Regulations Compliance Report

Approved Document L1A 2014 Edition, Wales assessed by Stroma FSAP 2012 program, 1.0.2.0
Printed on 16 January 2019 at 11:55:42

Project Information:

Assessed By: Nicholas Cox (STRO005875) **Building Type:** Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 140.12m²

Site Reference : Proposed Development **Plot Reference:** Plot 5

Address : Plot 5, Land Off Feidr Eglwys,, Newport

Client Details:

Name: Morgan Construction Ltd

Address : Ty Pengau, Ferryside, SA17 5UG

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

1 TER and DER

Fuel for main heating system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	15.66 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.53 kg/m²	**OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.21)	0.15 (max. 0.70)	**OK**
Floor	0.12 (max. 0.18)	0.12 (max. 0.70)	**OK**
Roof	0.10 (max. 0.15)	0.15 (max. 0.35)	**OK**
Openings	1.42 (max. 1.60)	1.60 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system: Database: (rev 437, product index 017688):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Vaillant
Model: ecoTEC pro 30 H combi A
Model qualifier: VUW GB 306/5-3 (Combi)
Efficiency 89.3 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: Measured cylinder loss: 0.00 kWh/day
Permitted by DBSCG: 2.74 kWh/day **OK**

Regulations Compliance Report

Primary pipework insulated:	Yes	**OK**

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Wales):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: West	3m²
Windows facing: West	3m²
Windows facing: East	0.68m²
Windows facing: East	4.2m²
Windows facing: East	4.2m²
Windows facing: North	0.68m²
Windows facing: West	1.19m²
Windows facing: West	1.19m²
Windows facing: West	1.19m²
Windows facing: East	1.19m²
Windows facing: East	1.19m²
Windows facing: East	0.59m²
Windows facing: North	0.68m²
Ventilation rate:	6.00
Blinds/curtains:	
	Closed 100% of daylight hours

10 Key features

Roofs U-value	0.1 W/m²K
External Walls U-value	0.15 W/m²K
Floors U-value	0.12 W/m²K

Thermal Bridge Report

Property Details: Plot 5

Address:	Plot 5, Land Off Feidr Eglwys,, Newport
Located in:	Wales
Region:	Wales

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0677

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Sill	0.04	11.4	E3	[A]
Jamb	0.05	28.8	E4	[A]
Ground floor (normal)	0.16	32.08	E5	[A]
Eaves (insulation at ceiling level)	0.06	17.32	E10	[A]
Gable (insulation at ceiling level)	0.24	13.64	E12	[A]
Corner (normal)	0.09	19.8	E16	[A]
Corner (inverted internal area greater than external area)	-0.09	7.6	E17	[A]
Other lintels (including other steel lintels)	0.3	16.4	E2	[A]
Intermediate floor within a dwelling	0.07	32.08	E6	[A]

Code for Sustainable Homes Report

For use with Nov 2010 addendum 2014 Wales

Assessor and House Details

Assessor Name: Nicholas Cox
Assessor Number: STRO005875
Property Address: Plot 5
Land Off Feidr Eglwys,
Newport

Buiding regulation assessment

	kg/m²/year
TER	15.66
DER	15.53

ENE 1 Assessment - Dwelling Emission Rate

Total Energy Type CO_2 Emissions for Codes Levels 1 - 5

	%	kg/m²/year	
DER from SAP 2012 DER Worksheet		15.53	*(ZC1)*
TER		15.66	
Residual CO2 emissions offset from biofuel CHP		0	*(ZC5)*
CO2 emissions offset from additional allowable electricty generation		0	*(ZC7)*
Total CO2 emissions offset from SAP Section 16 allowances		0	
DER accounting for SAP Section 16 allowances		15.53	
% improvement DER/TER	0.8		

Total Energy Type CO2 Emissions for Codes Levels 6

	kg/m²/year	
DER accounting for SAP Section 16 allowances	15.53	*(ZC1)*
CO2 emissions from appliances, equation (L14)	13.96	*(ZC2)*
CO2 emissions from cooking, equation (L16)	1.55	*(ZC3)*
Net CO2 emissions	34.3	*(ZC8)*

