77)
Southeast 0.9x	0.77	x	2.98	x	119.01	x	0.63	x	0.7	=	108.39	(77)
Southeast 0.9x	0.77	x	2.45	x	119.01	x	0.63	x	0.7	=	89.11	(77)
Southeast 0.9x	0.54	x	6.02	x	119.01	x	0.63	x	0.7	=	153.55	(77)
Southeast 0.9x	0.77	x	2.98	x	118.15	x	0.63	x	0.7	=	107.6	(77)
Southeast 0.9x	0.77	x	2.45	x	118.15	x	0.63	x	0.7	=	88.47	(77)
Southeast 0.9x	0.54	x	6.02	x	118.15	x	0.63	x	0.7	=	152.44	(77)
Southeast 0.9x	0.77	x	2.98	x	113.91	x	0.63	x	0.7	=	103.74	(77)
Southeast 0.9x	0.77	x	2.45	x	113.91	x	0.63	x	0.7	=	85.29	(77)
Southeast 0.9x	0.54	x	6.02	x	113.91	x	0.63	x	0.7	=	146.97	(77)
Southeast 0.9x	0.77	x	2.98	x	104.39	x	0.63	x	0.7	=	95.07	(77)
Southeast 0.9x	0.77	x	2.45	x	104.39	x	0.63	x	0.7	=	78.16	(77)
Southeast 0.9x	0.54	x	6.02	x	104.39	x	0.63	x	0.7	=	134.69	(77)
Southeast 0.9x	0.77	x	2.98	x	92.85	x	0.63	x	0.7	=	84.56	(77)
Southeast 0.9x	0.77	x	2.45	x	92.85	x	0.63	x	0.7	=	69.52	(77)
Southeast 0.9x	0.54	x	6.02	x	92.85	x	0.63	x	0.7	=	119.8	(77)
Southeast 0.9x	0.77	x	2.98	x	69.27	x	0.63	x	0.7	=	63.08	(77)
Southeast 0.9x	0.77	x	2.45	x	69.27	x	0.63	x	0.7	=	51.86	(77)
Southeast 0.9x	0.54	x	6.02	x	69.27	x	0.63	x	0.7	=	89.37	(77)
Southeast 0.9x	0.77	x	2.98	x	44.07	x	0.63	x	0.7	=	40.14	(77)
Southeast 0.9x	0.77	x	2.45	x	44.07	x	0.63	x	0.7	=	33	(77)
Southeast 0.9x	0.54	x	6.02	x	44.07	x	0.63	x	0.7	=	56.86	(77)
Southeast 0.9x	0.77	x	2.98	x	31.49	x	0.63	x	0.7	=	28.68	(77)
Southeast 0.9x	0.77	x	2.45	x	31.49	x	0.63	x	0.7	=	23.58	(77)
Southeast 0.9x	0.54	x	6.02	x	31.49	x	0.63	x	0.7	=	40.63	(77)
Southwest 0.9x	0.54	x	3	x	36.79		0.63	x	0.7	=	23.66	(79)
Southwest 0.9x	0.54	x	3	x	62.67		0.63	x	0.7	=	40.3	(79)
Southwest 0.9x	0.54	x	3	x	85.75		0.63	x	0.7	=	55.14	(79)

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Southwest0.9x	0.54	x	3	x	106.25	0.63	x	0.7	=	68.32	(79)
Southwest0.9x	0.54	x	3	x	119.01	0.63	x	0.7	=	76.52	(79)
Southwest0.9x	0.54	x	3	x	118.15	0.63	x	0.7	=	75.97	(79)
Southwest0.9x	0.54	x	3	x	113.91	0.63	x	0.7	=	73.24	(79)
Southwest0.9x	0.54	x	3	x	104.39	0.63	x	0.7	=	67.12	(79)
Southwest0.9x	0.54	x	3	x	92.85	0.63	x	0.7	=	59.7	(79)
Southwest0.9x	0.54	x	3	x	69.27	0.63	x	0.7	=	44.54	(79)
Southwest0.9x	0.54	x	3	x	44.07	0.63	x	0.7	=	28.34	(79)
Southwest0.9x	0.54	x	3	x	31.49	0.63	x	0.7	=	20.25	(79)

Solar gains in watts, calculated for each month	(83)m = Sum(74)m ... (82)m											(83)
(83)m=	132.19	225.17	308.08	381.73	427.57	424.48	409.24	375.04	333.59	248.86	158.33	113.13
Total gains – internal and solar (84)m = (73)m + (83)m , watts												(84)
(84)m=	450.86	541.47	612.85	668.3	695.86	674.96	648.4	619.97	588.03	521.68	452.19	422.73

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)												(86)
(86)m=	0.99	0.99	0.97	0.93	0.84	0.68	0.52	0.56	0.78	0.95	0.99	1
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)												(87)
(87)m=	19.66	19.86	20.15	20.49	20.77	20.94	20.99	20.98	20.88	20.51	20.01	19.62
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)												(88)
(88)m=	19.82	19.82	19.82	19.83	19.83	19.84	19.84	19.84	19.83	19.83	19.83	19.82
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)												(89)
(89)m=	0.99	0.98	0.96	0.91	0.78	0.58	0.39	0.43	0.7	0.93	0.98	0.99
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)												(90)
(90)m=	18.06	18.36	18.77	19.26	19.62	19.8	19.83	19.83	19.74	19.28	18.58	18
fLA = Living area ÷ (4) =	0.45											(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2												(92)
(92)m=	18.79	19.04	19.4	19.82	20.14	20.32	20.36	20.35	20.26	19.84	19.23	18.74
Apply adjustment to the mean internal temperature from Table 4e, where appropriate												(93)
(93)m=	18.79	19.04	19.4	19.82	20.14	20.32	20.36	20.35	20.26	19.84	19.23	18.74

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												(94)
Utilisation factor for gains, hm:												(94)
(94)m=	0.99	0.98	0.96	0.91	0.8	0.62	0.45	0.49	0.73	0.93	0.98	0.99
Useful gains, hmGm , W = (94)m x (84)m												(95)
(95)m=	446.8	530.8	586.99	605.3	556.9	421.5	289.59	302.36	430.05	482.83	444.04	419.79
Monthly average external temperature from Table 8												(96)
(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
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]												(97)
(97)m=	1157.45	1128.08	1027.15	862.11	665.63	447.36	294.05	309	483.43	728.46	959.26	1153.4

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	528.72	401.37	327.47	184.9	80.89	0	0	0	0	182.74	370.96	545.81		
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =												2622.88	(98)	
Space heating requirement in kWh/m ² /year												43.71	(99)	

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:															
Fraction of space heat from secondary/supplementary system												0	(201)		
Fraction of space heat from main system(s)												(202) = 1 – (201) =		1	(202)
Fraction of total heating from main system 1												(204) = (202) × [1 – (203)] =		1	(204)
Efficiency of main space heating system 1												93.4	(206)		
Efficiency of secondary/supplementary heating system, %												0	(208)		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year			

Space heating requirement (calculated above)												
528.72	401.37	327.47	184.9	80.89	0	0	0	0	182.74	370.96	545.81	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												
566.09	429.74	350.61	197.97	86.61	0	0	0	0	195.66	397.18	584.37	
Total (kWh/year) =Sum(211) _{1,5,10,12} =										2808.23		(211)

Space heating fuel (secondary), kWh/month															
= {[(98)m x (201)] } x 100 ÷ (208)															
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215) _{1...5,10...12} =													0	(215)	

Water heating

Output from water heater (calculated above)													
178.12	155.59	161.88	143.58	139.01	122.43	117.3	130.76	132.21	150.54	160.7	173.93		
Efficiency of water heater												80.3	(216)
(217)m=	87.62	87.33	86.79	85.69	83.74	80.3	80.3	80.3	80.3	85.54	87.09	87.73	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	203.28	178.16	186.52	167.56	166	152.47	146.08	162.84	164.64	175.99	184.52	198.25	
Total = Sum(219a), „ =												2086.3	(219)

Annual totals

Space heating fuel used, main system 1												2808.23	kWh/year
Water heating fuel used												2086.3	kWh/year
Electricity for pumps, fans and electric keep-hot													
central heating pump:												30	(230c)
boiler with a fan-assisted flue												45	(230e)
Total electricity for the above, kWh/year												75	(231)
Electricity for lighting												272.88	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year

TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	606.58	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	450.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1057.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	141.62	(268)
Total CO2, kg/year	sum of (265)...(271) =			1237.77	(272)
TER =				20.63	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.10

Property Address: D1 2-3-2

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80	(1a) x	2.8	(2a) =	224	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	224	(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							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) = 0 (8)

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 3 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.15 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.92 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Monthly average wind speed from Table 7

(22)m=

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0.29 0.29 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.27 0.28 (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.29 0.29 0.29 0.27 0.27 0.25 0.25 0.25 0.26 0.27 0.27 0.28 (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			2.2	x 1.3	= 2.86		(26)
Windows Type 1			2.98	x1/[1/(1.4)+ 0.04]	= 3.95		(27)
Windows Type 2			5.95	x1/[1/(1.4)+ 0.04]	= 7.89		(27)
Windows Type 3			2.98	x1/[1/(1.4)+ 0.04]	= 3.95		(27)
Windows Type 4			5.95	x1/[1/(1.4)+ 0.04]	= 7.89		(27)
Walls Type1	22.8	8.93	13.87	x 0.2	= 2.77		(29)
Walls Type2	4.5	2.2	2.3	x 0.2	= 0.46		(29)
Walls Type3	22.8	8.93	13.87	x 0.2	= 2.77		(29)
Walls Type4	27.4	0	27.4	x 0.2	= 5.48		(29)
Roof	80	0	80	x 0.13	= 10.4		(30)
Total area of elements, m²			157.5				(31)
Party wall			22.96	x 0	= 0		(32)
Party floor			80				(32a)
Internal wall **			70.56				(32c)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x u) (26)...(30) + (32) = 48.43 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 9018.4 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

8.6 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) = 57.03 (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=	21.76	21.51	21.25	19.97	19.71	18.43	18.43	18.17	18.94	19.71	20.22	20.74

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m= 78.79 78.53 78.28 76.99 76.74 75.46 75.46 75.2 75.97 76.74 77.25 77.76 (39)

Heat loss parameter (HLP), W/m²K

Average = Sum(39)_{1...12} /12= 76.93 (39)

(40)m = (39)m + (4)

(40)m= 0.98 0.98 0.98 0.96 0.96 0.94 0.94 0.94 0.95 0.96 0.97 0.97 (40)

Average = Sum(40)_{1...12} /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

2.46 (42)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

92.69 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m= 101.96 98.25 94.55 90.84 87.13 83.42 83.42 87.13 90.84 94.55 98.25 101.96 (44)

Total = Sum(44)_{1...12} =

1112.32

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= 151.21 132.25 136.47 118.97 114.16 98.51 91.28 104.75 106 123.53 134.85 146.44 (45)

Total = Sum(45)_{1...12} =

1458.42

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m= 22.68 19.84 20.47 17.85 17.12 14.78 13.69 15.71 15.9 18.53 20.23 21.97 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known: 0 (51)

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 (54) $(47) \times (51) \times (52) \times (53) =$ 0

Enter (50) or (54) in (55) (55) 0

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

If cylinder contains dedicated solar storage, (57)m = (56)m × [(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= 50.96 45.22 48.18 44.8 44.4 41.14 42.51 44.4 44.8 48.18 48.45 50.96 (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= 202.17 177.47 184.65 163.77 158.56 139.65 133.8 149.15 150.8 171.71 183.3 197.39 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)
(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (63)

Output from water heater
(64)m= 202.17 177.47 184.65 163.77 158.56 139.65 133.8 149.15 150.8 171.71 183.3 197.39
Output from water heater (annual)1..12 2012.43 (64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]
(65)m= 63.02 55.28 57.42 50.76 49.06 43.04 40.98 45.93 46.44 53.12 56.95 61.43 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating
5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts
(66)m= Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
123.14 123.14 123.14 123.14 123.14 123.14 123.14 123.14 123.14 123.14 123.14 123.14 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
(67)m= 19.56 17.38 14.13 10.7 8 6.75 7.3 9.48 12.73 16.16 18.86 20.11 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
(68)m= 219.44 221.72 215.98 203.76 188.34 173.85 164.17 161.89 167.63 179.84 195.27 209.76 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
(69)m= 35.31 35.31 35.31 35.31 35.31 35.31 35.31 35.31 35.31 35.31 35.31 35.31 (69)

Pumps and fans gains (Table 5a)
(70)m= 3 3 3 3 3 3 3 3 3 3 3 3 (70)

Losses e.g. evaporation (negative values) (Table 5)
(71)m= -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 (71)

Water heating gains (Table 5)
(72)m= 84.7 82.26 77.18 70.5 65.94 59.78 55.08 61.73 64.51 71.4 79.1 82.57 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m
(73)m= 386.65 384.3 370.23 347.9 325.22 303.32 289.49 296.05 307.81 330.35 356.17 375.37 (73)

6. Solar gains:
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.98	x	36.79	x	0.6	x	0.75	=	34.19	(77)
Southeast 0.9x	0.77	x	5.95	x	36.79	x	0.6	x	0.75	=	68.27	(77)
Southeast 0.9x	0.77	x	2.98	x	62.67	x	0.6	x	0.75	=	58.24	(77)
Southeast 0.9x	0.77	x	5.95	x	62.67	x	0.6	x	0.75	=	116.29	(77)
Southeast 0.9x	0.77	x	2.98	x	85.75	x	0.6	x	0.75	=	79.69	(77)
Southeast 0.9x	0.77	x	5.95	x	85.75	x	0.6	x	0.75	=	159.11	(77)
Southeast 0.9x	0.77	x	2.98	x	106.25	x	0.6	x	0.75	=	98.74	(77)
Southeast 0.9x	0.77	x	5.95	x	106.25	x	0.6	x	0.75	=	197.15	(77)
Southeast 0.9x	0.77	x	2.98	x	119.01	x	0.6	x	0.75	=	110.6	(77)
Southeast 0.9x	0.77	x	5.95	x	119.01	x	0.6	x	0.75	=	220.83	(77)
Southeast 0.9x	0.77	x	2.98	x	118.15	x	0.6	x	0.75	=	109.8	(77)
Southeast 0.9x	0.77	x	5.95	x	118.15	x	0.6	x	0.75	=	219.23	(77)
Southeast 0.9x	0.77	x	2.98	x	113.91	x	0.6	x	0.75	=	105.86	(77)
Southeast 0.9x	0.77	x	5.95	x	113.91	x	0.6	x	0.75	=	211.36	(77)
Southeast 0.9x	0.77	x	2.98	x	104.39	x	0.6	x	0.75	=	97.01	(77)
Southeast 0.9x	0.77	x	5.95	x	104.39	x	0.6	x	0.75	=	193.7	(77)
Southeast 0.9x	0.77	x	2.98	x	92.85	x	0.6	x	0.75	=	86.29	(77)
Southeast 0.9x	0.77	x	5.95	x	92.85	x	0.6	x	0.75	=	172.29	(77)
Southeast 0.9x	0.77	x	2.98	x	69.27	x	0.6	x	0.75	=	64.37	(77)
Southeast 0.9x	0.77	x	5.95	x	69.27	x	0.6	x	0.75	=	128.53	(77)
Southeast 0.9x	0.77	x	2.98	x	44.07	x	0.6	x	0.75	=	40.96	(77)
Southeast 0.9x	0.77	x	5.95	x	44.07	x	0.6	x	0.75	=	81.77	(77)
Southeast 0.9x	0.77	x	2.98	x	31.49	x	0.6	x	0.75	=	29.26	(77)
Southeast 0.9x	0.77	x	5.95	x	31.49	x	0.6	x	0.75	=	58.43	(77)
Northwest 0.9x	0.77	x	2.98	x	11.28	x	0.6	x	0.75	=	10.49	(81)
Northwest 0.9x	0.77	x	5.95	x	11.28	x	0.6	x	0.75	=	20.94	(81)
Northwest 0.9x	0.77	x	2.98	x	22.97	x	0.6	x	0.75	=	21.34	(81)
Northwest 0.9x	0.77	x	5.95	x	22.97	x	0.6	x	0.75	=	42.61	(81)
Northwest 0.9x	0.77	x	2.98	x	41.38	x	0.6	x	0.75	=	38.45	(81)
Northwest 0.9x	0.77	x	5.95	x	41.38	x	0.6	x	0.75	=	76.78	(81)
Northwest 0.9x	0.77	x	2.98	x	67.96	x	0.6	x	0.75	=	63.15	(81)
Northwest 0.9x	0.77	x	5.95	x	67.96	x	0.6	x	0.75	=	126.09	(81)
Northwest 0.9x	0.77	x	2.98	x	91.35	x	0.6	x	0.75	=	84.89	(81)
Northwest 0.9x	0.77	x	5.95	x	91.35	x	0.6	x	0.75	=	169.49	(81)
Northwest 0.9x	0.77	x	2.98	x	97.38	x	0.6	x	0.75	=	90.5	(81)
Northwest 0.9x	0.77	x	5.95	x	97.38	x	0.6	x	0.75	=	180.7	(81)
Northwest 0.9x	0.77	x	2.98	x	91.1	x	0.6	x	0.75	=	84.66	(81)
Northwest 0.9x	0.77	x	5.95	x	91.1	x	0.6	x	0.75	=	169.04	(81)
Northwest 0.9x	0.77	x	2.98	x	72.63	x	0.6	x	0.75	=	67.49	(81)

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Northwest 0.9x	0.77	x	5.95	x	72.63	x	0.6	x	0.75	=	134.76	(81)
Northwest 0.9x	0.77	x	2.98	x	50.42	x	0.6	x	0.75	=	46.86	(81)
Northwest 0.9x	0.77	x	5.95	x	50.42	x	0.6	x	0.75	=	93.56	(81)
Northwest 0.9x	0.77	x	2.98	x	28.07	x	0.6	x	0.75	=	26.08	(81)
Northwest 0.9x	0.77	x	5.95	x	28.07	x	0.6	x	0.75	=	52.08	(81)
Northwest 0.9x	0.77	x	2.98	x	14.2	x	0.6	x	0.75	=	13.19	(81)
Northwest 0.9x	0.77	x	5.95	x	14.2	x	0.6	x	0.75	=	26.34	(81)
Northwest 0.9x	0.77	x	2.98	x	9.21	x	0.6	x	0.75	=	8.56	(81)
Northwest 0.9x	0.77	x	5.95	x	9.21	x	0.6	x	0.75	=	17.1	(81)

Solar gains in watts, calculated for each month	(83)m = Sum(74)m ... (82)m												(83)
(83)m=	133.89	238.49	354.04	485.14	585.81	600.22	570.92	492.96	398.99	271.06	162.26	113.35	
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	520.53	622.79	724.27	833.04	911.03	903.55	860.4	789.01	706.79	601.41	518.43	488.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21												(85)
Utilisation factor for gains for living area, h1,m (see Table 9a)													
(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	0.99	0.97	0.9	0.73	0.53	0.39	0.44	0.7	0.94	0.99	1	
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)													
(87)m=	20.04	20.22	20.48	20.78	20.94	20.99	21	21	20.97	20.72	20.32	20.01	(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)													
(88)m=	20.1	20.1	20.1	20.11	20.12	20.13	20.13	20.13	20.13	20.12	20.11	20.11	(88)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)													
(89)m=	1	0.99	0.96	0.87	0.68	0.46	0.31	0.36	0.63	0.92	0.99	1	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m=	18.81	19.07	19.45	19.86	20.07	20.13	20.13	20.13	20.1	19.8	19.24	18.77	(90)
fLA = Living area ÷ (4) =												0.37	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2													
(92)m=	19.26	19.49	19.82	20.2	20.39	20.44	20.45	20.42	20.14	19.63	19.22		(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m=	19.11	19.34	19.67	20.05	20.24	20.29	20.3	20.3	20.27	19.99	19.48	19.07	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.96	0.87	0.69	0.47	0.32	0.37	0.64	0.92	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	517.62	613.49	692.91	721.06	625.02	426.76	278.76	292.66	453.56	552.45	511.5	486.75	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1166.58	1134.04	1031.19	858.26	655.14	429.56	279	293.18	468.56	720.48	956.52	1156.67	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	482.83	349.81	251.68	98.78	22.41	0	0	0	0	125.02	320.41	498.42	
Total per year (kWh/year) = Sum(98)_{1..5,9..12} =												2149.36	(98)