Result:

Credits awarded for ENE 1 = 0.2

Code Level = 3

ENE 2 - Fabric energy Efficiency

Fabric energy Efficiency: 45.92

Credits awarded for ENE 2 = 7

ENE 7 - Low or Zero Carbon (LZC) Technologies

Reduction in CO2 Emissions

	%	kg/m²/year
Standard Case CO2 emissions		30.92
Standard DER		16.53
Actual Case CO2 emissions		30.92
Actual DER		16.53
Reduction in CO2 emissions	0	

Credits awarded for ENE 7 = 0

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

The following requirements must also be met:

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

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

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

Predicted Energy Assessment

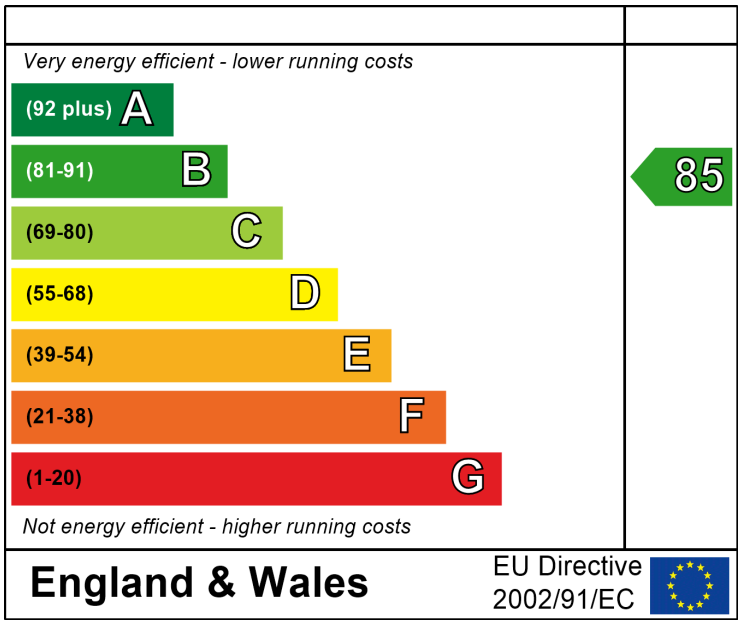
Plot 5
Land Off Feidr Eglwys,
Newport

Dwelling type:	Detached House
Date of assessment:	10 January 2019
Produced by:	Nicholas Cox
Total floor area:	140.12 m²

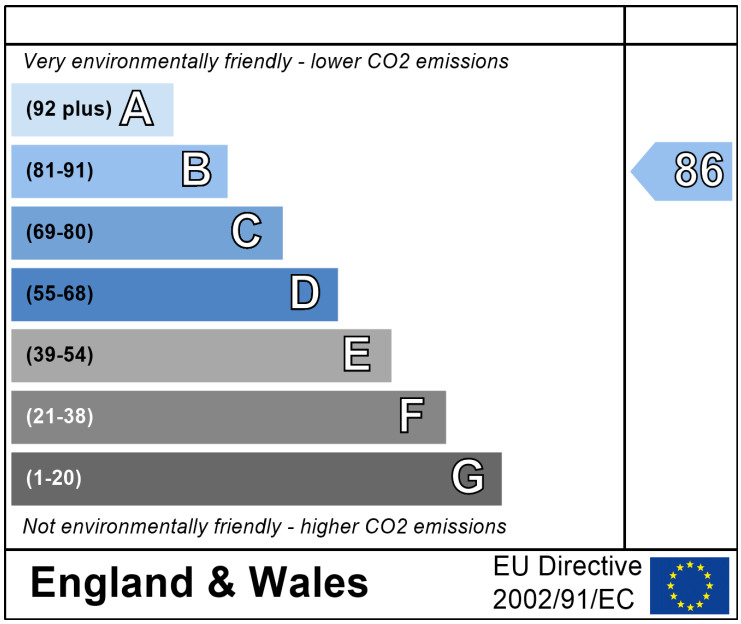
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