Space heating requirement in kWh/m²/year	26.87	(99)
--	-------	------

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(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)	482.83	349.81	251.68	98.78	22.41	0	0	0	0	125.02	320.41	498.42	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	534.69	387.38	278.71	109.39	24.82	0	0	0	0	138.44	354.83	551.96	(211)
Total (kWh/year) =Sum(211)_{1..5,10..12} =												2380.24	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)_{1..5,10..12} =												0	(215)

Water heating

Output from water heater (calculated above)

	202.17	177.47	184.65	163.77	158.56	139.65	133.8	149.15	150.8	171.71	183.3	197.39	
Efficiency of water heater	81												(216)
(217)m=	87.34	86.94	86.12	84.27	82.05	81	81	81	81	84.67	86.68	87.45	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m	231.47	204.13	214.42	194.35	193.26	172.41	165.18	184.14	186.17	202.79	211.47	225.72	
Total = Sum(219a)_{1..12} =												2385.51	(219)

Annual totals

Space heating fuel used, main system 1		2380.24	
Water heating fuel used		2385.51	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	267.81		(230a)
central heating pump:	30		(230c)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =	297.81	(231)
Electricity for lighting		345.49	(232)
Electricity generated by PVs		-421.45	(233)

12a. CO2 emissions – Individual heating systems including micro-CHP

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	514.13	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	515.27	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1029.4	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	154.57	(267)
Electricity for lighting	(232) x		0.519	=	179.31	(268)
Energy saving/generation technologies Item 1			0.519	=	-218.73	(269)
Total CO2, kg/year		sum of (265)...(271) =			1144.55	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			14.31	(273)
El rating (section 14)					88	(274)

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User Details:

Assessor Name:

Stroma Number:

Software Name:

Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: D1 2-3-2

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	80	(1a) x	2.8	(2a) =	224	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80	(4)				
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =				224	(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) =

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)

Additional infiltration

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

Infiltration rate

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered

Shelter factor

Infiltration rate incorporating shelter factor

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=

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42
------	------	------	------	------	------	------	------	------	------	-----	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m= 0.6 0.6 0.59 0.58 0.57 0.56 0.56 0.55 0.56 0.57 0.58 0.59 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m= 0.6 0.6 0.59 0.58 0.57 0.56 0.56 0.55 0.56 0.57 0.58 0.59 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m².K	A X k kJ/K
Doors			2.2	x 1	= 2.2		(26)
Windows Type 1			2.97	x1/[1/(1.4)+ 0.04]	= 3.94		(27)
Windows Type 2			5.93	x1/[1/(1.4)+ 0.04]	= 7.86		(27)
Windows Type 3			2.97	x1/[1/(1.4)+ 0.04]	= 3.94		(27)
Windows Type 4			5.93	x1/[1/(1.4)+ 0.04]	= 7.86		(27)
Walls Type1	22.8	8.9	13.9	x 0.18	= 2.5		(29)
Walls Type2	4.5	2.2	2.3	x 0.18	= 0.41		(29)
Walls Type3	22.8	8.9	13.9	x 0.18	= 2.5		(29)
Walls Type4	27.4	0	27.4	x 0.18	= 4.93		(29)
Roof	80	0	80	x 0.13	= 10.4		(30)
Total area of elements, m²			157.5				(31)
Party wall			22.96	x 0	= 0		(32)
Party floor			80				(32a)
Internal wall **			70.56				(32c)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 46.55 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 9019.24 (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

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

21.22 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

(33) + (36) = 67.77 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 × (25)m x (5)

(38)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	44.54	44.24	43.96	42.6	42.35	41.17	41.17	40.95	41.62	42.35	42.86	43.4	(38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m= 112.31 112.02 111.73 110.37 110.12 108.94 108.94 108.72 109.39 110.12 110.63 111.17

Average = Sum(39)_{1...12} /12= 110.37 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m ÷ (4)

(40)m= 1.4 1.4 1.4 1.38 1.38 1.36 1.36 1.36 1.37 1.38 1.38 1.39

Average = Sum(40)_{1...12} /12= 1.38 (40)

Number of days in month (Table 1a)

(41)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.46 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

92.69 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m= 101.96 98.25 94.55 90.84 87.13 83.42 83.42 87.13 90.84 94.55 98.25 101.96

Total = Sum(44)_{1...12} = 1112.32 (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= 151.21 132.25 136.47 118.97 114.16 98.51 91.28 104.75 106 123.53 134.85 146.44

Total = Sum(45)_{1...12} = 1458.42 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m= 22.68 19.84 20.47 17.85 17.12 14.78 13.69 15.71 15.9 18.53 20.23 21.97 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known: 0 (51)

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) x (41)m (56)m= 0 0 0 0 0 0 0 0 0 0 0 0 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m= 0 0 0 0 0 0 0 0 0 0 0 0 (57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)m= 0 0 0 0 0 0 0 0 0 0 0 0 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m

(61)m= 50.96 45.22 48.18 44.8 44.4 41.14 42.51 44.4 44.8 48.18 48.45 50.96 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m= 202.17 177.47 184.65 163.77 158.56 139.65 133.8 149.15 150.8 171.71 183.3 197.39 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (63)

Output from water heater

(64)m= 202.17 177.47 184.65 163.77 158.56 139.65 133.8 149.15 150.8 171.71 183.3 197.39 (64)

Output from water heater (annual)_{1...12} 2012.43

Heat gains from water heating, kWh/month 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m= 63.02 55.28 57.42 50.76 49.06 43.04 40.98 45.93 46.44 53.12 56.95 61.43 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m= Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 123.14 123.14 123.14 123.14 123.14 123.14 123.14 123.14 123.14 123.14 123.14 123.14 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m= 19.56 17.38 14.13 10.7 8 6.75 7.3 9.48 12.73 16.16 18.86 20.11 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m= 219.44 221.72 215.98 203.76 188.34 173.85 164.17 161.89 167.63 179.84 195.27 209.76 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m= 35.31 35.31 35.31 35.31 35.31 35.31 35.31 35.31 35.31 35.31 35.31 35.31 (69)

Pumps and fans gains (Table 5a)

(70)m= 3 3 3 3 3 3 3 3 3 3 3 3 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m= -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 -98.51 (71)

Water heating gains (Table 5)

(72)m= 84.7 82.26 77.18 70.5 65.94 59.78 55.08 61.73 64.51 71.4 79.1 82.57 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m= 386.65 384.3 370.23 347.9 325.22 303.32 289.49 296.05 307.81 330.35 356.17 375.38 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	2.97	x	36.79	x	0.63	x	0.7	=	33.4	(77)
Southeast 0.9x	0.77	x	5.93	x	36.79	x	0.63	x	0.7	=	66.68	(77)
Southeast 0.9x	0.77	x	2.97	x	62.67	x	0.63	x	0.7	=	56.89	(77)
Southeast 0.9x	0.77	x	5.93	x	62.67	x	0.63	x	0.7	=	113.58	(77)
Southeast 0.9x	0.77	x	2.97	x	85.75	x	0.63	x	0.7	=	77.84	(77)
Southeast 0.9x	0.77	x	5.93	x	85.75	x	0.63	x	0.7	=	155.41	(77)
Southeast 0.9x	0.77	x	2.97	x	106.25	x	0.63	x	0.7	=	96.44	(77)
Southeast 0.9x	0.77	x	5.93	x	106.25	x	0.63	x	0.7	=	192.56	(77)
Southeast 0.9x	0.77	x	2.97	x	119.01	x	0.63	x	0.7	=	108.02	(77)
Southeast 0.9x	0.77	x	5.93	x	119.01	x	0.63	x	0.7	=	215.68	(77)
Southeast 0.9x	0.77	x	2.97	x	118.15	x	0.63	x	0.7	=	107.24	(77)
Southeast 0.9x	0.77	x	5.93	x	118.15	x	0.63	x	0.7	=	214.12	(77)
Southeast 0.9x	0.77	x	2.97	x	113.91	x	0.63	x	0.7	=	103.39	(77)
Southeast 0.9x	0.77	x	5.93	x	113.91	x	0.63	x	0.7	=	206.44	(77)
Southeast 0.9x	0.77	x	2.97	x	104.39	x	0.63	x	0.7	=	94.75	(77)
Southeast 0.9x	0.77	x	5.93	x	104.39	x	0.63	x	0.7	=	189.19	(77)
Southeast 0.9x	0.77	x	2.97	x	92.85	x	0.63	x	0.7	=	84.28	(77)
Southeast 0.9x	0.77	x	5.93	x	92.85	x	0.63	x	0.7	=	168.27	(77)
Southeast 0.9x	0.77	x	2.97	x	69.27	x	0.63	x	0.7	=	62.87	(77)
Southeast 0.9x	0.77	x	5.93	x	69.27	x	0.63	x	0.7	=	125.53	(77)
Southeast 0.9x	0.77	x	2.97	x	44.07	x	0.63	x	0.7	=	40	(77)
Southeast 0.9x	0.77	x	5.93	x	44.07	x	0.63	x	0.7	=	79.87	(77)
Southeast 0.9x	0.77	x	2.97	x	31.49	x	0.63	x	0.7	=	28.58	(77)
Southeast 0.9x	0.77	x	5.93	x	31.49	x	0.63	x	0.7	=	57.06	(77)
Northwest 0.9x	0.77	x	2.97	x	11.28	x	0.63	x	0.7	=	10.24	(81)
Northwest 0.9x	0.77	x	5.93	x	11.28	x	0.63	x	0.7	=	20.45	(81)
Northwest 0.9x	0.77	x	2.97	x	22.97	x	0.63	x	0.7	=	20.85	(81)
Northwest 0.9x	0.77	x	5.93	x	22.97	x	0.63	x	0.7	=	41.62	(81)
Northwest 0.9x	0.77	x	2.97	x	41.38	x	0.63	x	0.7	=	37.56	(81)
Northwest 0.9x	0.77	x	5.93	x	41.38	x	0.63	x	0.7	=	74.99	(81)
Northwest 0.9x	0.77	x	2.97	x	67.96	x	0.63	x	0.7	=	61.68	(81)
Northwest 0.9x	0.77	x	5.93	x	67.96	x	0.63	x	0.7	=	123.16	(81)
Northwest 0.9x	0.77	x	2.97	x	91.35	x	0.63	x	0.7	=	82.91	(81)
Northwest 0.9x	0.77	x	5.93	x	91.35	x	0.63	x	0.7	=	165.54	(81)
Northwest 0.9x	0.77	x	2.97	x	97.38	x	0.63	x	0.7	=	88.39	(81)
Northwest 0.9x	0.77	x	5.93	x	97.38	x	0.63	x	0.7	=	176.49	(81)
Northwest 0.9x	0.77	x	2.97	x	91.1	x	0.63	x	0.7	=	82.69	(81)
Northwest 0.9x	0.77	x	5.93	x	91.1	x	0.63	x	0.7	=	165.1	(81)
Northwest 0.9x	0.77	x	2.97	x	72.63	x	0.63	x	0.7	=	65.92	(81)

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Northwest 0.9x	0.77	x	5.93	x	72.63	x	0.63	x	0.7	=	131.62	(81)
Northwest 0.9x	0.77	x	2.97	x	50.42	x	0.63	x	0.7	=	45.77	(81)
Northwest 0.9x	0.77	x	5.93	x	50.42	x	0.63	x	0.7	=	91.38	(81)
Northwest 0.9x	0.77	x	2.97	x	28.07	x	0.63	x	0.7	=	25.48	(81)
Northwest 0.9x	0.77	x	5.93	x	28.07	x	0.63	x	0.7	=	50.87	(81)
Northwest 0.9x	0.77	x	2.97	x	14.2	x	0.63	x	0.7	=	12.89	(81)
Northwest 0.9x	0.77	x	5.93	x	14.2	x	0.63	x	0.7	=	25.73	(81)
Northwest 0.9x	0.77	x	2.97	x	9.21	x	0.63	x	0.7	=	8.36	(81)
Northwest 0.9x	0.77	x	5.93	x	9.21	x	0.63	x	0.7	=	16.7	(81)

Solar gains in watts, calculated for each month	(83)m = Sum(74)m ... (82)m											(83)
(83)m=	130.77	232.94	345.79	473.84	572.16	586.24	557.62	481.48	389.7	264.75	158.48	110.71
Total gains – internal and solar (84)m = (73)m + (83)m , watts												(84)
(84)m=	517.41	617.23	716.02	821.74	897.38	889.57	847.11	777.53	697.5	595.09	514.65	486.08

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)												(86)
(86)m=	1	0.99	0.98	0.95	0.86	0.7	0.54	0.61	0.84	0.97	0.99	1
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)												(87)
(87)m=	19.47	19.66	19.97	20.37	20.72	20.92	20.98	20.97	20.81	20.36	19.84	19.44
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)												(88)
(88)m=	19.76	19.76	19.77	19.78	19.78	19.79	19.79	19.79	19.79	19.78	19.78	19.77
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)												(89)
(89)m=	1	0.99	0.98	0.93	0.81	0.6	0.41	0.47	0.77	0.96	0.99	1
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)												(90)
(90)m=	17.75	18.03	18.48	19.06	19.51	19.74	19.79	19.78	19.64	19.05	18.31	17.72
fLA = Living area ÷ (4) =	0.37											(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2												(92)
(92)m=	18.38	18.63	19.02	19.54	19.95	20.17	20.22	20.22	20.07	19.53	18.87	18.35
Apply adjustment to the mean internal temperature from Table 4e, where appropriate												(93)
(93)m=	18.38	18.63	19.02	19.54	19.95	20.17	20.22	20.22	20.07	19.53	18.87	18.35

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												(94)
Utilisation factor for gains, hm:												(94)
(94)m=	0.99	0.99	0.97	0.93	0.82	0.64	0.46	0.52	0.79	0.95	0.99	1
Useful gains, hmGm , W = (94)m x (84)m												(95)
(95)m=	514.55	609.92	696.04	760.6	734.64	565.91	387.12	402.25	548.61	566.93	509.11	484
Monthly average external temperature from Table 8												(96)
(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
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]												(97)
(97)m=	1581.53	1537.66	1399.17	1174.28	908.77	607.01	394.55	414.81	653.01	983.33	1301.81	1572.83

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	793.84	623.44	523.13	297.85	129.56	0	0	0	0	309.8	570.75	810.09	Total per year (kWh/year) = Sum(98)_{1..5,9..12} =	4058.45	(98)
--------	--------	--------	--------	--------	--------	---	---	---	---	-------	--------	--------	--	---------	------

Space heating requirement in kWh/m²/year	50.73	(99)
--	-------	------

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:														
Fraction of space heat from secondary/supplementary system												0	(201)	
Fraction of space heat from main system(s)												$(202) = 1 - (201) =$	1	(202)
Fraction of total heating from main system 1												$(204) = (202) \times [1 - (203)] =$	1	(204)
Efficiency of main space heating system 1												93.4	(206)	
Efficiency of secondary/supplementary heating system, %												0	(208)	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year		

Space heating requirement (calculated above)	793.84	623.44	523.13	297.85	129.56	0	0	0	0	309.8	570.75	810.09	(211)m = {[(98)m x (204)] } x 100 ÷ (206)	4345.24	(211)
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	849.93	667.49	560.1	318.9	138.71	0	0	0	0	331.69	611.08	867.33	Total (kWh/year) =Sum(211)_{1..5,10..12} =	4345.24	(211)

Space heating fuel (secondary), kWh/month																	
= {[(98)m x (201)] } x 100 ÷ (208)																	
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	Total (kWh/year) =Sum(215) _{1..5,10..12} =			0	(215)

Water heating													
Output from water heater (calculated above)													
202.17	177.47	184.65	163.77	158.56	139.65	133.8	149.15	150.8	171.71	183.3	197.39		
Efficiency of water heater												80.3	(216)
(217)m=	88.15	87.95	87.53	86.54	84.55	80.3	80.3	80.3	80.3	86.52	87.72	88.23	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	229.34	201.79	210.96	189.25	187.54	173.91	166.62	185.74	187.79	198.47	208.97	223.74	
Total = Sum(219a), n =												2364.12	(219)

Annual totals												kWh/year	kWh/year	
Space heating fuel used, main system 1												4345.24		
Water heating fuel used												2364.12		

Electricity for pumps, fans and electric keep-hot												30	(230c)
central heating pump:												45	(230e)
boiler with a fan-assisted flue												75	(231)
Total electricity for the above, kWh/year												345.51	(232)
Electricity for lighting												345.51	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	938.57	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	510.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1449.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	179.32	(268)
Total CO2, kg/year	sum of (265)...(271) =			1667.47	(272)
TER =				20.84	(273)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.10

Property Address: E 1-2-2

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m²)	Av. Height(m)	Volume(m³)
Ground floor	95.6 (1a) x	2.8 (2a) =	267.68 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	95.6 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	267.68 (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				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) = 0 (8)

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 3 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.15 (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) = 0.13 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27
------	------	------	------	------	------	------	------	------	------	------	------

 (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	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m².K	A X k kJ/K
Windows Type 1			1.79	x1/[1/(1.4)+ 0.04] =	2.37		(27)
Windows Type 2			2.99	x1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 3			5.86	x1/[1/(1.4)+ 0.04] =	7.77		(27)
Windows Type 4			2.99	x1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 5			2.99	x1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 6			2.99	x1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 7			2.99	x1/[1/(1.4)+ 0.04] =	3.96		(27)
Walls Type1	30.7	10.64	20.06	x 0.2 =	4.01		(29)
Walls Type2	32.8	0	32.8	x 0.2 =	6.56		(29)
Walls Type3	5	0	5	x 0.2 =	1		(29)
Walls Type4	5	11.96	-6.96	x 0.2 =	-1.39		(29)
Total area of elements, m²			73.5				(31)
Party wall			21	x 0 =	0		(32)
Party wall			26.88	x 0 =	0		(32)
Party floor			95.6				(32a)
Party ceiling			95.6				(32b)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) =

40.14

 (33)Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) =

18878.2

 (34)Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium

250

 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

8.68

 (36)

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) =

48.83

 (37)

Ventilation heat loss calculated monthly

(38)m = 0.33 × (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
24.74	24.46	24.18	22.77	22.49	21.08	21.08	20.8	21.64	22.49	23.05	23.61

 (38)

Heat transfer coefficient, W/K

(39)m = (37) + (38)m

(39)m=

73.56	73.28	73	71.59	71.31	69.9	69.9	69.62	70.47	71.31	71.87	72.44
-------	-------	----	-------	-------	------	------	-------	-------	-------	-------	-------

Average = Sum(39)_{1...12} /12=

71.52

 (39)

Heat loss parameter (HLP), W/m²K

(40)m = (39)m + (4)

(40)m=

0.77	0.77	0.76	0.75	0.75	0.73	0.73	0.73	0.74	0.75	0.75	0.76
------	------	------	------	------	------	------	------	------	------	------	------

Average = Sum(40)_{1...12} /12=

0.75

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.69

 (42)

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

98.2

 (43)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=

108.02	104.1	100.17	96.24	92.31	88.38	88.38	92.31	96.24	100.17	104.1	108.02
--------	-------	--------	-------	-------	-------	-------	-------	-------	--------	-------	--------

Total = Sum(44)_{1...12} =

1178.44

 (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=

160.2	140.11	144.58	126.05	120.95	104.37	96.71	110.98	112.3	130.88	142.86	155.14
-------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------

Total = Sum(45)_{1...12} =

1545.13

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

24.03	21.02	21.69	18.91	18.14	15.66	14.51	16.65	16.85	19.63	21.43	23.27
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)Temperature factor from Table 2b

0

 (49)Energy lost from water storage, kWh/year (48) x (49) =

0

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

 (51)

If community heating see section 4.3

Volume factor from Table 2a

0

 (52)Temperature factor from Table 2b

0

 (53)

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Energy lost from water storage, kWh/year (54) $(47) \times (51) \times (52) \times (53) =$ 0

Enter (50) or (54) in (55) (55) 0

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

If cylinder contains dedicated solar storage, (57)m = (56)m × [(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= 50.96 46.03 50.96 47.46 47.04 43.59 45.04 47.04 47.46 50.96 49.32 50.96 (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= 211.16 186.14 195.54 173.51 167.99 147.95 141.75 158.02 159.76 181.84 192.18 206.1 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRs and/or WWHRs applies, see Appendix G) (63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (63)

Output from water heater (64)m= 211.16 186.14 195.54 173.51 167.99 147.95 141.75 158.02 159.76 181.84 192.18 206.1

Output from water heater (annual) 1..12 2121.93 (64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m] (65)m= 66.01 58.09 60.81 53.78 51.97 45.6 43.42 48.66 49.21 56.26 59.83 64.32 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts (66)m= Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 134.74 134.74 134.74 134.74 134.74 134.74 134.74 134.74 134.74 134.74 134.74 134.74 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 22.2 19.72 16.04 12.14 9.07 7.66 8.28 10.76 14.44 18.34 21.4 22.82 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 249.01 251.6 245.08 231.22 213.72 197.28 186.29 183.71 190.22 204.08 221.58 238.02 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 36.47 36.47 36.47 36.47 36.47 36.47 36.47 36.47 36.47 36.47 36.47 36.47 (69)

Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 (70)

Losses e.g. evaporation (negative values) (Table 5) (71)m= -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 -107.8 (71)

Water heating gains (Table 5) (72)m= 88.72 86.45 81.74 74.69 69.86 63.33 58.36 65.4 68.34 75.61 83.1 86.46 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m (73)m= 426.35 424.18 409.28 384.47 359.08 334.69 319.35 326.29 339.43 364.46 392.5 413.72 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)
Southwest0.9x	0.77	x	1.79	x	36.79		0.6	x	0.75	=	20.54 (79)
Southwest0.9x	0.77	x	2.99	x	36.79		0.6	x	0.75	=	34.31 (79)
Southwest0.9x	0.54	x	5.86	x	36.79		0.6	x	0.75	=	47.15 (79)
Southwest0.9x	0.77	x	1.79	x	62.67		0.6	x	0.75	=	34.99 (79)
Southwest0.9x	0.77	x	2.99	x	62.67		0.6	x	0.75	=	58.44 (79)
Southwest0.9x	0.54	x	5.86	x	62.67		0.6	x	0.75	=	80.32 (79)
Southwest0.9x	0.77	x	1.79	x	85.75		0.6	x	0.75	=	47.87 (79)
Southwest0.9x	0.77	x	2.99	x	85.75		0.6	x	0.75	=	79.96 (79)
Southwest0.9x	0.54	x	5.86	x	85.75		0.6	x	0.75	=	109.9 (79)
Southwest0.9x	0.77	x	1.79	x	106.25		0.6	x	0.75	=	59.31 (79)
Southwest0.9x	0.77	x	2.99	x	106.25		0.6	x	0.75	=	99.07 (79)
Southwest0.9x	0.54	x	5.86	x	106.25		0.6	x	0.75	=	136.17 (79)
Southwest0.9x	0.77	x	1.79	x	119.01		0.6	x	0.75	=	66.43 (79)
Southwest0.9x	0.77	x	2.99	x	119.01		0.6	x	0.75	=	110.97 (79)
Southwest0.9x	0.54	x	5.86	x	119.01		0.6	x	0.75	=	152.52 (79)
Southwest0.9x	0.77	x	1.79	x	118.15		0.6	x	0.75	=	65.95 (79)
Southwest0.9x	0.77	x	2.99	x	118.15		0.6	x	0.75	=	110.17 (79)
Southwest0.9x	0.54	x	5.86	x	118.15		0.6	x	0.75	=	151.42 (79)
Southwest0.9x	0.77	x	1.79	x	113.91		0.6	x	0.75	=	63.59 (79)
Southwest0.9x	0.77	x	2.99	x	113.91		0.6	x	0.75	=	106.21 (79)
Southwest0.9x	0.54	x	5.86	x	113.91		0.6	x	0.75	=	145.98 (79)
Southwest0.9x	0.77	x	1.79	x	104.39		0.6	x	0.75	=	58.27 (79)
Southwest0.9x	0.77	x	2.99	x	104.39		0.6	x	0.75	=	97.34 (79)
Southwest0.9x	0.54	x	5.86	x	104.39		0.6	x	0.75	=	133.78 (79)
Southwest0.9x	0.77	x	1.79	x	92.85		0.6	x	0.75	=	51.83 (79)
Southwest0.9x	0.77	x	2.99	x	92.85		0.6	x	0.75	=	86.58 (79)
Southwest0.9x	0.54	x	5.86	x	92.85		0.6	x	0.75	=	119 (79)
Southwest0.9x	0.77	x	1.79	x	69.27		0.6	x	0.75	=	38.67 (79)
Southwest0.9x	0.77	x	2.99	x	69.27		0.6	x	0.75	=	64.59 (79)
Southwest0.9x	0.54	x	5.86	x	69.27		0.6	x	0.75	=	88.77 (79)
Southwest0.9x	0.77	x	1.79	x	44.07		0.6	x	0.75	=	24.6 (79)
Southwest0.9x	0.77	x	2.99	x	44.07		0.6	x	0.75	=	41.09 (79)
Southwest0.9x	0.54	x	5.86	x	44.07		0.6	x	0.75	=	56.48 (79)
Southwest0.9x	0.77	x	1.79	x	31.49		0.6	x	0.75	=	17.58 (79)
Southwest0.9x	0.77	x	2.99	x	31.49		0.6	x	0.75	=	29.36 (79)
Southwest0.9x	0.54	x	5.86	x	31.49		0.6	x	0.75	=	40.35 (79)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.6	x	0.75	=	10.52 (81)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.6	x	0.75	=	10.52 (81)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.6	x	0.75	=	10.52 (81)

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Northwest 0.9x	0.77	x	2.99	x	11.28	x	0.6	x	0.75	=	10.52	(81)
Northwest 0.9x	0.77	x	2.99	x	22.97	x	0.6	x	0.75	=	21.41	(81)
Northwest 0.9x	0.77	x	2.99	x	22.97	x	0.6	x	0.75	=	21.41	(81)
Northwest 0.9x	0.77	x	2.99	x	22.97	x	0.6	x	0.75	=	21.41	(81)
Northwest 0.9x	0.77	x	2.99	x	22.97	x	0.6	x	0.75	=	21.41	(81)
Northwest 0.9x	0.77	x	2.99	x	41.38	x	0.6	x	0.75	=	38.58	(81)
Northwest 0.9x	0.77	x	2.99	x	41.38	x	0.6	x	0.75	=	38.58	(81)
Northwest 0.9x	0.77	x	2.99	x	41.38	x	0.6	x	0.75	=	38.58	(81)
Northwest 0.9x	0.77	x	2.99	x	41.38	x	0.6	x	0.75	=	38.58	(81)
Northwest 0.9x	0.77	x	2.99	x	67.96	x	0.6	x	0.75	=	63.36	(81)
Northwest 0.9x	0.77	x	2.99	x	67.96	x	0.6	x	0.75	=	63.36	(81)
Northwest 0.9x	0.77	x	2.99	x	67.96	x	0.6	x	0.75	=	63.36	(81)
Northwest 0.9x	0.77	x	2.99	x	67.96	x	0.6	x	0.75	=	63.36	(81)
Northwest 0.9x	0.77	x	2.99	x	91.35	x	0.6	x	0.75	=	85.17	(81)
Northwest 0.9x	0.77	x	2.99	x	91.35	x	0.6	x	0.75	=	85.17	(81)
Northwest 0.9x	0.77	x	2.99	x	91.35	x	0.6	x	0.75	=	85.17	(81)
Northwest 0.9x	0.77	x	2.99	x	91.35	x	0.6	x	0.75	=	85.17	(81)
Northwest 0.9x	0.77	x	2.99	x	97.38	x	0.6	x	0.75	=	90.8	(81)
Northwest 0.9x	0.77	x	2.99	x	97.38	x	0.6	x	0.75	=	90.8	(81)
Northwest 0.9x	0.77	x	2.99	x	97.38	x	0.6	x	0.75	=	90.8	(81)
Northwest 0.9x	0.77	x	2.99	x	97.38	x	0.6	x	0.75	=	90.8	(81)
Northwest 0.9x	0.77	x	2.99	x	91.1	x	0.6	x	0.75	=	84.95	(81)
Northwest 0.9x	0.77	x	2.99	x	91.1	x	0.6	x	0.75	=	84.95	(81)
Northwest 0.9x	0.77	x	2.99	x	91.1	x	0.6	x	0.75	=	84.95	(81)
Northwest 0.9x	0.77	x	2.99	x	91.1	x	0.6	x	0.75	=	84.95	(81)
Northwest 0.9x	0.77	x	2.99	x	91.1	x	0.6	x	0.75	=	84.95	(81)
Northwest 0.9x	0.77	x	2.99	x	72.63	x	0.6	x	0.75	=	67.72	(81)
Northwest 0.9x	0.77	x	2.99	x	72.63	x	0.6	x	0.75	=	67.72	(81)
Northwest 0.9x	0.77	x	2.99	x	72.63	x	0.6	x	0.75	=	67.72	(81)
Northwest 0.9x	0.77	x	2.99	x	72.63	x	0.6	x	0.75	=	67.72	(81)
Northwest 0.9x	0.77	x	2.99	x	50.42	x	0.6	x	0.75	=	47.01	(81)
Northwest 0.9x	0.77	x	2.99	x	50.42	x	0.6	x	0.75	=	47.01	(81)
Northwest 0.9x	0.77	x	2.99	x	50.42	x	0.6	x	0.75	=	47.01	(81)
Northwest 0.9x	0.77	x	2.99	x	50.42	x	0.6	x	0.75	=	47.01	(81)
Northwest 0.9x	0.77	x	2.99	x	28.07	x	0.6	x	0.75	=	26.17	(81)
Northwest 0.9x	0.77	x	2.99	x	28.07	x	0.6	x	0.75	=	26.17	(81)
Northwest 0.9x	0.77	x	2.99	x	28.07	x	0.6	x	0.75	=	26.17	(81)
Northwest 0.9x	0.77	x	2.99	x	28.07	x	0.6	x	0.75	=	26.17	(81)
Northwest 0.9x	0.77	x	2.99	x	14.2	x	0.6	x	0.75	=	13.24	(81)
Northwest 0.9x	0.77	x	2.99	x	14.2	x	0.6	x	0.75	=	13.24	(81)
Northwest 0.9x	0.77	x	2.99	x	14.2	x	0.6	x	0.75	=	13.24	(81)

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Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.6	x	0.75	=	8.59	(81)
Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.6	x	0.75	=	8.59	(81)
Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.6	x	0.75	=	8.59	(81)
Northwest 0.9x	0.77	x	2.99	x	9.21	x	0.6	x	0.75	=	8.59	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	144.08	259.4	392.06	548.01	670.62	690.76	655.56	560.27	445.46	296.71	175.12	121.66	(83)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	570.43	683.59	801.34	932.48	1029.7	1025.45	974.91	886.57	784.89	661.16	567.63	535.38	(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)

(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	0.99	0.96	0.84	0.63	0.44	0.32	0.36	0.61	0.92	0.99	1	

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.3	20.47	20.7	20.92	20.99	21	21	21	20.99	20.86	20.54	20.28	(87)
--------	------	-------	------	-------	-------	----	----	----	-------	-------	-------	-------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.28	20.28	20.28	20.3	20.3	20.31	20.31	20.32	20.31	20.3	20.3	20.29	(88)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	------	------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.95	0.81	0.59	0.39	0.27	0.31	0.55	0.9	0.99	1	(89)
--------	---	------	------	------	------	------	------	------	------	-----	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.34	19.58	19.91	20.21	20.29	20.31	20.31	20.32	20.3	20.15	19.7	19.31	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------	-------	------

fLA = Living area + (4) = 0.33 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.66	19.87	20.17	20.44	20.52	20.54	20.54	20.54	20.53	20.38	19.97	19.63	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.51	19.72	20.02	20.29	20.37	20.39	20.39	20.39	20.38	20.23	19.82	19.48	(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	0.95	0.81	0.59	0.39	0.27	0.31	0.56	0.89	0.99	1	(94)
--------	---	------	------	------	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	567.95	673.63	758.76	756.78	611.95	404.37	264.84	277.79	439.56	591.21	560.39	533.79	(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=	1118.74	1086.38	986.72	815.39	618.3	404.63	264.86	277.83	442.57	686.83	914.42	1106.79	(97)
--------	---------	---------	--------	--------	-------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	409.79	277.37	169.6	42.2	4.73	0	0	0	0	71.14	254.9	426.31	(98)
--------	--------	--------	-------	------	------	---	---	---	---	-------	-------	--------	------

Total per year (kWh/year) = Sum(98)1...5,9...12 = 1656.04 (98)

Space heating requirement in kWh/m²/year

17.32 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system

0

(201)

Fraction of space heat from main system(s)

(202) = 1 – (201) =

1

(202)

Fraction of total heating from main system 1

(204) = (202) × [1 – (203)] =

1

(204)

Efficiency of main space heating system 1

90.3

(206)

Efficiency of secondary/supplementary heating system, %

0

(208)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
409.79	277.37	169.6	42.2	4.73	0	0	0	0	71.14	254.9	426.31	

(211)m = {[(98)m x (204)] } x 100 ÷ (206)

(211)

453.81	307.16	187.82	46.73	5.24	0	0	0	0	78.78	282.28	472.11	
--------	--------	--------	-------	------	---	---	---	---	-------	--------	--------	--

Total (kWh/year) =Sum(211)_{1...5,10...12} =

1833.93

(211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=

0	0	0	0	0	0	0	0	0	0	0	0	
---	---	---	---	---	---	---	---	---	---	---	---	--

Total (kWh/year) =Sum(215)_{1...5,10...12} =

0

(215)

Water heating

Output from water heater (calculated above)

211.16	186.14	195.54	173.51	167.99	147.95	141.75	158.02	159.76	181.84	192.18	206.1	
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--

Efficiency of water heater

81

(216)

(217)m=

86.91	86.32	85.07	82.67	81.23	81	81	81	81	83.42	86.05	87.04	
-------	-------	-------	-------	-------	----	----	----	----	-------	-------	-------	--

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=

242.97	215.64	229.86	209.89	206.81	182.66	175	195.09	197.24	217.99	223.33	236.78	
--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------	--------	--

Total = Sum(219a)_{1...12} =

2533.24

(219)

Annual totals

Space heating fuel used, main system 1

kWh/year

1833.93

Water heating fuel used

kWh/year

2533.24

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

320.04

(230a)

central heating pump:

30

(230c)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

350.04

(231)

Electricity for lighting

392.05

(232)

Electricity generated by PVs

-504.35

(233)

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	396.13 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	547.18 (264)

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Space and water heating

(261) + (262) + (263) + (264) =

943.31

(265)

Electricity for pumps, fans and electric keep-hot

(231) x

0.519

=

181.67

(267)

Electricity for lighting

(232) x

0.519

=

203.47

(268)

Energy saving/generation technologies
Item 1

0.519

=

-261.76

(269)

Total CO2, kg/year

sum of (265)...(271) =

1066.69

(272)

Dwelling CO2 Emission Rate

(272) ÷ (4) =

11.16

(273)

EI rating (section 14)

90

(274)

DRAFT

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User Details:

Assessor Name:

Stroma Number:

Software Name:

Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: E 1-2-2

Address :

5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	95.6 (1a) x	2.8 (2a) =	267.68 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	95.6 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	267.68 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				3	30 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.11 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]x(8), otherwise (18) = (16)			0.36 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.31 (21)

Infiltration rate modified for monthly wind speed												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0
---------	---	---	---	---	---	---	---	---	---	---	---	---

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
---------	---	---	---	---	---	---	---	---	---	---	---	---

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
---------	---	---	---	---	---	---	---	---	---	---	---	---

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57
---------	------	------	------	------	------	------	------	------	------	------	------	------

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57
--------	------	------	------	------	------	------	------	------	------	------	------	------

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m2K	A X U (W/K)	k-value kJ/m ² .K	A X k kJ/K
Windows Type 1			1.79	x 1/[1/(1.4)+ 0.04] =	2.37		(27)
Windows Type 2			2.99	x 1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 3			5.86	x 1/[1/(1.4)+ 0.04] =	7.77		(27)
Windows Type 4			2.99	x 1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 5			2.99	x 1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 6			2.99	x 1/[1/(1.4)+ 0.04] =	3.96		(27)
Windows Type 7			2.99	x 1/[1/(1.4)+ 0.04] =	3.96		(27)
Walls Type1	30.7	10.64	20.06	x 0.18 =	3.61		(29)
Walls Type2	32.8	0	32.8	x 0.18 =	5.9		(29)
Walls Type3	5	0	5	x 0.18 =	0.9		(29)
Walls Type4	5	11.96	-6.96	x 0.18 =	-1.25		(29)
Total area of elements, m ²			73.5				(31)
Party wall			21	x 0 =	0		(32)
Party wall			26.88	x 0 =	0		(32)
Party floor			95.6				(32a)
Party ceiling			95.6				(32b)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 39.12 (33)

Heat capacity Cm = S(A x k) (28)...(30) + (32) + (32a)...(32e) = 18878.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

if details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss

Ventilation heat loss calculated monthly

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	50.97	50.7	50.44	49.23	49	47.94	47.94	47.75	48.35	49	49.46	49.94	(38)

Heat transfer coefficient, W/K

(39)m=	96.56	96.3	96.04	94.83	94.6	93.54	93.54	93.34	93.95	94.6	95.06	95.54	
--------	-------	------	-------	-------	------	-------	-------	-------	-------	------	-------	-------	--

Heat loss parameter (HLP), W/m²K

(40)m=	1.01	1.01	1	0.99	0.99	0.98	0.98	0.98	0.98	0.99	0.99	1	
--------	------	------	---	------	------	------	------	------	------	------	------	---	--

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

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

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	108.02	104.1	100.17	96.24	92.31	88.38	88.38	92.31	96.24	100.17	104.1	108.02	

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	160.2	140.11	144.58	126.05	120.95	104.37	96.71	110.98	112.3	130.88	142.86	155.14	
--------	-------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	--

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.03	21.02	21.69	18.91	18.14	15.66	14.51	16.65	16.85	19.63	21.43	23.27	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

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):

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

If community heating see section 4.3

Volume factor from Table 2a

Temperature factor from Table 2b

TER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year

Enter (50) or (54) in (55)

Water storage loss calculated for each month

(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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 x (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Combi loss calculated for each month (61)m = (60) ÷ 365 x (41)m

(61)m=	50.96	46.03	50.96	47.46	47.04	43.59	45.04	47.04	47.46	50.96	49.32	50.96	(61)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.16	186.14	195.54	173.51	167.99	147.95	141.75	158.02	159.76	181.84	192.18	206.1	(62)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	211.16	186.14	195.54	173.51	167.99	147.95	141.75	158.02	159.76	181.84	192.18	206.1	
	Output from water heater (annual) 1..12											2121.93	(64)