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

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



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

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

SAP Input

Property Details: Plot 5

Address:	Plot 5, Land Off Feidr Eglwys,, Newport
Located in:	Wales
Region:	Wales
UPRN:	
Date of assessment:	10 January 2019
Date of certificate:	16 January 2019
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	437

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2019

Floor Location:	Floor area:	Storey height:
Floor 0	74 m²	2.4 m
Floor 1	66.12 m²	2.5 m

Living area:	13.26 m² (fraction 0.091)
Front of dwelling faces:	West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
D1	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	No	PVC-U
W1	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
W2	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
W3	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
D02	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
D03	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
W4	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
W5	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
W6	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
W7	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
W8	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
W9	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
W10	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
W11	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
D1	12mm mm	0.7	0.63	1.6	2.1	1
W1	12mm	0.7	0.63	1.4	3	1
W2	12mm	0.7	0.63	1.4	3	1
W3	12mm	0.7	0.63	1.4	0.675	1
D02	12mm	0.7	0.63	1.4	4.2	1
D03	12mm	0.7	0.63	1.4	4.2	1
W4	12mm	0.7	0.63	1.4	0.675	1
W5	12mm	0.7	0.63	1.4	1.19	1
W6	12mm	0.7	0.63	1.4	1.19	1
W7	12mm	0.7	0.63	1.4	1.19	1
W8	12mm	0.7	0.63	1.4	1.19	1
W9	12mm	0.7	0.63	1.4	1.19	1

SAP Input

W10	12mm	0.7	0.63	1.4	0.59	1
W11	12mm	0.7	0.63	1.4	0.675	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
D1		Type 1 Ex Wall	West	0	0
W1		Type 1 Ex Wall	West	0	0
W2		Type 1 Ex Wall	West	0	0
W3		Type 1 Ex Wall	East	0	0
D02		Type 1 Ex Wall	East	0	0
D03		Type 1 Ex Wall	East	0	0
W4		Type 1 Ex Wall	North	0	0
W5		Type 1 Ex Wall	West	0	0
W6		Type 1 Ex Wall	West	0	0
W7		Type 1 Ex Wall	West	0	0
W8		Type 1 Ex Wall	East	0	0
W9		Type 1 Ex Wall	East	0	0
W10		Type 1 Ex Wall	East	0	0
W11		Type 1 Ex Wall	North	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
Type 1 Ex Wall	149.43	25.06	124.36	0.15	0	False	N/A
Type 1 Ex Rf	64	0	64	0.1	0		N/A
Type 2 Ex Rf	2.08	0	2.08	0.15	0		N/A
Type 1 Ex Fl	74			0.12			N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0677

	Length	Psi-value		
[Approved]	11.4	0.04	E3	Sill
[Approved]	28.8	0.05	E4	Jamb
[Approved]	32.08	0.16	E5	Ground floor (normal)
[Approved]	17.32	0.06	E10	Eaves (insulation at ceiling level)
[Approved]	13.64	0.24	E12	Gable (insulation at ceiling level)
[Approved]	19.8	0.09	E16	Corner (normal)
[Approved]	7.6	-0.09	E17	Corner (inverted internal area greater than external area)
[Approved]	16.4	0.3	E2	Other lintels (including other steel lintels)
[Approved]	32.08	0.07	E6	Intermediate floor within a dwelling

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	5

Main heating system:

Main heating system: Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database

SAP Input

	Database: (rev 437, product index 017688) Efficiency: Winter 87.0 % Summer: 90.2 Brand name: Vaillant Model: ecoTEC pro 30 H combi A Model qualifier: VUW GB 306/5-3 (Combi boiler) Systems with radiators Central heating pump : 2012 or earlier Design flow temperature: Design flow temperature >45°C Boiler interlock: Yes Delayed start
Main heating Control:	
Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services Control code: 2110
Secondary heating system:	
Secondary heating system:	None
Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :mains gas Hot water cylinder Cylinder volume: 280 litres Cylinder insulation: Factory 65 mm Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False
Others:	
Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Nicholas Cox	**Stroma Number:**	STRO005875
Software Name:	Stroma FSAP 2012	**Software Version:**	1.0.2.0