Heat gains from water heating, kWh/month 0.25 x [0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	66.01	58.09	60.81	53.78	51.97	45.6	43.42	48.66	49.21	56.26	59.83	64.32	(65)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	134.74	134.74	134.74	134.74	134.74	134.74	134.74	134.74	134.74	134.74	134.74	134.74	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.2	19.72	16.03	12.14	9.07	7.66	8.28	10.76	14.44	18.34	21.4	22.81	(67)
--------	------	-------	-------	-------	------	------	------	-------	-------	-------	------	-------	------

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	249.01	251.6	245.08	231.22	213.72	197.28	186.29	183.71	190.22	204.08	221.58	238.02	(68)
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.47	36.47	36.47	36.47	36.47	36.47	36.47	36.47	36.47	36.47	36.47	36.47	(69)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
--------	---	---	---	---	---	---	---	---	---	---	---	---	------

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	-107.8	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	88.72	86.45	81.74	74.69	69.86	63.33	58.36	65.4	68.34	75.61	83.1	86.46	(72)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------	-------	------

Total internal gains =

(73)m=	426.35	424.18	409.28	384.47	359.08	334.69	319.35	326.29	339.42	364.45	392.5	413.72	(73)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

TER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southwest0.9x	0.77	x	1.79	x	36.79	x	0.63	x	0.7	=	20.13	(79)
Southwest0.9x	0.77	x	2.99	x	36.79	x	0.63	x	0.7	=	33.62	(79)
Southwest0.9x	0.54	x	5.86	x	36.79	x	0.63	x	0.7	=	46.21	(79)
Southwest0.9x	0.77	x	1.79	x	62.67	x	0.63	x	0.7	=	34.29	(79)
Southwest0.9x	0.77	x	2.99	x	62.67	x	0.63	x	0.7	=	57.27	(79)
Southwest0.9x	0.54	x	5.86	x	62.67	x	0.63	x	0.7	=	78.71	(79)
Southwest0.9x	0.77	x	1.79	x	85.75	x	0.63	x	0.7	=	46.91	(79)
Southwest0.9x	0.77	x	2.99	x	85.75	x	0.63	x	0.7	=	78.36	(79)
Southwest0.9x	0.54	x	5.86	x	85.75	x	0.63	x	0.7	=	107.7	(79)
Southwest0.9x	0.77	x	1.79	x	106.25	x	0.63	x	0.7	=	58.12	(79)
Southwest0.9x	0.77	x	2.99	x	106.25	x	0.63	x	0.7	=	97.09	(79)
Southwest0.9x	0.54	x	5.86	x	106.25	x	0.63	x	0.7	=	133.45	(79)
Southwest0.9x	0.77	x	1.79	x	119.01	x	0.63	x	0.7	=	65.1	(79)
Southwest0.9x	0.77	x	2.99	x	119.01	x	0.63	x	0.7	=	108.75	(79)
Southwest0.9x	0.54	x	5.86	x	119.01	x	0.63	x	0.7	=	149.47	(79)
Southwest0.9x	0.77	x	1.79	x	118.15	x	0.63	x	0.7	=	64.63	(79)
Southwest0.9x	0.77	x	2.99	x	118.15	x	0.63	x	0.7	=	107.96	(79)
Southwest0.9x	0.54	x	5.86	x	118.15	x	0.63	x	0.7	=	148.39	(79)
Southwest0.9x	0.77	x	1.79	x	113.91	x	0.63	x	0.7	=	62.31	(79)
Southwest0.9x	0.77	x	2.99	x	113.91	x	0.63	x	0.7	=	104.09	(79)
Southwest0.9x	0.54	x	5.86	x	113.91	x	0.63	x	0.7	=	143.06	(79)
Southwest0.9x	0.77	x	1.79	x	104.39	x	0.63	x	0.7	=	57.11	(79)
Southwest0.9x	0.77	x	2.99	x	104.39	x	0.63	x	0.7	=	95.39	(79)
Southwest0.9x	0.54	x	5.86	x	104.39	x	0.63	x	0.7	=	131.11	(79)
Southwest0.9x	0.77	x	1.79	x	92.85	x	0.63	x	0.7	=	50.79	(79)
Southwest0.9x	0.77	x	2.99	x	92.85	x	0.63	x	0.7	=	84.85	(79)
Southwest0.9x	0.54	x	5.86	x	92.85	x	0.63	x	0.7	=	116.62	(79)
Southwest0.9x	0.77	x	1.79	x	69.27	x	0.63	x	0.7	=	37.89	(79)
Southwest0.9x	0.77	x	2.99	x	69.27	x	0.63	x	0.7	=	63.3	(79)
Southwest0.9x	0.54	x	5.86	x	69.27	x	0.63	x	0.7	=	87	(79)
Southwest0.9x	0.77	x	1.79	x	44.07	x	0.63	x	0.7	=	24.11	(79)
Southwest0.9x	0.77	x	2.99	x	44.07	x	0.63	x	0.7	=	40.27	(79)
Southwest0.9x	0.54	x	5.86	x	44.07	x	0.63	x	0.7	=	55.35	(79)
Southwest0.9x	0.77	x	1.79	x	31.49	x	0.63	x	0.7	=	17.23	(79)
Southwest0.9x	0.77	x	2.99	x	31.49	x	0.63	x	0.7	=	28.77	(79)
Southwest0.9x	0.54	x	5.86	x	31.49	x	0.63	x	0.7	=	39.55	(79)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.63	x	0.7	=	10.31	(81)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.63	x	0.7	=	10.31	(81)
Northwest0.9x	0.77	x	2.99	x	11.28	x	0.63	x	0.7	=	10.31	(81)

TER WorkSheet: New dwelling design stage

Northwest0.9x	0.77	x	2.99	x	11.28	x	0.63	x	0.7	=	10.31	(81)
Northwest0.9x	0.77	x	2.99	x	22.97	x	0.63	x	0.7	=	20.99	(81)
Northwest0.9x	0.77	x	2.99	x	22.97	x	0.63	x	0.7	=	20.99	(81)
Northwest0.9x	0.77	x	2.99	x	22.97	x	0.63	x	0.7	=	20.99	(81)
Northwest0.9x	0.77	x	2.99	x	41.38	x	0.63	x	0.7	=	37.81	(81)
Northwest0.9x	0.77	x	2.99	x	41.38	x	0.63	x	0.7	=	37.81	(81)
Northwest0.9x	0.77	x	2.99	x	41.38	x	0.63	x	0.7	=	37.81	(81)
Northwest0.9x	0.77	x	2.99	x	67.96	x	0.63	x	0.7	=	62.1	(81)
Northwest0.9x	0.77	x	2.99	x	67.96	x	0.63	x	0.7	=	62.1	(81)
Northwest0.9x	0.77	x	2.99	x	67.96	x	0.63	x	0.7	=	62.1	(81)
Northwest0.9x	0.77	x	2.99	x	91.35	x	0.63	x	0.7	=	83.47	(81)
Northwest0.9x	0.77	x	2.99	x	91.35	x	0.63	x	0.7	=	83.47	(81)
Northwest0.9x	0.77	x	2.99	x	91.35	x	0.63	x	0.7	=	83.47	(81)
Northwest0.9x	0.77	x	2.99	x	97.38	x	0.63	x	0.7	=	88.99	(81)
Northwest0.9x	0.77	x	2.99	x	97.38	x	0.63	x	0.7	=	88.99	(81)
Northwest0.9x	0.77	x	2.99	x	97.38	x	0.63	x	0.7	=	88.99	(81)
Northwest0.9x	0.77	x	2.99	x	97.38	x	0.63	x	0.7	=	88.99	(81)
Northwest0.9x	0.77	x	2.99	x	91.1	x	0.63	x	0.7	=	83.25	(81)
Northwest0.9x	0.77	x	2.99	x	91.1	x	0.63	x	0.7	=	83.25	(81)
Northwest0.9x	0.77	x	2.99	x	91.1	x	0.63	x	0.7	=	83.25	(81)
Northwest0.9x	0.77	x	2.99	x	91.1	x	0.63	x	0.7	=	83.25	(81)
Northwest0.9x	0.77	x	2.99	x	72.63	x	0.63	x	0.7	=	66.37	(81)
Northwest0.9x	0.77	x	2.99	x	72.63	x	0.63	x	0.7	=	66.37	(81)
Northwest0.9x	0.77	x	2.99	x	72.63	x	0.63	x	0.7	=	66.37	(81)
Northwest0.9x	0.77	x	2.99	x	72.63	x	0.63	x	0.7	=	66.37	(81)
Northwest0.9x	0.77	x	2.99	x	50.42	x	0.63	x	0.7	=	46.07	(81)
Northwest0.9x	0.77	x	2.99	x	50.42	x	0.63	x	0.7	=	46.07	(81)
Northwest0.9x	0.77	x	2.99	x	50.42	x	0.63	x	0.7	=	46.07	(81)
Northwest0.9x	0.77	x	2.99	x	50.42	x	0.63	x	0.7	=	46.07	(81)
Northwest0.9x	0.77	x	2.99	x	28.07	x	0.63	x	0.7	=	25.65	(81)
Northwest0.9x	0.77	x	2.99	x	28.07	x	0.63	x	0.7	=	25.65	(81)
Northwest0.9x	0.77	x	2.99	x	28.07	x	0.63	x	0.7	=	25.65	(81)
Northwest0.9x	0.77	x	2.99	x	28.07	x	0.63	x	0.7	=	25.65	(81)
Northwest0.9x	0.77	x	2.99	x	14.2	x	0.63	x	0.7	=	12.97	(81)
Northwest0.9x	0.77	x	2.99	x	14.2	x	0.63	x	0.7	=	12.97	(81)
Northwest0.9x	0.77	x	2.99	x	14.2	x	0.63	x	0.7	=	12.97	(81)
Northwest0.9x	0.77	x	2.99	x	14.2	x	0.63	x	0.7	=	12.97	(81)

TER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot

(231)

 ×

0.519

 =

38.93

(267)

Electricity for lighting

(232)

 ×

0.519

 =

203.45

(268)

Total CO2, kg/year

sum of (265)...(271) =

1479.09

(272)

TER =

15.47

(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name:

Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: E 2-6-3

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

Area(m²)

Av. Height(m)

Volume(m³)

Ground floor

99.9

(1a) ×

4.45

(2a) =

444.55

(3a)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)

99.9

(4)

Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =

444.55

(5)

2. Ventilation rate:

main heating

secondary heating

other

total

m³ per hour

Number of chimneys

0

 +

0

 +

0

 =

0

 × 40 =

0

(6a)

Number of open flues

0

 +

0

 +

0

 =

0

 × 20 =

0

(6b)

Number of intermittent fans

0

 × 10 =

0

(7a)

Number of passive vents

0

 × 10 =

0

(7b)

Number of flueless gas fires

0

 × 40 =

0

(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =

(6a)+(6b)+(7a)+(7b)+(7c) =

0

 ÷ (5) =

0

(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]×0.1 =

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 × (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

3

(17)

If based on air permeability value, then

(18) = [(17) ÷ 20]÷(8), otherwise (18) = (16)

0.15

(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered

1

(19)

Shelter factor

(20) = 1 - [0.075 × (19)] =

0.92

(20)

Infiltration rate incorporating shelter factor

(21) = (18) × (20) =

0.14

(21)

Infiltration rate modified for monthly wind speed

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Monthly average wind speed from Table 7

(22)m=

5.1

5

4.9

4.4

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=

1.27

1.25

1.23

1.1

1.08

0.95

0.95

0.92

1

1.08

1.12

1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28
------	------	------	------	------	------	------	------	------	------	------	------

 (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	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m².K	A X k kJ/K
Windows Type 1			2.88	$x1/[1/(1.4)+0.04]$	3.82		
Windows Type 2			2.88	$x1/[1/(1.4)+0.04]$	3.82		
Windows Type 3			6	$x1/[1/(1.4)+0.04]$	7.95		
Rooflights			4.32	$x1/[1/(1.4)+0.04]$	6.048		
Walls Type1	33.9	0	33.9	x 0.2	6.78		
Walls Type2	35.2	5.76	29.44	x 0.2	5.89		
Walls Type3	37.4	8.88	28.52	x 0.2	5.7		
Roof	126	8.64	117.36	x 0.13	15.26		
Total area of elements, m²			232.5				
Party wall			21	x 0	0		
Party wall			15.96	x 0	0		
Party floor			99.9				
Internal wall **			50.82				

* for windows and roof windows, use effective window U-value calculated using formula $1/[(1/U\text{-value})+0.04]$ as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) =

64.49

 (33)Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) =

22645.92

 (34)Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium

250

 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

9.21

 (36)

DER WorkSheet: New dwelling design stage

If details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) =

73.71

 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
43.19	42.68	42.17	39.63	39.12	36.57	36.57	36.07	37.59	39.12	40.14	41.15

 (38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=

116.9	116.39	115.88	113.33	112.82	110.28	110.28	109.77	111.3	112.82	113.84	114.86
-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------

 Average = Sum(39)_{1...12} /12=

113.21

 (39)

Heat loss parameter (HLP), W/m²K

(40)m=

1.17	1.17	1.16	1.13	1.13	1.1	1.1	1.1	1.11	1.13	1.14	1.15
------	------	------	------	------	-----	-----	-----	------	------	------	------

 Average = Sum(40)_{1...12} /12=

1.13

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
109.17	105.2	101.23	97.26	93.29	89.32	89.32	93.29	97.26	101.23	105.2	109.17

 Total = Sum(44)_{1...12} =

1190.9

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

161.89	141.59	146.11	127.38	122.22	105.47	97.73	112.15	113.49	132.26	144.37	156.78
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 Total = Sum(45)_{1...12} =

1561.46

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

24.28	21.24	21.92	19.11	18.33	15.82	14.66	16.82	17.02	19.84	21.66	23.52
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)Temperature factor from Table 2b

0

 (49)Energy lost from water storage, kWh/year (48) x (49) =

0

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

 (51)

If community heating see section 4.3

Volume factor from Table 2a

0

 (52)Temperature factor from Table 2b

0

 (53)Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

0

 (54)Enter (50) or (54) in (55)

0

 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

50.96	46.03	50.96	47.96	47.54	44.05	45.52	47.54	47.96	50.96	49.32	50.96
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

212.85	187.62	197.07	175.34	169.76	149.52	143.25	159.69	161.45	183.22	193.69	207.74
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

212.85	187.62	197.07	175.34	169.76	149.52	143.25	159.69	161.45	183.22	193.69	207.74
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual)

2141.2

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

66.57	58.59	61.32	54.34	52.52	46.08	43.88	49.17	49.73	56.72	60.33	64.87
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93	136.93

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

22.84	20.28	16.5	12.49	9.34	7.88	8.52	11.07	14.86	18.86	22.02	23.47
-------	-------	------	-------	------	------	------	-------	-------	-------	-------	-------

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

256.17	258.82	252.13	237.87	219.86	202.95	191.64	188.98	195.68	209.94	227.94	244.86
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

36.69	36.69	36.69	36.69	36.69	36.69	36.69	36.69	36.69	36.69	36.69	36.69
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54	-109.54
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

89.47	87.18	82.42	75.48	70.6	64	58.97	66.1	69.06	76.23	83.8	87.19
-------	-------	-------	-------	------	----	-------	------	-------	-------	------	-------

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

435.56	433.37	418.12	392.91	366.88	341.91	326.21	333.23	346.68	372.12	400.84	422.6
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor			Area			Flux			g _l			FF			Gains
		Table 6d		m ²			Table 6a			Table 6b			Table 6c			(W)
East	0.9x	2	x	2.88	x		19.64	x		0.6	x		0.8	=		(76)
East	0.9x	2	x	2.88	x		38.42	x		0.6	x		0.8	=		(76)
East	0.9x	2	x	2.88	x		63.27	x		0.6	x		0.8	=		(76)
East	0.9x	2	x	2.88	x		92.28	x		0.6	x		0.8	=		(76)
East	0.9x	2	x	2.88	x		113.09	x		0.6	x		0.8	=		(76)
East	0.9x	2	x	2.88	x		115.77	x		0.6	x		0.8	=		(76)
East	0.9x	2	x	2.88	x		110.22	x		0.6	x		0.8	=		(76)
East	0.9x	2	x	2.88	x		94.68	x		0.6	x		0.8	=		(76)
East	0.9x	2	x	2.88	x		73.59	x		0.6	x		0.8	=		(76)
East	0.9x	2	x	2.88	x		45.59	x		0.6	x		0.8	=		(76)
East	0.9x	2	x	2.88	x		24.49	x		0.6	x		0.8	=		(76)
East	0.9x	2	x	2.88	x		16.15	x		0.6	x		0.8	=		(76)
West	0.9x	0.77	x	2.88	x		19.64	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		19.64	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	2.88	x		38.42	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		38.42	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	2.88	x		63.27	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		63.27	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	2.88	x		92.28	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		92.28	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	2.88	x		113.09	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		113.09	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	2.88	x		115.77	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		115.77	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	2.88	x		110.22	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		110.22	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	2.88	x		94.68	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		94.68	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	2.88	x		73.59	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		73.59	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	2.88	x		45.59	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		45.59	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	2.88	x		24.49	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		24.49	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	2.88	x		16.15	x		0.6	x		0.8	=		(80)
West	0.9x	0.77	x	6	x		16.15	x		0.6	x		0.8	=		(80)
Rooflights	0.9x	1	x	4.32	x		26	x		0.6	x		0.8	=		(82)
Rooflights	0.9x	1	x	4.32	x		54	x		0.6	x		0.8	=		(82)
Rooflights	0.9x	1	x	4.32	x		96	x		0.6	x		0.8	=		(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	4.32	x	150	x	0.6	x	0.8	=	559.87	(82)
Rooflights 0.9x	1	x	4.32	x	192	x	0.6	x	0.8	=	716.64	(82)
Rooflights 0.9x	1	x	4.32	x	200	x	0.6	x	0.8	=	746.5	(82)
Rooflights 0.9x	1	x	4.32	x	189	x	0.6	x	0.8	=	705.44	(82)
Rooflights 0.9x	1	x	4.32	x	157	x	0.6	x	0.8	=	586	(82)
Rooflights 0.9x	1	x	4.32	x	115	x	0.6	x	0.8	=	429.24	(82)
Rooflights 0.9x	1	x	4.32	x	66	x	0.6	x	0.8	=	246.34	(82)
Rooflights 0.9x	1	x	4.32	x	33	x	0.6	x	0.8	=	123.17	(82)
Rooflights 0.9x	1	x	4.32	x	21	x	0.6	x	0.8	=	78.38	(82)

Solar gains in watts, calculated for each month	(83)m = Sum(74)m ... (82)m												(83)
(83)m=	192.69	388.66	666.45	1009.26	1267.38	1310.28	1242.19	1047.06	787.6	468.36	242.43	157.04	
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	628.25	822.02	1084.57	1402.17	1634.26	1652.19	1568.39	1380.28	1134.29	840.48	643.27	579.64	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)	21												(85)
Utilisation factor for gains for living area, h1,m (see Table 9a)													
(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(86)
	1	0.99	0.96	0.83	0.62	0.42	0.31	0.36	0.64	0.94	0.99	1	
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)													
(87)m=	19.76	20.01	20.4	20.8	20.96	21	21	21	20.97	20.64	20.11	19.73	(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)													
(88)m=	19.94	19.95	19.95	19.97	19.98	20	20	20	19.99	19.98	19.97	19.96	(88)
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)													
(89)m=	1	0.99	0.94	0.79	0.56	0.36	0.24	0.29	0.56	0.92	0.99	1	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)													
(90)m=	18.29	18.66	19.22	19.76	19.94	20	20	20	19.97	19.58	18.83	18.26	(90)
fLA = Living area ÷ (4) =	0.31												(91)
Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2													
(92)m=	18.75	19.08	19.59	20.09	20.26	20.31	20.31	20.31	20.28	19.91	19.23	18.72	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate													
(93)m=	18.6	18.93	19.44	19.94	20.11	20.16	20.16	20.16	20.13	19.76	19.08	18.57	(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	0.98	0.94	0.78	0.56	0.37	0.25	0.3	0.57	0.91	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	625.17	808.36	1014.94	1099.91	923.28	610.74	392.52	412.6	651.97	764.16	635.62	577.69	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1671.96	1632.96	1499.06	1250.84	949.13	612.99	392.74	413.14	671.02	1033.54	1363.8	1650.93	(97)

DER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	778.81	554.13	360.19	108.67	19.23	0	0	0	0	200.42	524.29	798.49		
Total per year (kWh/year) = Sum(98) _{1...5,9...12} =													3344.24	(98)
Space heating requirement in kWh/m²/year													33.48	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system													0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =												1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =												1	(204)
Efficiency of main space heating system 1													90.3	(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)	778.81	554.13	360.19	108.67	19.23	0	0	0	0	200.42	524.29	798.49	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	862.47	613.65	398.88	120.34	21.3	0	0	0	0	221.95	580.61	884.27	
Total (kWh/year) =Sum(211)_{1..5,10..12} =												3703.47	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215) _{1...5,10...12} =												0	(215)

Water heating

Output from water heater (calculated above)													
212.85	187.62	197.07	175.34	169.76	149.52	143.25	159.69	161.45	183.22	193.69	207.74		
Efficiency of water heater												81	(216)
(217)m=	88.13	87.75	86.78	84.32	81.86	81	81	81	81	85.61	87.59	88.21	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	241.52	213.81	227.1	207.94	207.39	184.59	176.85	197.15	199.32	214.03	221.14	235.51	
Total = Sum(219a) _{1..12} =												2526.34	(219)

Annual totals

Space heating fuel used, main system 1													3703.47	
Water heating fuel used													2526.34	
Electricity for pumps, fans and electric keep-hot														
mechanical ventilation - balanced, extract or positive input from outside													531.51	(230a)
central heating pump:													30	(230c)
Total electricity for the above, kWh/year	sum of (230a)...(230g) =												561.51	(231)
Electricity for lighting													403.32	(232)
Electricity generated by PVs													-525.08	(233)

12a. CO2 emissions – Individual heating systems including micro-CHP

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	799.95	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	545.69	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1345.64	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	291.42	(267)
Electricity for lighting	(232) x		0.519	=	209.32	(268)
Energy saving/generation technologies Item 1			0.519	=	-272.52	(269)
Total CO2, kg/year		sum of (265)...(271) =			1573.87	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			15.75	(273)
El rating (section 14)					85	(274)

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User Details:

Assessor Name:

Stroma Number:

Software Name:

Stroma FSAP 2012

Software Version:

Version: 1.0.4.10

Property Address: E 2-6-3

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	99.9	(1a) x	4.45	(2a) =	444.55	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.9	(4)				
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =				444.55	(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) =

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)

Additional infiltration

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

Infiltration rate

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered

Shelter factor

Infiltration rate incorporating shelter factor

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=

5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=

1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
------	------	------	-----	------	------	------	------	---	------	------	------

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.37	0.36	0.32	0.32	0.28	0.28	0.27	0.29	0.32	0.33	0.35
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Windows Type 1			2.88	x1/[1/(1.4)+ 0.04] =	3.82		(27)
Windows Type 2			2.88	x1/[1/(1.4)+ 0.04] =	3.82		(27)
Windows Type 3			6	x1/[1/(1.4)+ 0.04] =	7.95		(27)
Rooflights			4.32	x1/[1/(1.7) + 0.04] =	7.344		(27b)
Walls Type1	33.9	0	33.9	x 0.18 =	6.1		(29)
Walls Type2	35.2	5.76	29.44	x 0.18 =	5.3		(29)
Walls Type3	37.4	8.88	28.52	x 0.18 =	5.13		(29)
Roof	126	8.64	117.36	x 0.13 =	15.26		(30)
Total area of elements, m²			232.5				(31)
Party wall			21	x 0 =	0		(32)
Party wall			15.96	x 0 =	0		(32)
Party floor			99.9				(32a)
Internal wall **			50.82				(32c)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) =

64.95

 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) =

22645.92

 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium

250

 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

9.52

 (36)

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If details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) =

74.47

 (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=	83.64	83.24	82.84	81.01	80.66	79.06	79.06	78.76	79.68	80.66	81.36	82.09

 (38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=

158.1	157.7	157.31	155.47	155.13	153.53	153.53	153.23	154.15	155.13	155.83	156.55
-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 Average = Sum(39)_{1...12} /12=

155.47

 (39)

Heat loss parameter (HLP), W/m²K

(40)m=

1.58	1.58	1.57	1.56	1.55	1.54	1.54	1.53	1.54	1.55	1.56	1.57
------	------	------	------	------	------	------	------	------	------	------	------

 Average = Sum(40)_{1...12} /12=

1.56

 (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

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)²)] + 0.0013 x (TFA -13.9)

2.74

 (42)

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36

99.24

 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	109.17	105.2	101.23	97.26	93.29	89.32	89.32	93.29	97.26	101.23	105.2	109.17
Total = Sum(44) _{1...12} =												1190.9

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

161.89	141.59	146.11	127.38	122.22	105.47	97.73	112.15	113.49	132.26	144.37	156.78
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

 Total = Sum(45)_{1...12} =

1561.46

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

24.28	21.24	21.92	19.11	18.33	15.82	14.66	16.82	17.02	19.84	21.66	23.52
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year (48) x (49) =

0

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

 (51)

If community heating see section 4.3

Volume factor from Table 2a

0

 (52)

Temperature factor from Table 2b

0

 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

0

 (54)

Enter (50) or (54) in (55)

0

 (55)

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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 × [(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= 50.96 46.03 50.96 47.96 47.54 44.05 45.52 47.54 47.96 50.96 49.32 50.96 (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= 212.85 187.62 197.07 175.34 169.76 149.52 143.25 159.69 161.45 183.22 193.69 207.74 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m= 0 0 0 0 0 0 0 0 0 0 0 0 (63)

Output from water heater

(64)m= 212.85 187.62 197.07 175.34 169.76 149.52 143.25 159.69 161.45 183.22 193.69 207.74

Output from water heater (annual) 2141.2 (64)

Heat gains from water heating, kWh/month 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

(65)m= 66.57 58.59 61.32 54.34 52.52 46.08 43.88 49.17 49.73 56.72 60.33 64.87 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m= Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 136.93 136.93 136.93 136.93 136.93 136.93 136.93 136.93 136.93 136.93 136.93 136.93 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m= 22.84 20.28 16.5 12.49 9.34 7.88 8.52 11.07 14.86 18.86 22.02 23.47 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m= 256.17 258.82 252.13 237.87 219.86 202.95 191.64 188.98 195.68 209.94 227.94 244.86 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m= 36.69 36.69 36.69 36.69 36.69 36.69 36.69 36.69 36.69 36.69 36.69 36.69 (69)

Pumps and fans gains (Table 5a)

(70)m= 3 3 3 3 3 3 3 3 3 3 3 3 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m= -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 -109.54 (71)

Water heating gains (Table 5)

(72)m= 89.47 87.18 82.42 75.48 70.6 64 58.97 66.1 69.06 76.23 83.8 87.19 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m= 435.56 433.37 418.12 392.91 366.88 341.91 326.21 333.23 346.68 372.12 400.84 422.6 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d			Area m ²			Flux Table 6a			g_ Table 6b			FF Table 6c			Gains (W)		
East	0.9x	2	x	2.88	x	19.64	x	0.63	x	0.7	=	34.57	(76)					
East	0.9x	2	x	2.88	x	38.42	x	0.63	x	0.7	=	67.63	(76)					
East	0.9x	2	x	2.88	x	63.27	x	0.63	x	0.7	=	111.38	(76)					
East	0.9x	2	x	2.88	x	92.28	x	0.63	x	0.7	=	162.44	(76)					
East	0.9x	2	x	2.88	x	113.09	x	0.63	x	0.7	=	199.08	(76)					
East	0.9x	2	x	2.88	x	115.77	x	0.63	x	0.7	=	203.79	(76)					
East	0.9x	2	x	2.88	x	110.22	x	0.63	x	0.7	=	194.02	(76)					
East	0.9x	2	x	2.88	x	94.68	x	0.63	x	0.7	=	166.66	(76)					
East	0.9x	2	x	2.88	x	73.59	x	0.63	x	0.7	=	129.54	(76)					
East	0.9x	2	x	2.88	x	45.59	x	0.63	x	0.7	=	80.25	(76)					
East	0.9x	2	x	2.88	x	24.49	x	0.63	x	0.7	=	43.11	(76)					
East	0.9x	2	x	2.88	x	16.15	x	0.63	x	0.7	=	28.43	(76)					
West	0.9x	0.77	x	2.88	x	19.64	x	0.63	x	0.7	=	17.29	(80)					
West	0.9x	0.77	x	6	x	19.64	x	0.63	x	0.7	=	36.01	(80)					
West	0.9x	0.77	x	2.88	x	38.42	x	0.63	x	0.7	=	33.82	(80)					
West	0.9x	0.77	x	6	x	38.42	x	0.63	x	0.7	=	70.45	(80)					
West	0.9x	0.77	x	2.88	x	63.27	x	0.63	x	0.7	=	55.69	(80)					
West	0.9x	0.77	x	6	x	63.27	x	0.63	x	0.7	=	116.02	(80)					
West	0.9x	0.77	x	2.88	x	92.28	x	0.63	x	0.7	=	81.22	(80)					
West	0.9x	0.77	x	6	x	92.28	x	0.63	x	0.7	=	169.21	(80)					
West	0.9x	0.77	x	2.88	x	113.09	x	0.63	x	0.7	=	99.54	(80)					
West	0.9x	0.77	x	6	x	113.09	x	0.63	x	0.7	=	207.38	(80)					
West	0.9x	0.77	x	2.88	x	115.77	x	0.63	x	0.7	=	101.9	(80)					
West	0.9x	0.77	x	6	x	115.77	x	0.63	x	0.7	=	212.29	(80)					
West	0.9x	0.77	x	2.88	x	110.22	x	0.63	x	0.7	=	97.01	(80)					
West	0.9x	0.77	x	6	x	110.22	x	0.63	x	0.7	=	202.1	(80)					
West	0.9x	0.77	x	2.88	x	94.68	x	0.63	x	0.7	=	83.33	(80)					
West	0.9x	0.77	x	6	x	94.68	x	0.63	x	0.7	=	173.61	(80)					
West	0.9x	0.77	x	2.88	x	73.59	x	0.63	x	0.7	=	64.77	(80)					
West	0.9x	0.77	x	6	x	73.59	x	0.63	x	0.7	=	134.94	(80)					
West	0.9x	0.77	x	2.88	x	45.59	x	0.63	x	0.7	=	40.13	(80)					
West	0.9x	0.77	x	6	x	45.59	x	0.63	x	0.7	=	83.6	(80)					
West	0.9x	0.77	x	2.88	x	24.49	x	0.63	x	0.7	=	21.55	(80)					
West	0.9x	0.77	x	6	x	24.49	x	0.63	x	0.7	=	44.91	(80)					
West	0.9x	0.77	x	2.88	x	16.15	x	0.63	x	0.7	=	14.22	(80)					
West	0.9x	0.77	x	6	x	16.15	x	0.63	x	0.7	=	29.62	(80)					
Rooflights	0.9x	1	x	4.32	x	26	x	0.63	x	0.7	=	89.16	(82)					
Rooflights	0.9x	1	x	4.32	x	54	x	0.63	x	0.7	=	185.18	(82)					
Rooflights	0.9x	1	x	4.32	x	96	x	0.63	x	0.7	=	329.2	(82)					

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Rooflights 0.9x	1	x	4.32	x	150	x	0.63	x	0.7	=	514.38	(82)
Rooflights 0.9x	1	x	4.32	x	192	x	0.63	x	0.7	=	658.41	(82)
Rooflights 0.9x	1	x	4.32	x	200	x	0.63	x	0.7	=	685.84	(82)
Rooflights 0.9x	1	x	4.32	x	189	x	0.63	x	0.7	=	648.12	(82)
Rooflights 0.9x	1	x	4.32	x	157	x	0.63	x	0.7	=	538.39	(82)
Rooflights 0.9x	1	x	4.32	x	115	x	0.63	x	0.7	=	394.36	(82)
Rooflights 0.9x	1	x	4.32	x	66	x	0.63	x	0.7	=	226.33	(82)
Rooflights 0.9x	1	x	4.32	x	33	x	0.63	x	0.7	=	113.16	(82)
Rooflights 0.9x	1	x	4.32	x	21	x	0.63	x	0.7	=	72.01	(82)

Solar gains in watts, calculated for each month	(83)m = Sum(74)m ... (82)m											(83)
(83)m=	177.03	357.08	612.3	927.26	1164.41	1203.82	1141.26	961.98	723.61	430.3	222.73	144.28
Total gains – internal and solar (84)m = (73)m + (83)m , watts												(84)
(84)m=	612.59	790.45	1030.42	1320.17	1531.28	1545.73	1467.47	1295.21	1070.29	802.42	623.57	566.88

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)												(86)
(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1	0.99	0.98	0.91	0.77	0.59	0.45	0.52	0.8	0.97	0.99	1
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)												(87)
(87)m=	19.23	19.47	19.89	20.41	20.78	20.94	20.99	20.97	20.82	20.27	19.65	19.2
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)												(88)
(88)m=	19.63	19.63	19.63	19.65	19.65	19.66	19.66	19.66	19.66	19.65	19.64	19.64
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)												(89)
(89)m=	1	0.99	0.97	0.88	0.7	0.49	0.32	0.38	0.7	0.95	0.99	1
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)												(90)
(90)m=	17.31	17.66	18.26	18.99	19.45	19.63	19.66	19.65	19.52	18.83	17.93	17.27
fLA = Living area ÷ (4) =	0.31											(91)
Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2												(92)
(92)m=	17.91	18.23	18.77	19.44	19.87	20.04	20.07	20.07	19.93	19.28	18.47	17.87
Apply adjustment to the mean internal temperature from Table 4e, where appropriate												(93)
(93)m=	17.91	18.23	18.77	19.44	19.87	20.04	20.07	20.07	19.93	19.28	18.47	17.87

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												(94)
Utilisation factor for gains, hm:												(94)
(94)m=	0.99	0.99	0.96	0.87	0.72	0.52	0.36	0.43	0.72	0.94	0.99	1
Useful gains, hmGm , W = (94)m x (84)m												(95)
(95)m=	609.42	779.83	988.03	1155.08	1098.51	801.13	527.23	550.68	775.5	757.71	617.12	564.7
Monthly average external temperature from Table 8												(96)
(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
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]												(97)
(97)m=	2152.4	2102	1930.68	1638.23	1266.81	835.15	533.11	561.96	898.19	1346.17	1771.66	2140.48

TER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1147.98	888.5	701.33	347.87	125.21	0	0	0	0	437.81	831.27	1172.38	Total per year (kWh/year) = Sum(98)_{1..5,9..12} =	5652.35	(98)
--------	---------	-------	--------	--------	--------	---	---	---	---	--------	--------	---------	--	---------	------

Space heating requirement in kWh/m²/year	56.58	(99)
--	-------	------

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)									
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)									
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)									
Efficiency of main space heating system 1		93.4	(206)									
Efficiency of secondary/supplementary heating system, %		0	(208)									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year

Space heating requirement (calculated above)	1147.98	888.5	701.33	347.87	125.21	0	0	0	0	437.81	831.27	1172.38	(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1229.1	951.29	750.89	372.45	134.06	0	0	0	0	468.75	890.01	1255.23	Total (kWh/year) =Sum(211)_{1..5,10..12} =	6051.77	(211)
--	---------	-------	--------	--------	--------	---	---	---	---	--------	--------	---------	---	--------	--------	--------	--------	--------	---	---	---	---	--------	--------	---------	--	---------	-------

Space heating fuel (secondary), kWh/month												(215)m = {[(98)m x (201)] } x 100 ÷ (208)	0	0	0	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)														
212.85	187.62	197.07	175.34	169.76	149.52	143.25	159.69	161.45	183.22	193.69	207.74			
Efficiency of water heater												80.3	(216)	
(217)m=	88.66	88.46	87.97	86.74	84.3	80.3	80.3	80.3	80.3	87.17	88.3	88.72	(217)	
Fuel for water heating, kWh/month														
(219)m = (64)m x 100 ÷ (217)m														
(219)m=	240.08	212.09	224.01	202.14	201.38	186.2	178.39	198.87	201.06	210.2	219.35	234.15		
												Total = Sum(219a) ₁₂ =	2507.93	(219)

Annual totals

Space heating fuel used, main system 1	6051.77	kWh/year
Water heating fuel used	2507.93	kWh/year
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	75	(231)
Electricity for lighting	403.32	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year

TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	1307.18	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	541.71	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1848.89	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	209.32	(268)
Total CO2, kg/year	sum of (265)...(271) =			2097.14	(272)
TER =				20.99	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.10

Property Address: E 4-2-18

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m²)	Av. Height(m)	Volume(m³)
Ground floor	69.7 (1a) x	2.8 (2a) =	195.16 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.7 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	195.16 (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				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) = 0 (8)

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 3 (17)

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16) 0.15 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered 1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.92 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.14 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.18	0.17	0.17	0.15	0.15	0.13	0.13	0.13	0.14	0.15	0.16	0.16
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28
------	------	------	------	------	------	------	------	------	------	------	------

 (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	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.29	0.29	0.29	0.27	0.27	0.25	0.25	0.25	0.26	0.27	0.27	0.28
------	------	------	------	------	------	------	------	------	------	------	------

 (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			2.4	x 1.4	= 3.36		(26)
Windows Type 1			6	x 1/[1/(1.4)+ 0.04]	= 7.95		(27)
Windows Type 2			2.88	x 1/[1/(1.4)+ 0.04]	= 3.82		(27)
Windows Type 3			2.88	x 1/[1/(1.4)+ 0.04]	= 3.82		(27)
Windows Type 4			6	x 1/[1/(1.4)+ 0.04]	= 7.95		(27)
Walls Type1	21.3	8.88	12.42	x 0.2	= 2.48		(29)
Walls Type2	21	8.88	12.12	x 0.2	= 2.42		(29)
Walls Type3	25.8	2.4	23.4	x 0.2	= 4.68		(29)
Total area of elements, m²			68.1				(31)
Party wall			25.76	x 0	= 0		(32)
Party floor			69.7				(32a)
Party ceiling			69.7				(32b)
Internal wall **			52.5				(32c)

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) =

36.49

 (33)Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) =

20005.6

 (34)Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium

250

 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

7.81

 (36)

DER WorkSheet: New dwelling design stage

If details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) =

44.31

 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
18.96	18.74	18.51	17.4	17.17	16.06	16.06	15.83	16.5	17.17	17.62	18.07

 (38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=

63.27	63.04	62.82	61.7	61.48	60.36	60.36	60.14	60.81	61.48	61.93	62.37
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 Average = Sum(39)_{1...12} /12=

61.65

 (39)

Heat loss parameter (HLP), W/m²K

(40)m=

0.91	0.9	0.9	0.89	0.88	0.87	0.87	0.86	0.87	0.88	0.89	0.89
------	-----	-----	------	------	------	------	------	------	------	------	------

 Average = Sum(40)_{1...12} /12=

0.88

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
96.11	92.61	89.12	85.62	82.13	78.63	78.63	82.13	85.62	89.12	92.61	96.11

 Total = Sum(44)_{1...12} =

1048.46

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

142.53	124.66	128.63	112.15	107.61	92.86	86.04	98.74	99.92	116.44	127.11	138.03
--------	--------	--------	--------	--------	-------	-------	-------	-------	--------	--------	--------

 Total = Sum(45)_{1...12} =

1374.7

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.38	18.7	19.29	16.82	16.14	13.93	12.91	14.81	14.99	17.47	19.07	20.7
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)Temperature factor from Table 2b