Property Address: Plot 5

Address : Plot 5, Land Off Feidr Eglwys,, Newport

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74	(1a) x	2.4	(2a) =	177.6	(3a)
First floor	66.12	(1b) x	2.5	(2b) =	165.3	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	140.12	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		342.9	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.09 (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)		0.34 (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) =		0.29 (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

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	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	(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	0.54	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	0.56	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	
Doors			2.1	x	1.6	=	3.36			(26)
Windows Type 1			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 2			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 3			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 4			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 5			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 6			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 7			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 8			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 9			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 10			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 11			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 12			0.59	x1/[1/(1.4)+ 0.04]		=	0.78			(27)
Windows Type 13			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Floor			74	x	0.12	=	8.88			(28)
Walls	149.43	25.06	124.36	x	0.15	=	18.65			(29)
Roof Type1	64	0	64	x	0.1	=	6.4			(30)

SAP WorkSheet: New dwelling design stage

Roof Type2	2.08	0	2.08	x	0.15	=	0.31	(30)
Total area of elements, m²			289.51					(31)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	68.05 (33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	32364.07 (34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K	19.61 (36)

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

Total fabric heat loss	(33) + (36) =	87.66 (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=	64.15	63.85	63.57	62.21	61.96	60.78	60.78	60.56	61.23	61.96	62.47	63.01	(38)

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

(39)m=	151.81	151.51	151.22	149.87	149.62	148.44	148.44	148.22	148.89	149.62	150.13	150.66	

Average = Sum(39)$_{1...12}$ /12= 149.87 (39)

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

(40)m=	1.08	1.08	1.08	1.07	1.07	1.06	1.06	1.06	1.06	1.07	1.07	1.08	

Average = Sum(40)$_{1...12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.92 (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) + 36 103.49 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	113.83	109.7	105.56	101.42	97.28	93.14	93.14	97.28	101.42	105.56	109.7	113.83	

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

Total = Sum(44)$_{1...12}$ = 1241.83 (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=	168.81	147.65	152.36	132.83	127.45	109.98	101.91	116.95	118.34	137.92	150.55	163.49	

Total = Sum(45)$_{1...12}$ = 1628.24 (45)

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

(46)m=	25.32	22.15	22.85	19.92	19.12	16.5	15.29	17.54	17.75	20.69	22.58	24.52	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 280 (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:

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a) If manufacturer's declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

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

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

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

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

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

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

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

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

(61)m=	34.21	30.89	34.19	33.08	34.17	33.05	34.15	34.16	33.07	34.18	33.09	34.2	(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=	203.02	178.54	186.55	165.91	161.62	143.03	136.06	151.11	151.41	172.1	183.64	197.69	(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=	203.02	178.54	186.55	165.91	161.62	143.03	136.06	151.11	151.41	172.1	183.64	197.69	

Output from water heater (annual)$_{1...12}$ 2030.68 (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=	64.68	56.81	59.21	52.43	50.92	44.83	42.42	47.43	47.62	54.4	58.33	62.91	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	175.04	175.04	175.04	175.04	175.04	175.04	175.04	175.04	175.04	175.04	175.04	175.04	(66)

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

(67)m=	70.54	62.65	50.95	38.57	28.83	24.34	26.3	34.19	45.89	58.27	68	72.5	(67)

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

(68)m=	462.01	466.81	454.73	429.01	396.54	366.03	345.64	340.85	352.93	378.65	411.11	441.63	(68)

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

(69)m=	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	(71)

Water heating gains (Table 5)

(72)m=	86.94	84.55	79.58	72.83	68.44	62.27	57.02	63.74	66.13	73.12	81.01	84.56	(72)