0

 (49)Energy lost from water storage, kWh/year (48) x (49) =

0

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

 (51)

If community heating see section 4.3

Volume factor from Table 2a

0

 (52)Temperature factor from Table 2b

0

 (53)Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

0

 (54)Enter (50) or (54) in (55)

0

 (55)

DER WorkSheet: New dwelling design stage

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) - (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=

48.98	42.63	45.41	42.23	41.85	38.78	40.07	41.85	42.23	45.41	45.67	48.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (63)

Output from water heater

(64)m=

191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (64)

Output from water heater (annual)

1898.79

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

59.63	52.1	54.12	47.84	46.24	40.57	38.63	43.29	43.78	50.07	53.68	58.14
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94

 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

17.53	15.57	12.66	9.58	7.16	6.05	6.54	8.5	11.4	14.48	16.9	18.01
-------	-------	-------	------	------	------	------	-----	------	-------	------	-------

 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

196.6	198.64	193.5	182.55	168.74	155.75	147.08	145.04	150.18	161.12	174.94	187.92
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

80.15	77.54	72.75	66.45	62.15	56.35	51.92	58.19	60.8	67.3	74.56	78.14
-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------

 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

353.86	351.32	338.48	318.17	297.64	277.73	265.11	271.3	281.97	302.48	325.97	343.66
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.54	x	2.88	x	36.79	x	0.6	x	0.8	=	24.72	(77)
Southeast 0.9x	0.77	x	6	x	36.79	x	0.6	x	0.8	=	73.43	(77)
Southeast 0.9x	0.54	x	2.88	x	62.67	x	0.6	x	0.8	=	42.11	(77)
Southeast 0.9x	0.77	x	6	x	62.67	x	0.6	x	0.8	=	125.09	(77)
Southeast 0.9x	0.54	x	2.88	x	85.75	x	0.6	x	0.8	=	57.61	(77)
Southeast 0.9x	0.77	x	6	x	85.75	x	0.6	x	0.8	=	171.15	(77)
Southeast 0.9x	0.54	x	2.88	x	106.25	x	0.6	x	0.8	=	71.38	(77)
Southeast 0.9x	0.77	x	6	x	106.25	x	0.6	x	0.8	=	212.06	(77)
Southeast 0.9x	0.54	x	2.88	x	119.01	x	0.6	x	0.8	=	79.96	(77)
Southeast 0.9x	0.77	x	6	x	119.01	x	0.6	x	0.8	=	237.53	(77)
Southeast 0.9x	0.54	x	2.88	x	118.15	x	0.6	x	0.8	=	79.38	(77)
Southeast 0.9x	0.77	x	6	x	118.15	x	0.6	x	0.8	=	235.81	(77)
Southeast 0.9x	0.54	x	2.88	x	113.91	x	0.6	x	0.8	=	76.53	(77)
Southeast 0.9x	0.77	x	6	x	113.91	x	0.6	x	0.8	=	227.34	(77)
Southeast 0.9x	0.54	x	2.88	x	104.39	x	0.6	x	0.8	=	70.13	(77)
Southeast 0.9x	0.77	x	6	x	104.39	x	0.6	x	0.8	=	208.35	(77)
Southeast 0.9x	0.54	x	2.88	x	92.85	x	0.6	x	0.8	=	62.38	(77)
Southeast 0.9x	0.77	x	6	x	92.85	x	0.6	x	0.8	=	185.32	(77)
Southeast 0.9x	0.54	x	2.88	x	69.27	x	0.6	x	0.8	=	46.54	(77)
Southeast 0.9x	0.77	x	6	x	69.27	x	0.6	x	0.8	=	138.25	(77)
Southeast 0.9x	0.54	x	2.88	x	44.07	x	0.6	x	0.8	=	29.61	(77)
Southeast 0.9x	0.77	x	6	x	44.07	x	0.6	x	0.8	=	87.96	(77)
Southeast 0.9x	0.54	x	2.88	x	31.49	x	0.6	x	0.8	=	21.16	(77)
Southeast 0.9x	0.77	x	6	x	31.49	x	0.6	x	0.8	=	62.84	(77)
Northwest 0.9x	0.77	x	6	x	11.28	x	0.6	x	0.8	=	22.52	(81)
Northwest 0.9x	0.77	x	2.88	x	11.28	x	0.6	x	0.8	=	10.81	(81)
Northwest 0.9x	0.77	x	6	x	22.97	x	0.6	x	0.8	=	45.84	(81)
Northwest 0.9x	0.77	x	2.88	x	22.97	x	0.6	x	0.8	=	22	(81)
Northwest 0.9x	0.77	x	6	x	41.38	x	0.6	x	0.8	=	82.59	(81)
Northwest 0.9x	0.77	x	2.88	x	41.38	x	0.6	x	0.8	=	39.64	(81)
Northwest 0.9x	0.77	x	6	x	67.96	x	0.6	x	0.8	=	135.63	(81)
Northwest 0.9x	0.77	x	2.88	x	67.96	x	0.6	x	0.8	=	65.1	(81)
Northwest 0.9x	0.77	x	6	x	91.35	x	0.6	x	0.8	=	182.31	(81)
Northwest 0.9x	0.77	x	2.88	x	91.35	x	0.6	x	0.8	=	87.51	(81)
Northwest 0.9x	0.77	x	6	x	97.38	x	0.6	x	0.8	=	194.36	(81)
Northwest 0.9x	0.77	x	2.88	x	97.38	x	0.6	x	0.8	=	93.29	(81)
Northwest 0.9x	0.77	x	6	x	91.1	x	0.6	x	0.8	=	181.82	(81)
Northwest 0.9x	0.77	x	2.88	x	91.1	x	0.6	x	0.8	=	87.28	(81)
Northwest 0.9x	0.77	x	6	x	72.63	x	0.6	x	0.8	=	144.95	(81)

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Northwest 0.9x	0.77	x	2.88	x	72.63	x	0.6	x	0.8	=	69.58	(81)
Northwest 0.9x	0.77	x	6	x	50.42	x	0.6	x	0.8	=	100.63	(81)
Northwest 0.9x	0.77	x	2.88	x	50.42	x	0.6	x	0.8	=	48.3	(81)
Northwest 0.9x	0.77	x	6	x	28.07	x	0.6	x	0.8	=	56.02	(81)
Northwest 0.9x	0.77	x	2.88	x	28.07	x	0.6	x	0.8	=	26.89	(81)
Northwest 0.9x	0.77	x	6	x	14.2	x	0.6	x	0.8	=	28.33	(81)
Northwest 0.9x	0.77	x	2.88	x	14.2	x	0.6	x	0.8	=	13.6	(81)
Northwest 0.9x	0.77	x	6	x	9.21	x	0.6	x	0.8	=	18.39	(81)
Northwest 0.9x	0.77	x	2.88	x	9.21	x	0.6	x	0.8	=	8.83	(81)

Solar gains in watts, calculated for each month	(83)m = Sum(74)m ... (82)m											(83)
(83)m=	131.48	235.03	350.99	484.18	587.3	602.85	572.97	493.01	396.63	267.69	159.5	111.22
Total gains – internal and solar (84)m = (73)m + (83)m , watts												(84)
(84)m=	485.34	586.36	689.47	802.35	884.94	880.57	838.09	764.31	678.6	570.17	485.48	454.88

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)												(86)
(86)m=	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1	0.98	0.95	0.83	0.63	0.44	0.32	0.36	0.61	0.91	0.99	1
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)												(87)
(87)m=	20.19	20.38	20.64	20.88	20.98	21	21	21	20.99	20.83	20.46	20.16
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)												(88)
(88)m=	20.16	20.16	20.17	20.18	20.18	20.2	20.2	20.2	20.19	20.18	20.18	20.17
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)												(89)
(89)m=	0.99	0.98	0.94	0.79	0.58	0.38	0.26	0.3	0.54	0.88	0.98	1
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)												(90)
(90)m=	19.08	19.36	19.72	20.06	20.17	20.2	20.2	20.2	20.18	20	19.49	19.05
fLA = Living area ÷ (4) =	0.39											(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2												(92)
(92)m=	19.52	19.76	20.08	20.38	20.49	20.51	20.51	20.51	20.5	20.32	19.87	19.48
Apply adjustment to the mean internal temperature from Table 4e, where appropriate												(93)
(93)m=	19.37	19.61	19.93	20.23	20.34	20.36	20.36	20.36	20.35	20.17	19.72	19.33

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												(94)
Utilisation factor for gains, hm:												(94)
(94)m=	0.99	0.98	0.93	0.8	0.59	0.39	0.27	0.31	0.55	0.88	0.98	0.99
Useful gains, hmGm , W = (94)m x (84)m												(95)
(95)m=	481.43	572.81	641.67	638.71	522.01	347.18	227.06	238.28	375.67	499.08	475.6	452.27
Monthly average external temperature from Table 8												(96)
(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
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]												(97)
(97)m=	953.45	927.65	843.91	699.26	530.96	347.76	227.1	238.38	380.06	588.53	781.54	944.02

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	351.18	238.46	150.47	43.59	6.66	0	0	0	0	66.55	220.28	365.86	Total per year (kWh/year) = Sum(98)_{1..5,9..12} =	1443.04	(98)
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Space heating requirement in kWh/m²/year	20.7	(99)
--	------	------

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		90.3	(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)	351.18	238.46	150.47	43.59	6.66	0	0	0	0	66.55	220.28	365.86	(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1598.06	(211)
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	388.9	264.07	166.63	48.28	7.37	0	0	0	0	73.7	243.94	405.17	Total (kWh/year) = Sum(211)_{1..5,10..12} =	1598.06	(211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)	0	0	0	0	0	0	0	0	0	0	0	0	Total (kWh/year) = Sum(215)_{1..5,10..12} =	0	(215)
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0			

Water heating

Output from water heater (calculated above)	191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01	Efficiency of water heater	81	(216)
(217)m=	86.78	86.22	85.06	82.88	81.36	81	81	81	81	83.51	85.96	86.92	Fuel for water heating, kWh/month		(217)
(219)m = (64)m x 100 ÷ (217)m	220.67	194.02	204.61	186.26	183.71	162.51	155.7	173.57	175.48	193.83	201	215.14	Total = Sum(219a)_{1..12} =	2266.49	(219)
(219)m=	220.67	194.02	204.61	186.26	183.71	162.51	155.7	173.57	175.48	193.83	201	215.14			

Annual totals

Space heating fuel used, main system 1	1598.06	
Water heating fuel used	2266.49	
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	233.33	(230a)
central heating pump:	30	(230c)
Total electricity for the above, kWh/year	263.33	(231)
Electricity for lighting	309.53	(232)
Electricity generated by PVs	-366.17	(233)

12a. CO2 emissions – Individual heating systems including micro-CHP

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	345.18	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	489.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =				834.74	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	136.67	(267)
Electricity for lighting	(232) x		0.519	=	160.64	(268)
Energy saving/generation technologies Item 1			0.519	=	-190.04	(269)
Total CO2, kg/year		sum of (265)...(271) =			942.01	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			13.52	(273)
El rating (section 14)					89	(274)

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User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.10

Property Address: E 4-2-18

Address : 5 Clarendon Road, Wood Green, London, N22 6XJ

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	69.7	(1a) x	2.8	(2a) =	195.16	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	69.7	(4)				
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =				195.16	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =

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)

Additional infiltration

Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0

If no draught lobby, enter 0.05, else enter 0

Percentage of windows and doors draught stripped

Window infiltration

Infiltration rate

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area

If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered

Shelter factor

Infiltration rate incorporating shelter factor

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Monthly average wind speed from Table 7

(22)m=

5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
-----	---	-----	-----	-----	-----	-----	-----	---	-----	-----	-----

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=

1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18
------	------	------	-----	------	------	------	------	---	------	------	------

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38
------	------	-----	------	------	------	------	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

 (24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57
------	------	------	------	------	------	------	------	------	------	------	------

 (24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57
------	------	------	------	------	------	------	------	------	------	------	------

 (25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K
Doors			2.4	x 1	2.4		
Windows Type 1			5.08	x 1/[1/(1.4)+ 0.04]	6.73		
Windows Type 2			2.44	x 1/[1/(1.4)+ 0.04]	3.23		
Windows Type 3			2.44	x 1/[1/(1.4)+ 0.04]	3.23		
Windows Type 4			5.08	x 1/[1/(1.4)+ 0.04]	6.73		
Walls Type1	21.3	7.52	13.78	x 0.18	2.48		
Walls Type2	21	7.52	13.48	x 0.18	2.43		
Walls Type3	25.8	2.4	23.4	x 0.18	4.21		
Total area of elements, m²			68.1				
Party wall			25.76	x 0	0		
Party floor			69.7				
Party ceiling			69.7				
Internal wall **			52.5				

* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2

** include the areas on both sides of internal walls and partitions

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) =

31.46

 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) =

20372.8

 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium

250

 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K

4.74

 (36)

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If details of thermal bridging are not known (36) = 0.15 x (31)

Total fabric heat loss (33) + (36) =

36.2

 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
37.77	37.55	37.34	36.34	36.16	35.29	35.29	35.13	35.62	36.16	36.53	36.93

 (38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=

73.97	73.75	73.54	72.54	72.36	71.49	71.49	71.33	71.82	72.36	72.73	73.13
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 Average = Sum(39)_{1...12} /12=

72.54

 (39)

Heat loss parameter (HLP), W/m²K

(40)m=

1.06	1.06	1.06	1.04	1.04	1.03	1.03	1.02	1.03	1.04	1.04	1.05
------	------	------	------	------	------	------	------	------	------	------	------

 (40)m = (39)m ÷ (4) Average = Sum(40)_{1...12} /12=

1.04

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
96.11	92.61	89.12	85.62	82.13	78.63	78.63	82.13	85.62	89.12	92.61	96.11

 (44)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)_{1...12} =

1048.46

 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=

142.53	124.66	128.63	112.15	107.61	92.86	86.04	98.74	99.92	116.44	127.11	138.03
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 Total = Sum(45)_{1...12} =

1374.7

 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=

21.38	18.7	19.29	16.82	16.14	13.93	12.91	14.81	14.99	17.47	19.07	20.7
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 (46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel

0

 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):

0

 (48)

Temperature factor from Table 2b

0

 (49)

Energy lost from water storage, kWh/year (48) x (49) =

0

 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)

0

 (51)

If community heating see section 4.3

Volume factor from Table 2a

0

 (52)

Temperature factor from Table 2b

0

 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =

0

 (54)

Enter (50) or (54) in (55)

0

 (55)

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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 × [(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

(58)

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=

48.98	42.63	45.41	42.23	41.85	38.78	40.07	41.85	42.23	45.41	45.67	48.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(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=

191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRs and/or WWHRs applies, see Appendix G)

(63)m=

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

(63)

Output from water heater

(64)m=

191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(64)

Output from water heater (annual) 1898.79

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

59.63	52.1	54.12	47.84	46.24	40.57	38.63	43.29	43.78	50.07	53.68	58.14
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94	111.94

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=

17.58	15.61	12.7	9.61	7.19	6.07	6.56	8.52	11.44	14.52	16.95	18.07
-------	-------	------	------	------	------	------	------	-------	-------	-------	-------

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=

196.6	198.64	193.5	182.55	168.74	155.75	147.08	145.04	150.18	161.12	174.94	187.92
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=

34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19	34.19
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=

-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55	-89.55
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

(71)

Water heating gains (Table 5)

(72)m=

80.15	77.54	72.75	66.45	62.15	56.35	51.92	58.19	60.8	67.3	74.56	78.14
-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=

353.91	351.37	338.52	318.2	297.66	277.75	265.13	271.33	282	302.53	326.03	343.72
--------	--------	--------	-------	--------	--------	--------	--------	-----	--------	--------	--------

(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

TER WorkSheet: New dwelling design stage

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.54	x	2.44	x	36.79	x	0.63	x	0.7	=	19.24	(77)
Southeast 0.9x	0.77	x	5.08	x	36.79	x	0.63	x	0.7	=	57.12	(77)
Southeast 0.9x	0.54	x	2.44	x	62.67	x	0.63	x	0.7	=	32.78	(77)
Southeast 0.9x	0.77	x	5.08	x	62.67	x	0.63	x	0.7	=	97.3	(77)
Southeast 0.9x	0.54	x	2.44	x	85.75	x	0.63	x	0.7	=	44.84	(77)
Southeast 0.9x	0.77	x	5.08	x	85.75	x	0.63	x	0.7	=	133.13	(77)
Southeast 0.9x	0.54	x	2.44	x	106.25	x	0.63	x	0.7	=	55.56	(77)
Southeast 0.9x	0.77	x	5.08	x	106.25	x	0.63	x	0.7	=	164.96	(77)
Southeast 0.9x	0.54	x	2.44	x	119.01	x	0.63	x	0.7	=	62.24	(77)
Southeast 0.9x	0.77	x	5.08	x	119.01	x	0.63	x	0.7	=	184.77	(77)
Southeast 0.9x	0.54	x	2.44	x	118.15	x	0.63	x	0.7	=	61.79	(77)
Southeast 0.9x	0.77	x	5.08	x	118.15	x	0.63	x	0.7	=	183.43	(77)
Southeast 0.9x	0.54	x	2.44	x	113.91	x	0.63	x	0.7	=	59.57	(77)
Southeast 0.9x	0.77	x	5.08	x	113.91	x	0.63	x	0.7	=	176.85	(77)
Southeast 0.9x	0.54	x	2.44	x	104.39	x	0.63	x	0.7	=	54.59	(77)
Southeast 0.9x	0.77	x	5.08	x	104.39	x	0.63	x	0.7	=	162.07	(77)
Southeast 0.9x	0.54	x	2.44	x	92.85	x	0.63	x	0.7	=	48.56	(77)
Southeast 0.9x	0.77	x	5.08	x	92.85	x	0.63	x	0.7	=	144.15	(77)
Southeast 0.9x	0.54	x	2.44	x	69.27	x	0.63	x	0.7	=	36.22	(77)
Southeast 0.9x	0.77	x	5.08	x	69.27	x	0.63	x	0.7	=	107.54	(77)
Southeast 0.9x	0.54	x	2.44	x	44.07	x	0.63	x	0.7	=	23.05	(77)
Southeast 0.9x	0.77	x	5.08	x	44.07	x	0.63	x	0.7	=	68.42	(77)
Southeast 0.9x	0.54	x	2.44	x	31.49	x	0.63	x	0.7	=	16.47	(77)
Southeast 0.9x	0.77	x	5.08	x	31.49	x	0.63	x	0.7	=	48.89	(77)
Northwest 0.9x	0.77	x	5.08	x	11.28	x	0.63	x	0.7	=	17.52	(81)
Northwest 0.9x	0.77	x	2.44	x	11.28	x	0.63	x	0.7	=	8.41	(81)
Northwest 0.9x	0.77	x	5.08	x	22.97	x	0.63	x	0.7	=	35.66	(81)
Northwest 0.9x	0.77	x	2.44	x	22.97	x	0.63	x	0.7	=	17.13	(81)
Northwest 0.9x	0.77	x	5.08	x	41.38	x	0.63	x	0.7	=	64.24	(81)
Northwest 0.9x	0.77	x	2.44	x	41.38	x	0.63	x	0.7	=	30.86	(81)
Northwest 0.9x	0.77	x	5.08	x	67.96	x	0.63	x	0.7	=	105.5	(81)
Northwest 0.9x	0.77	x	2.44	x	67.96	x	0.63	x	0.7	=	50.67	(81)
Northwest 0.9x	0.77	x	5.08	x	91.35	x	0.63	x	0.7	=	141.82	(81)
Northwest 0.9x	0.77	x	2.44	x	91.35	x	0.63	x	0.7	=	68.12	(81)
Northwest 0.9x	0.77	x	5.08	x	97.38	x	0.63	x	0.7	=	151.19	(81)
Northwest 0.9x	0.77	x	2.44	x	97.38	x	0.63	x	0.7	=	72.62	(81)
Northwest 0.9x	0.77	x	5.08	x	91.1	x	0.63	x	0.7	=	141.44	(81)
Northwest 0.9x	0.77	x	2.44	x	91.1	x	0.63	x	0.7	=	67.93	(81)
Northwest 0.9x	0.77	x	5.08	x	72.63	x	0.63	x	0.7	=	112.75	(81)

TER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	2.44	x	72.63	x	0.63	x	0.7	=	54.16	(81)
Northwest 0.9x	0.77	x	5.08	x	50.42	x	0.63	x	0.7	=	78.28	(81)
Northwest 0.9x	0.77	x	2.44	x	50.42	x	0.63	x	0.7	=	37.6	(81)
Northwest 0.9x	0.77	x	5.08	x	28.07	x	0.63	x	0.7	=	43.57	(81)
Northwest 0.9x	0.77	x	2.44	x	28.07	x	0.63	x	0.7	=	20.93	(81)
Northwest 0.9x	0.77	x	5.08	x	14.2	x	0.63	x	0.7	=	22.04	(81)
Northwest 0.9x	0.77	x	2.44	x	14.2	x	0.63	x	0.7	=	10.59	(81)
Northwest 0.9x	0.77	x	5.08	x	9.21	x	0.63	x	0.7	=	14.31	(81)
Northwest 0.9x	0.77	x	2.44	x	9.21	x	0.63	x	0.7	=	6.87	(81)

Solar gains in watts, calculated for each month	(83)m = Sum(74)m ... (82)m												(83)
(83)m=	102.3	182.86	273.07	376.7	456.94	469.03	445.78	383.57	308.59	208.27	124.09	86.53	
Total gains – internal and solar (84)m = (73)m + (83)m , watts													
(84)m=	456.21	534.23	611.6	694.9	754.59	746.77	710.92	654.9	590.59	510.79	450.12	430.25	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C)

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	0.79	0.6	0.44	0.5	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.93	20.1	20.36	20.68	20.9	20.98	21	20.99	20.94	20.64	20.23	19.9	(87)
--------	-------	------	-------	-------	------	-------	----	-------	-------	-------	-------	------	------

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.04	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.04	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.74	0.52	0.35	0.4	0.69	0.94	0.99	1	(89)
--------	---	------	------	-----	------	------	------	-----	------	------	------	---	------

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.61	18.86	19.23	19.68	19.96	20.05	20.06	20.06	20.01	19.64	19.05	18.58	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

(91)	0.39													(91)
------	------	--	--	--	--	--	--	--	--	--	--	--	--	------

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.13	19.34	19.67	20.07	20.33	20.42	20.43	20.43	20.38	20.03	19.51	19.1	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.13	19.34	19.67	20.07	20.33	20.42	20.43	20.43	20.38	20.03	19.51	19.1	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	--

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.9	0.76	0.55	0.38	0.44	0.71	0.94	0.99	1	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	---	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	453.79	527.63	591.62	626.8	570	408.42	272.87	285.66	421.51	479.58	444.93	428.54	(95)
--------	--------	--------	--------	-------	-----	--------	--------	--------	--------	--------	--------	--------	------

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
--------	-----	-----	-----	-----	------	------	------	------	------	------	-----	-----	------

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1096.86	1065.32	968.79	810.54	624.21	415.9	273.74	287.37	450.77	682.52	902.74	1089.42	(97)
--------	---------	---------	--------	--------	--------	-------	--------	--------	--------	--------	--------	---------	------

TER WorkSheet: New dwelling design stage

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	478.45	361.33	280.61	132.29	40.33	0	0	0	0	150.98	329.62	491.7	
Total per year (kWh/year) = Sum(98)_{1..5,9..12} =												2265.32	(98)

Space heating requirement in kWh/m²/year

(99)	32.5													(99)
------	------	--	--	--	--	--	--	--	--	--	--	--	--	------

9a. Energy requirements – Individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system

Fraction of space heat from main system(s) (202) = 1 – (201) =

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =

Efficiency of main space heating system 1

Efficiency of secondary/supplementary heating system, %

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------	--

Space heating requirement (calculated above)

	478.45	361.33	280.61	132.29	40.33	0	0	0	0	150.98	329.62	491.7	
--	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	-------	--

(211)m = {[(98)m x (204)] } x 100 ÷ (206)

	512.26	386.86	300.44	141.64	43.18	0	0	0	0	161.65	352.91	526.44	
--	--------	--------	--------	--------	-------	---	---	---	---	--------	--------	--------	--

Total (kWh/year) =Sum(211)_{1..5,10..12} =

(211)	2425.39													(211)
-------	---------	--	--	--	--	--	--	--	--	--	--	--	--	-------

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
---------	---	---	---	---	---	---	---	---	---	---	---	---	--

Total (kWh/year) =Sum(215)_{1..5,10..12} =

(215)	0													(215)
-------	---	--	--	--	--	--	--	--	--	--	--	--	--	-------

Water heating

Output from water heater (calculated above)

	191.5	167.28	174.05	154.37	149.46	131.63	126.12	140.59	142.14	161.86	172.78	187.01	
--	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

Efficiency of water heater

(217)m=	87.26	86.94	86.25	84.67	82.25	80.3	80.3	80.3	80.3	84.88	86.65	87.37	(217)
---------	-------	-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	219.46	192.41	201.8	182.33	181.71	163.93	157.06	175.08	177.01	190.7	199.4	214.03	
---------	--------	--------	-------	--------	--------	--------	--------	--------	--------	-------	-------	--------	--

Total = Sum(219a)_{1..12} =

(219)	2254.91													(219)
-------	---------	--	--	--	--	--	--	--	--	--	--	--	--	-------

Annual totals

Space heating fuel used, main system 1

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

boiler with a fan-assisted flue

Total electricity for the above, kWh/year

Electricity for lighting

sum of (230a)...(230g) =

(231)	75													(231)
-------	----	--	--	--	--	--	--	--	--	--	--	--	--	-------

Electricity for lighting

(232)	310.48													(232)
-------	--------	--	--	--	--	--	--	--	--	--	--	--	--	-------

12a. CO2 emissions – Individual heating systems including micro-CHP

Energy	Emission factor	Emissions
kWh/year	kg CO2/kWh	kg CO2/year

TER WorkSheet: New dwelling design stage

Space heating (main system 1)	(211) x	0.216	=	523.89	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	487.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1010.95	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	161.14	(268)
Total CO2, kg/year	sum of (265)...(271) =			1211.01	(272)
TER =				17.37	(273)

DRAFT

BRUKL DOCUMENTS FOR NON-RESIDENTIAL ELEMENTS MODELLED

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2013

Project name

03 Chocolate Factory - Refurbishment-Proposed

As designed

Date: Thu Aug 03 13:37:49 2017

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.4.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.4.1

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

The building does not comply with England Building Regulations Part L 2013

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	20.5
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.24	0.25	External Wall
Floor	0.25	0.4	1.24	Ground Floor/Internal Ceiling
Roof	0.25	0.16	0.16	Roof
Windows***, roof windows, and rooflights	2.2	2.01	5.43	Curtain Wall - Single Skin PC/Internal Glazing
Personnel doors	2.2	0.87	0.87	External Door
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	10

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Extract Only (16 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

3- Mech Vent (63 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	4	-	1.5	0.7
Standard value	2.5*	3.2	N/A	1.1^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					
^ Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

1- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name		SFP [W/(l/s)]									HR efficiency	
ID of system type		A	B	C	D	E	F	G	H	I		
Standard value		0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
B1_Toilet-00 1		0.3	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
B1_Toilet-00 23	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-00 24	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-01 1	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-02 1	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-03 1	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-04 1	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-05 1	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-01 2	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-01 3	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-02 2	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-02 3	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-03 2	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-03 3	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet-04 2	0.3	-	-	-	-	-	-	-	-	-	N/A
B1_Changing - 00 1	0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value	60	60	22		
B1_Office - 00 1	60	-	-		450
B1_Circulation - 00 1	-	60	-		63
B1_EatDrink - 00 1	-	60	22		151
B1_Toilet-00 1	-	60	-		283
B1_Store - 00 1	60	-	-		41
B1_Toilet-00 23	-	60	-		53
B1_Toilet-00 24	-	60	-		84
B1_Circulation - 00 38	-	60	-		201
B1_Circulation - 00 39	-	60	-		378
B1_Circulation - 00 40	-	60	-		74
B1_Circulation - 00 41	-	60	-		203
B1_Circulation - 00 42	-	60	-		330
B1_Circulation - 00 43	-	60	-		77
B1_Circulation - 00 44	-	60	-		189
B1_EatDrink - 00 7	-	60	22		182
B1_EatDrink - 00 8	-	60	22		209
B1_EatDrink - 00 9	-	60	22		179
B1_Office - 00 58	60	-	-		856
B1_Office - 00 59	60	-	-		1325
B1_Office - 00 60	60	-	-		2035
B1_Office - 00 61	60	-	-		554
B1_Office - 00 62	60	-	-		262
B1_Office - 00 63	60	-	-		307
B1_Store - 00 11	60	-	-		16

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value	60	60	22		
B1_Stairs - 00 1	-	60	-		64
B1_Stairs - 00 2	-	60	-		92
B1_Stairs - 00 3	-	60	-		71
B1_Circulation - 01 1	-	60	-		310
B1_Office - 01 1	60	-	-		585
B1_Office - 02 1	60	-	-		592
B1_Office - 03 1	60	-	-		577
B1_Office - 04 1	60	-	-		579
B1_Office - 05 1	60	-	-		461
B1_Circulation - 02 1	-	60	-		53
B1_Circulation - 03 1	-	60	-		280
B1_Circulation - 04 1	-	60	-		179
B1_Circulation - 05 1	-	70	-		265
B1_Stairs - 01 1	-	60	-		69
B1_Stairs - 02 1	-	60	-		63
B1_Stairs - 03 1	-	60	-		60
B1_Stairs - 04 1	-	60	-		60
B1_Stairs - 05 1	-	60	-		52
B1_Toilet-01 1	-	60	-		124
B1_Toilet-02 1	-	60	-		103
B1_Toilet-03 1	-	60	-		94
B1_Toilet-04 1	-	60	-		246
B1_Toilet-05 1	-	60	-		269
B1_Store - 02 1	60	-	-		20
B1_Store - 03 1	60	-	-		16
B1_Store - 04 1	60	-	-		19
B1_Office - 01 2	60	-	-		1015
B1_Office - 01 3	60	-	-		714
B1_Office - 01 4	60	-	-		810
B1_Office - 01 5	60	-	-		472
B1_Office - 01 6	60	-	-		352
B1_Office - 01 7	60	-	-		395
B1_Office - 01 8	60	-	-		1095
B1_Office - 01 9	60	-	-		1099
B1_Office - 01 10	60	-	-		829
B1_Office - 01 11	60	-	-		1143
B1_Office - 01 12	60	-	-		1733
B1_Office - 01 13	60	-	-		646
B1_Stairs - 01 2	-	60	-		58
B1_Stairs - 01 3	-	60	-		65
B1_Store - 01 3	60	-	-		19
B1_Circulation - 01 2	-	60	-		58
B1_Circulation - 01 3	-	60	-		317

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
B1_Circulation - 01 4	-	60	-	-	176
B1_Circulation - 01 5	-	60	-	-	69
B1_Circulation - 01 6	-	60	-	-	77
B1_Toilet-01 2	-	60	-	-	252
B1_Toilet-01 3	-	60	-	-	53
B1_Circulation - 02 2	-	60	-	-	286
B1_Circulation - 02 3	-	60	-	-	320
B1_Circulation - 02 4	-	60	-	-	70
B1_Circulation - 02 5	-	60	-	-	254
B1_Office - 02 2	60	-	-	-	1038
B1_Office - 02 3	60	-	-	-	683
B1_Office - 02 4	60	-	-	-	464
B1_Office - 02 5	60	-	-	-	346
B1_Office - 02 6	60	-	-	-	387
B1_Office - 02 7	60	-	-	-	1101
B1_Office - 02 8	60	-	-	-	1097
B1_Office - 02 9	60	-	-	-	831
B1_Office - 02 10	60	-	-	-	1145
B1_Office - 02 11	60	-	-	-	647
B1_Office - 02 12	60	-	-	-	1756
B1_Office - 02 13	60	-	-	-	789
B1_Stairs - 02 2	-	60	-	-	55
B1_Stairs - 02 3	-	60	-	-	66
B1_Toilet-02 2	-	60	-	-	257
B1_Toilet-02 3	-	60	-	-	53
B1_Circulation - 03 2	-	60	-	-	44
B1_Circulation - 03 3	-	60	-	-	309
B1_Circulation - 03 4	-	60	-	-	60
B1_Circulation - 03 5	-	60	-	-	165
B1_Circulation - 03 7	-	60	-	-	77
B1_Office - 03 2	60	-	-	-	995
B1_Office - 03 3	60	-	-	-	730
B1_Office - 03 4	60	-	-	-	788
B1_Office - 03 5	60	-	-	-	442
B1_Office - 03 6	60	-	-	-	325
B1_Office - 03 7	60	-	-	-	384
B1_Office - 03 8	60	-	-	-	1086
B1_Office - 03 9	60	-	-	-	469
B1_Office - 03 10	60	-	-	-	323
B1_Office - 03 11	60	-	-	-	519
B1_Office - 03 12	60	-	-	-	639
B1_Office - 03 13	60	-	-	-	1133
B1_Office - 03 14	60	-	-	-	1746

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
B1_Office - 03 15	60	-	-	-	636
B1_Stairs - 03 2	-	60	-	-	47
B1_Stairs - 03 3	-	60	-	-	60
B1_Toilet-03 2	-	60	-	-	219
B1_Toilet-03 3	-	60	-	-	43
B1_Circulation - 04 2	-	60	-	-	74
B1_Circulation - 04 3	-	60	-	-	317
B1_Circulation - 04 4	-	60	-	-	178
B1_Circulation - 04 5	-	60	-	-	67
B1_Office - 04 2	60	-	-	-	995
B1_Office - 04 3	60	-	-	-	728
B1_Office - 04 4	60	-	-	-	1067
B1_Office - 04 5	60	-	-	-	1053
B1_Office - 04 6	60	-	-	-	896
B1_Office - 04 7	60	-	-	-	1141
B1_Office - 04 8	60	-	-	-	1753
B1_Office - 04 9	60	-	-	-	644
B1_Stairs - 04 2	-	60	-	-	52
B1_Stairs - 04 3	-	60	-	-	64
B1_Toilet-04 2	-	60	-	-	49
B1_Circulation - 05 2	-	70	-	-	63
B1_Office - 05 2	60	-	-	-	1355
B1_Office - 05 3	60	-	-	-	791
B1_Office - 05 4	60	-	-	-	907
B1_Office - 05 5	60	-	-	-	989
B1_Office - 05 6	60	-	-	-	559
B1_Toilet-05 2	-	60	-	-	49
B1_FoodPrep - 00 1	-	60	-	-	683
B1_Plant - 00 1	60	-	-	-	740
B1_Changing - 00 1	-	60	-	-	109
B1_FoodPrep - 00 3	-	60	-	-	835
B1_Plant - 00 2	60	-	-	-	411
B1_Plant - 00 3	60	-	-	-	169

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B1_Office - 00 1	NO (-68%)	NO
B1_EatDrink - 00 1	NO (-86%)	NO
B1_EatDrink - 00 7	NO (-35%)	NO
B1_EatDrink - 00 8	YES (+81%)	NO
B1_EatDrink - 00 9	NO (-31%)	NO
B1_Office - 00 58	NO (-97%)	NO
B1_Office - 00 59	YES (+73%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B1_Office - 00 60	NO (-68%)	NO
B1_Office - 00 61	NO (-92%)	NO
B1_Office - 00 62	NO (-83%)	NO
B1_Office - 00 63	NO (-71%)	NO
B1_Office - 01 1	NO (-75%)	NO
B1_Office - 02 1	NO (-73%)	NO
B1_Office - 03 1	NO (-72%)	NO
B1_Office - 04 1	NO (-69%)	NO
B1_Office - 05 1	NO (-69%)	NO
B1_Office - 01 2	NO (-86%)	NO
B1_Office - 01 3	NO (-91%)	NO
B1_Office - 01 4	N/A	N/A
B1_Office - 01 5	NO (-74%)	NO
B1_Office - 01 6	NO (-72%)	NO
B1_Office - 01 7	NO (-65%)	NO
B1_Office - 01 8	NO (-40%)	NO
B1_Office - 01 9	NO (-4%)	NO
B1_Office - 01 10	NO (-49%)	NO
B1_Office - 01 11	NO (-23%)	NO
B1_Office - 01 12	NO (-82%)	NO
B1_Office - 01 13	NO (-91%)	NO
B1_Office - 02 2	NO (-87%)	NO
B1_Office - 02 3	NO (-93%)	NO
B1_Office - 02 4	NO (-78%)	NO
B1_Office - 02 5	NO (-85%)	NO
B1_Office - 02 6	NO (-84%)	NO
B1_Office - 02 7	NO (-2%)	NO
B1_Office - 02 8	NO (-31%)	NO
B1_Office - 02 9	NO (-49%)	NO
B1_Office - 02 10	NO (-23%)	NO
B1_Office - 02 11	NO (-91%)	NO
B1_Office - 02 12	NO (-82%)	NO
B1_Office - 02 13	NO (-64%)	NO
B1_Office - 03 2	NO (-87%)	NO
B1_Office - 03 3	NO (-93%)	NO
B1_Office - 03 4	NO (-74%)	NO
B1_Office - 03 5	NO (-70%)	NO
B1_Office - 03 6	NO (-78%)	NO
B1_Office - 03 7	NO (-65%)	NO
B1_Office - 03 8	NO (-25%)	NO
B1_Office - 03 9	NO (0%)	NO
B1_Office - 03 10	NO (-26%)	NO
B1_Office - 03 11	NO (-78%)	NO
B1_Office - 03 12	NO (-5%)	NO
B1_Office - 03 13	NO (-20%)	NO
B1_Office - 03 14	NO (-84%)	NO
B1_Office - 03 15	NO (-93%)	NO
B1_Office - 04 2	NO (-79%)	NO
B1_Office - 04 3	NO (-81%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B1_Office - 04 4	NO (-35%)	NO
B1_Office - 04 5	NO (-7%)	NO
B1_Office - 04 6	NO (-57%)	NO
B1_Office - 04 7	NO (-22%)	NO
B1_Office - 04 8	NO (-83%)	NO
B1_Office - 04 9	NO (-92%)	NO
B1_Office - 05 2	NO (-60%)	NO
B1_Office - 05 3	NO (-56%)	NO
B1_Office - 05 4	NO (-45%)	NO
B1_Office - 05 5	NO (-44%)	NO
B1_Office - 05 6	NO (-55%)	NO
B1_FoodPrep - 00 1	NO (-49%)	NO
B1_FoodPrep - 00 3	YES (+77%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m²]	7427	7427		A1/A2 Retail/Financial and Professional services
External area [m²]	7817	7817	3	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	LON	LON	97	B1 Offices and Workshop businesses
Infiltration [m³/hm²@ 50Pa]	10	3		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	4691	3258		B8 Storage or Distribution
Average U-value [W/m²K]	0.6	0.42		C1 Hotels
Alpha value* [%]	6.53	6.53		C2 Residential Inst.: Hospitals and Care Homes
				C2 Residential Inst.: Residential schools
				C2 Residential Inst.: Universities and colleges
				C2A Secure Residential Inst.
				Residential spaces
				D1 Non-residential Inst.: Community/Day Centre
				D1 Non-residential Inst.: Libraries, Museums, and Galleries
				D1 Non-residential Inst.: Education
				D1 Non-residential Inst.: Primary Health Care Building
				D1 Non-residential Inst.: Crown and County Courts
				D2 General Assembly and Leisure, Night Clubs and Theatres
				Others: Passenger terminals
				Others: Emergency services
				Others: Miscellaneous 24hr activities
				Others: Car Parks 24 hrs
				Others - Stand alone utility block