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

(73)m=	743.25	737.77	709.02	664.17	617.58	576.4	552.73	562.55	588.72	633.8	683.9	722.45	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x 0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x 0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x 0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x 0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x 0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x 0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x 0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x 0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x 0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x 0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x 0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x 0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x 0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x 0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x 0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x 0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x 0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x 0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x 0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x 0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x 0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x 0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
North	0.9x 0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
East	0.9x 1	x	0.68	x	19.64	x	0.63	x	0.7	=	4.05	(76)
East	0.9x 1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x 1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x 1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x 1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x 1	x	0.59	x	19.64	x	0.63	x	0.7	=	3.54	(76)

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East	0.9x	1	x	0.68	x	38.42	x	0.63	x	0.7	=	7.93	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	0.59	x	38.42	x	0.63	x	0.7	=	6.93	(76)
East	0.9x	1	x	0.68	x	63.27	x	0.63	x	0.7	=	13.05	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	0.59	x	63.27	x	0.63	x	0.7	=	11.41	(76)
East	0.9x	1	x	0.68	x	92.28	x	0.63	x	0.7	=	19.04	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	0.59	x	92.28	x	0.63	x	0.7	=	16.64	(76)
East	0.9x	1	x	0.68	x	113.09	x	0.63	x	0.7	=	23.33	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	0.59	x	113.09	x	0.63	x	0.7	=	20.39	(76)
East	0.9x	1	x	0.68	x	115.77	x	0.63	x	0.7	=	23.88	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	0.59	x	115.77	x	0.63	x	0.7	=	20.87	(76)
East	0.9x	1	x	0.68	x	110.22	x	0.63	x	0.7	=	22.74	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	0.59	x	110.22	x	0.63	x	0.7	=	19.87	(76)
East	0.9x	1	x	0.68	x	94.68	x	0.63	x	0.7	=	19.53	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)

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East	0.9x	1	x	0.59	x	94.68	x	0.63	x	0.7	=	17.07	(76)
East	0.9x	1	x	0.68	x	73.59	x	0.63	x	0.7	=	15.18	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	0.59	x	73.59	x	0.63	x	0.7	=	13.27	(76)
East	0.9x	1	x	0.68	x	45.59	x	0.63	x	0.7	=	9.4	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	0.59	x	45.59	x	0.63	x	0.7	=	8.22	(76)
East	0.9x	1	x	0.68	x	24.49	x	0.63	x	0.7	=	5.05	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	0.59	x	24.49	x	0.63	x	0.7	=	4.42	(76)
East	0.9x	1	x	0.68	x	16.15	x	0.63	x	0.7	=	3.33	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	0.59	x	16.15	x	0.63	x	0.7	=	2.91	(76)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)

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West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)

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West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)

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

(83)m=	134.13	262.18	432.22	632.47	777.9	797.76	758.89	649.86	503.25	311.13	167.18	110.35	(83)

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

(84)m=	877.38	999.95	1141.24	1296.64	1395.48	1374.16	1311.62	1212.4	1091.96	944.94	851.08	832.8	(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	0.84	0.66	0.49	0.55	0.82	0.97	0.99	1	(86)

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

(87)m=	19.87	20.02	20.27	20.6	20.85	20.97	20.99	20.99	20.91	20.57	20.16	19.84	(87)

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

(88)m=	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.04	20.03	20.03	20.02	20.02	(88)

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

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.44	0.74	0.96	0.99	1	(89)

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

(90)m=	18.51	18.73	19.1	19.56	19.89	20.01	20.03	20.03	19.96	19.52	18.93	18.48	(90)

fLA = Living area ÷ (4) = 0.09 (91)

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

(92)m=	18.64	18.85	19.21	19.66	19.98	20.1	20.12	20.12	20.05	19.62	19.05	18.61	(92)

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

(93)m=	18.49	18.7	19.06	19.51	19.83	19.95	19.97	19.97	19.9	19.47	18.9	18.46	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.91	0.78	0.57	0.38	0.43	0.73	0.95	0.99	1	(94)