	Actual	Notional
Heating	3.65	2.19
Cooling	4.95	8.67
Auxiliary	4.49	3.69
Lighting	21.8	18.79
Hot water	11.14	9.97
Equipment*	33.12	33.12
TOTAL**	46.04	43.31

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO ₂ Emissions Summary		
	Actual	Notional
Heating + cooling demand [MJ/m²]	123.48	138.35
Primary energy* [kWh/m²]	120.72	111.96
Total emissions [kg/m²]	20.5	19

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance									
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Water loop heat pump, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
	Actual	55.3	0	4.4	0	7.9	3.5	0	3.5
	Notional	19	0	2.2	0	6.1	2.43	0	----
[ST] Water loop heat pump, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
	Actual	121.2	0	9.6	0	6.3	3.5	0	3.5
	Notional	48.5	0	5.5	0	3.2	2.43	0	----
[ST] Water loop heat pump, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
	Actual	16.6	111.2	1.3	7.7	13.2	3.5	4	3.5
	Notional	8	175.2	0.9	13.5	7.4	2.43	3.6	----

Key to terms	
Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.18	External Wall - Extension
Floor	0.2	0.39	Ground Floor
Roof	0.15	0.16	Roof
Windows, roof windows, and rooflights	1.5	1.2	Top Floor Window - Large
Personnel doors	1.5	0.87	External Door
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	10

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2013

Project name

03 Chocolate Factory - Extension - Proposed

As designed

Date: Thu Aug 03 12:36:32 2017

Administrative information

Building Details

Address: ,

Owner Details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.4.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.4.1

BRUKL compliance check version: v5.2.g.3

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	19.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	19.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	14.8
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.24	0.25	External Wall
Floor	0.25	0.4	1.24	Ground Floor/Internal Ceiling
Roof	0.25	0.16	0.16	Roof
Windows***, roof windows, and rooflights	2.2	2.01	5.43	Curtain Wall - Single Skin PC/Internal Glazing
Personnel doors	2.2	0.87	0.87	External Door
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)] * There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

- Single C

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Extract Only (2 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

2- Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

3- Office Mech Vent + VRF (6 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	4	-	1.1	0.7
Standard value	2.5*	3.2	N/A	1.1^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					
^ Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

1- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers ≤30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name		SFP [W/(l/s)]									HR efficiency	
ID of system type		A	B	C	D	E	F	G	H	I		
Standard value		0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
B1_Toilet-05 1		0.3	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I		
Standard value		0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
B1_Toilet-05 2		0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value		60	60	22	
B1_Office - 00 1		60	-	-	450
B1_Circulation - 00 1		-	60	-	63
B1_EatDrink - 00 1		-	60	22	151
B1_Toilet-00 1		-	60	-	283
B1_Store - 00 1		60	-	-	41
B1_Toilet-00 23		-	60	-	53
B1_Toilet-00 24		-	60	-	84
B1_Circulation - 00 38		-	60	-	201
B1_Circulation - 00 39		-	60	-	378
B1_Circulation - 00 40		-	60	-	74
B1_Circulation - 00 41		-	60	-	203
B1_Circulation - 00 42		-	60	-	330
B1_Circulation - 00 43		-	60	-	77
B1_Circulation - 00 44		-	60	-	189
B1_EatDrink - 00 7		-	60	22	182
B1_EatDrink - 00 8		-	60	22	209
B1_EatDrink - 00 9		-	60	22	179
B1_Office - 00 58		60	-	-	856
B1_Office - 00 59		60	-	-	1325
B1_Office - 00 60		60	-	-	2035
B1_Office - 00 61		60	-	-	554
B1_Office - 00 62		60	-	-	262
B1_Office - 00 63		60	-	-	307
B1_Store - 00 11		60	-	-	16
B1_Stairs - 00 1		-	60	-	64
B1_Stairs - 00 2		-	60	-	92
B1_Stairs - 00 3		-	60	-	71
B1_Circulation - 01 1		-	60	-	310
B1_Office - 01 1		60	-	-	585
B1_Office - 02 1		60	-	-	592
B1_Office - 03 1		60	-	-	577
B1_Office - 04 1		60	-	-	579
B1_Office - 05 1		60	-	-	461
B1_Circulation - 02 1		-	60	-	53
B1_Circulation - 03 1		-	60	-	280
B1_Circulation - 04 1		-	60	-	179
B1_Circulation - 05 1		-	70	-	265
B1_Stairs - 01 1		-	60	-	69

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
Standard value		60	60	22	
B1_Stairs - 02 1		-	60	-	63
B1_Stairs - 03 1		-	60	-	60
B1_Stairs - 04 1		-	60	-	60
B1_Stairs - 05 1		-	60	-	52
B1_Toilet-01 1		-	60	-	124
B1_Toilet-02 1		-	60	-	103
B1_Toilet-03 1		-	60	-	94
B1_Toilet-04 1		-	60	-	246
B1_Toilet-05 1		-	60	-	269
B1_Store - 02 1		60	-	-	20
B1_Store - 03 1		60	-	-	16
B1_Store - 04 1		60	-	-	19
B1_Office - 01 2		60	-	-	1015
B1_Office - 01 3		60	-	-	714
B1_Office - 01 4		60	-	-	810
B1_Office - 01 5		60	-	-	472
B1_Office - 01 6		60	-	-	352
B1_Office - 01 7		60	-	-	395
B1_Office - 01 8		60	-	-	1095
B1_Office - 01 9		60	-	-	1099
B1_Office - 01 10		60	-	-	829
B1_Office - 01 11		60	-	-	1143
B1_Office - 01 12		60	-	-	1733
B1_Office - 01 13		60	-	-	646
B1_Stairs - 01 2		-	60	-	58
B1_Stairs - 01 3		-	60	-	65
B1_Store - 01 3		60	-	-	19
B1_Circulation - 01 2		-	60	-	58
B1_Circulation - 01 3		-	60	-	317
B1_Circulation - 01 4		-	60	-	176
B1_Circulation - 01 5		-	60	-	69
B1_Circulation - 01 6		-	60	-	77
B1_Toilet-01 2		-	60	-	252
B1_Toilet-01 3		-	60	-	53
B1_Circulation - 02 2		-	60	-	286
B1_Circulation - 02 3		-	60	-	320
B1_Circulation - 02 4		-	60	-	70
B1_Circulation - 02 5		-	60	-	254
B1_Office - 02 2		60	-	-	1038
B1_Office - 02 3		60	-	-	683
B1_Office - 02 4		60	-	-	464
B1_Office - 02 5		60	-	-	346
B1_Office - 02 6		60	-	-	387

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
B1_Office - 02 7		60	-	-	1101
B1_Office - 02 8		60	-	-	1097
B1_Office - 02 9		60	-	-	831
B1_Office - 02 10		60	-	-	1145
B1_Office - 02 11		60	-	-	647
B1_Office - 02 12		60	-	-	1756
B1_Office - 02 13		60	-	-	789
B1_Stairs - 02 2		-	60	-	55
B1_Stairs - 02 3		-	60	-	66
B1_Toilet-02 2		-	60	-	257
B1_Toilet-02 3		-	60	-	53
B1_Circulation - 03 2		-	60	-	44
B1_Circulation - 03 3		-	60	-	309
B1_Circulation - 03 4		-	60	-	60
B1_Circulation - 03 5		-	60	-	165
B1_Circulation - 03 7		-	60	-	77
B1_Office - 03 2		60	-	-	995
B1_Office - 03 3		60	-	-	730
B1_Office - 03 4		60	-	-	788
B1_Office - 03 5		60	-	-	442
B1_Office - 03 6		60	-	-	325
B1_Office - 03 7		60	-	-	384
B1_Office - 03 8		60	-	-	1086
B1_Office - 03 9		60	-	-	469
B1_Office - 03 10		60	-	-	323
B1_Office - 03 11		60	-	-	519
B1_Office - 03 12		60	-	-	639
B1_Office - 03 13		60	-	-	1133
B1_Office - 03 14		60	-	-	1746
B1_Office - 03 15		60	-	-	636
B1_Stairs - 03 2		-	60	-	47
B1_Stairs - 03 3		-	60	-	60
B1_Toilet-03 2		-	60	-	219
B1_Toilet-03 3		-	60	-	43
B1_Circulation - 04 2		-	60	-	74
B1_Circulation - 04 3		-	60	-	317
B1_Circulation - 04 4		-	60	-	178
B1_Circulation - 04 5		-	60	-	67
B1_Office - 04 2		60	-	-	995
B1_Office - 04 3		60	-	-	728
B1_Office - 04 4		60	-	-	1067
B1_Office - 04 5		60	-	-	1053
B1_Office - 04 6		60	-	-	896

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
B1_Office - 04 7		60	-	-	1141
B1_Office - 04 8		60	-	-	1753
B1_Office - 04 9		60	-	-	644
B1_Stairs - 04 2		-	60	-	52
B1_Stairs - 04 3		-	60	-	64
B1_Toilet-04 2		-	60	-	49
B1_Circulation - 05 2		-	70	-	63
B1_Office - 05 2		60	-	-	1355
B1_Office - 05 3		60	-	-	791
B1_Office - 05 4		60	-	-	907
B1_Office - 05 5		60	-	-	989
B1_Office - 05 6		60	-	-	559
B1_Toilet-05 2		-	60	-	49
B1_FoodPrep - 00 1		-	60	-	683
B1_Plant - 00 1		60	-	-	740
B1_Changing - 00 1		-	60	-	109
B1_FoodPrep - 00 3		-	60	-	835
B1_Plant - 00 2		60	-	-	411
B1_Plant - 00 3		60	-	-	169

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B1_Office - 00 1	NO (-68%)	NO
B1_EatDrink - 00 1	NO (-86%)	NO
B1_EatDrink - 00 7	NO (-35%)	NO
B1_EatDrink - 00 8	YES (+81%)	NO
B1_EatDrink - 00 9	NO (-31%)	NO
B1_Office - 00 58	NO (-97%)	NO
B1_Office - 00 59	YES (+73%)	NO
B1_Office - 00 60	NO (-68%)	NO
B1_Office - 00 61	NO (-92%)	NO
B1_Office - 00 62	NO (-83%)	NO
B1_Office - 00 63	NO (-71%)	NO
B1_Office - 01 1	NO (-75%)	NO
B1_Office - 02 1	NO (-73%)	NO
B1_Office - 03 1	NO (-72%)	NO
B1_Office - 04 1	NO (-69%)	NO
B1_Office - 05 1	NO (-69%)	NO
B1_Office - 01 2	NO (-86%)	NO
B1_Office - 01 3	NO (-91%)	NO
B1_Office - 01 4	N/A	N/A
B1_Office - 01 5	NO (-74%)	NO
B1_Office - 01 6	NO (-72%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
B1_Office - 01 7	NO (-65%)	NO
B1_Office - 01 8	NO (-40%)	NO
B1_Office - 01 9	NO (-4%)	NO
B1_Office - 01 10	NO (-49%)	NO
B1_Office - 01 11	NO (-23%)	NO
B1_Office - 01 12	NO (-82%)	NO
B1_Office - 01 13	NO (-91%)	NO
B1_Office - 02 2	NO (-87%)	NO
B1_Office - 02 3	NO (-93%)	NO
B1_Office - 02 4	NO (-78%)	NO
B1_Office - 02 5	NO (-85%)	NO
B1_Office - 02 6	NO (-84%)	NO
B1_Office - 02 7	NO (-2%)	NO
B1_Office - 02 8	NO (-31%)	NO
B1_Office - 02 9	NO (-49%)	NO
B1_Office - 02 10	NO (-23%)	NO
B1_Office - 02 11	NO (-91%)	NO
B1_Office - 02 12	NO (-82%)	NO
B1_Office - 02 13	NO (-64%)	NO
B1_Office - 03 2	NO (-87%)	NO
B1_Office - 03 3	NO (-93%)	NO
B1_Office - 03 4	NO (-74%)	NO
B1_Office - 03 5	NO (-70%)	NO
B1_Office - 03 6	NO (-78%)	NO
B1_Office - 03 7	NO (-65%)	NO
B1_Office - 03 8	NO (-25%)	NO
B1_Office - 03 9	NO (0%)	NO
B1_Office - 03 10	NO (-26%)	NO
B1_Office - 03 11	NO (-78%)	NO
B1_Office - 03 12	NO (-5%)	NO
B1_Office - 03 13	NO (-20%)	NO
B1_Office - 03 14	NO (-84%)	NO
B1_Office - 03 15	NO (-93%)	NO
B1_Office - 04 2	NO (-79%)	NO
B1_Office - 04 3	NO (-81%)	NO
B1_Office - 04 4	NO (-35%)	NO
B1_Office - 04 5	NO (-7%)	NO
B1_Office - 04 6	NO (-57%)	NO
B1_Office - 04 7	NO (-22%)	NO
B1_Office - 04 8	NO (-83%)	NO
B1_Office - 04 9	NO (-92%)	NO
B1_Office - 05 2	NO (-60%)	NO
B1_Office - 05 3	NO (-56%)	NO
B1_Office - 05 4	NO (-45%)	NO
B1_Office - 05 5	NO (-44%)	NO
B1_Office - 05 6	NO (-55%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m²]	658	658	100	A1/A2 Retail/Financial and Professional services
External area [m²]	7817	7817		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	LON	LON		B1 Offices and Workshop businesses
Infiltration [m³/hm²@ 50Pa]	5	3		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	4691	2101		B8 Storage or Distribution
Average U-value [W/m²K]	0.6	0.27		C1 Hotels
Alpha value* [%]	6.53	6.53		C2 Residential Inst.: Hospitals and Care Homes
				C2 Residential Inst.: Residential schools
				C2 Residential Inst.: Universities and colleges
				C2A Secure Residential Inst.
				Residential spaces
				D1 Non-residential Inst.: Community/Day Centre
				D1 Non-residential Inst.: Libraries, Museums, and Galleries
				D1 Non-residential Inst.: Education
				D1 Non-residential Inst.: Primary Health Care Building
				D1 Non-residential Inst.: Crown and County Courts
				D2 General Assembly and Leisure, Night Clubs and Theatres
				Others: Passenger terminals
				Others: Emergency services
				Others: Miscellaneous 24hr activities
				Others: Car Parks 24 hrs
				Others - Stand alone utility block

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.22	2.58
Cooling	8.09	12.83
Auxiliary	3.47	3.5
Lighting	13.58	18.45
Hot water	2.68	2.4
Equipment*	33.66	33.66
TOTAL**	30.04	39.75

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	152.14	198.76
Primary energy* [kWh/m²]	87.26	114.74
Total emissions [kg/m²]	14.8	19.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance									
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Water loop heat pump, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
	Actual	46.8	0	3.7	0	7.8	3.5	0	3.5
	Notional	23.1	0	2.6	0	6.1	2.43	0	----
[ST] Water loop heat pump, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
	Actual	84.6	0	6.7	0	6.4	3.5	0	3.5
	Notional	72	0	8.2	0	3.2	2.43	0	----
[ST] Water loop heat pump, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
	Actual	13.9	162.4	1.1	11.3	10.7	3.5	4	3.5
	Notional	11.2	231.8	1.3	17.9	6.8	2.43	3.6	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.18	External Wall - Extension
Floor	0.2	0.39	Ground Floor
Roof	0.15	0.16	Roof
Windows, roof windows, and rooflights	1.5	1.2	Top Floor Window - Large
Personnel doors	1.5	0.87	External Door
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2013

Project name

Chocolate Factory - Block F

As designed

Date: Thu Feb 15 12:25:44 2018

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.4.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.4.1

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building should not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	21.1
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	21.1
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	13.8
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and the building services should achieve reasonable overall standards of energy efficiency

Values not achieving standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	External Wall
Floor	0.25	0.16	0.16	Ground Floor
Roof	0.25	0.15	0.15	Roof
Windows***, roof windows, and rooflights	2.2	1.51	1.56	Ground Floor Above Entrance-0.9m
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

Air Permeability	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- WC + Circulation (13 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

2- Office + Retail (11 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	4	-	1.1	0.8
Standard value	0.91*	2.6	N/A	1.1^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					
^ Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

1- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
B1_Toilet 1		0.5	-	-	-	-	-	-	-	-	-	N/A
B1_Store 1		0.5	-	-	-	-	-	-	-	-	-	N/A
B1_Circulation 1		0.5	-	-	-	-	-	-	-	-	-	N/A
B1_Plant 1		0.5	-	-	-	-	-	-	-	-	-	N/A
B1_Toilet 2		0.5	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I			
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard	
B1_Toilet 8	0.5	-	-	-	-	-	-	-	-	-	N/A	
B1_Circulation 2	0.5	-	-	-	-	-	-	-	-	-	N/A	
B1_Circulation 3	0.5	-	-	-	-	-	-	-	-	-	N/A	
B1_Circulation 4	0.5	-	-	-	-	-	-	-	-	-	N/A	
B1_Circulation 5	0.5	-	-	-	-	-	-	-	-	-	N/A	
B1_Store 2	0.5	-	-	-	-	-	-	-	-	-	N/A	
B1_Store 3	0.5	-	-	-	-	-	-	-	-	-	N/A	
B1_Store 4	0.5	-	-	-	-	-	-	-	-	-	N/A	

"LENI calculation for lighting energy provided in a separate submission."

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Retail 1	NO (-57%)	NO
Retail 2	NO (-48%)	NO
Retail 3	NO (-42%)	NO
B1_Office 1	NO (-68%)	NO
B1_Office 2	NO (-71%)	NO
B1_Office 3	NO (-66%)	NO
B1_Office 4	N/A	N/A
B1_Office 5	NO (-68%)	NO
B1_Office 6	NO (-72%)	NO
B1_Office 7	NO (-64%)	NO
B1_Office 8	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	706	706
External area [m²]	1345	1345
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	459	670
Average U-value [W/m²K]	0.34	0.5
Alpha value* [%]	10.46	10.46

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	A1/A2 Retail/Financial and Professional services A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways B1 Offices and Workshop businesses B2 to B7 General Industrial and Special Industrial Groups B8 Storage or Distribution C1 Hotels C2 Residential Inst.: Hospitals and Care Homes C2 Residential Inst.: Residential schools C2 Residential Inst.: Universities and colleges C2A Secure Residential Inst. Residential spaces D1 Non-residential Inst.: Community/Day Centre D1 Non-residential Inst.: Libraries, Museums, and Galleries D1 Non-residential Inst.: Education D1 Non-residential Inst.: Primary Health Care Building D1 Non-residential Inst.: Crown and County Courts D2 General Assembly and Leisure, Night Clubs and Theatres Others: Passenger terminals Others: Emergency services Others: Miscellaneous 24hr activities Others: Car Parks 24 hrs Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.25	10.63
Cooling	4.64	9.11
Auxiliary	4.12	3.51
Lighting	13.82	22.69
Hot water	2.56	2.96
Equipment*	31.64	31.64
TOTAL**	28.4	48.91

* Energy used by equipment does not count towards the total for calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	113.51	175.03
Primary energy* [kWh/m²]	81.15	121.94
Total emissions [kg/m²]	13.8	21.1

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	85.1	0	6.8	0	3.6	3.5	0	3.5	0
	Notional	100.6	0	22.2	0	3.1	1.26	0	----	----
[ST] Water loop heat pump, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	22.1	105.7	1.8	7.3	12.5	3.5	4	3.5	4
	Notional	25.7	186.6	5.7	14.4	7.9	1.26	3.6	----	----

Key to terms	
Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric			
Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.18	External Wall
Floor	0.2	0.15	Exposed Floor
Roof	0.15	0.15	Roof
Windows, roof windows, and rooflights	1.5	1.48	Ground Floor Window-1.8m
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5