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

(95)m=	872.81	989.24	1109.13	1185.36	1087.04	776.59	498.96	526.01	797.1	894.7	842.05	829.44	(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=	2154.37	2090.66	1899.02	1590.16	1215.91	794.87	500.73	529.49	863.32	1327.42	1771.41	2147.75	(97)

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

(98)m=	953.48	740.15	587.67	291.45	95.88	0	0	0	0	321.94	669.14	980.82	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4640.54 (98)

Space heating requirement in kWh/m²/year 33.12 (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		90.2 (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)													
	953.48	740.15	587.67	291.45	95.88	0	0	0	0	321.94	669.14	980.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1057.08	820.57	651.52	323.12	106.3	0	0	0	0	356.92	741.84	1087.38	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 5144.73 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	203.02	178.54	186.55	165.91	161.62	143.03	136.06	151.11	151.41	172.1	183.64	197.69	

Efficiency of water heater 87 (216)

(217)m=	89.62	89.56	89.41	89.01	88.16	87	87	87	87	89.06	89.49	89.65	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	226.53	199.35	208.65	186.39	183.32	164.41	156.39	173.69	174.03	193.24	205.21	220.52	

Total = Sum(219a)$_{1...12}$ = 2291.72 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		5144.73
Water heating fuel used		2291.72
Electricity for pumps, fans and electric keep-hot		
central heating pump:	120	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	165 (231)
Electricity for lighting		498.27 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	3.48 x 0.01 =	179.04 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	13.19 x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.48 x 0.01 =	79.75 (247)

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Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	21.76	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	13.19	x 0.01 =	65.72	(250)
Additional standing charges (Table 12)				120	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =			466.27	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.06	(257)
SAP rating (Section 12)		85.24	(258)

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

		Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	1111.26	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	495.01	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1606.27	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	85.64	(267)
Electricity for lighting	(232) x		0.519	=	258.6	(268)
Total CO2, kg/year	sum of (265)…(271) =				1950.51	(272)
CO2 emissions per m²	(272) ÷ (4) =				13.92	(273)
EI rating (section 14)					86	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x		1.22	=	6276.57	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		1.22	=	2795.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				9072.47	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	506.55	(267)
Electricity for lighting	(232) x		0	=	1529.69	(268)
'Total Primary Energy	sum of (265)…(271) =				11108.71	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				79.28	(273)

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User Details:

Assessor Name:	Nicholas Cox	**Stroma Number:**	STRO005875
Software Name:	Stroma FSAP 2012	**Software Version:**	1.0.2.0

Property Address: Plot 5

Address : Plot 5, Land Off Feidr Eglwys,, Newport

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74	(1a) x	2.4	(2a) =	177.6	(3a)
First floor	66.12	(1b) x	2.5	(2b) =	165.3	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	140.12	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		342.9	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.09 (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)		0.34 (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) =		0.29 (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

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	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	(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	0.54	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	0.56	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	
Doors			2.1	x	1.6	=	3.36			(26)
Windows Type 1			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 2			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 3			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 4			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 5			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 6			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 7			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 8			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 9			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 10			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 11			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 12			0.59	x1/[1/(1.4)+ 0.04]		=	0.78			(27)
Windows Type 13			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Floor			74	x	0.12	=	8.88			(28)
Walls	149.43	25.06	124.36	x	0.15	=	18.65			(29)
Roof Type1	64	0	64	x	0.1	=	6.4			(30)

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Roof Type2	2.08	0	2.08	x	0.15	=	0.31	(30)
Total area of elements, m²			289.51					(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 68.05 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 32364.07 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 19.61 (36)

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

Total fabric heat loss (33) + (36) = 87.66 (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=	64.15	63.85	63.57	62.21	61.96	60.78	60.78	60.56	61.23	61.96	62.47	63.01	(38)

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

(39)m=	151.81	151.51	151.22	149.87	149.62	148.44	148.44	148.22	148.89	149.62	150.13	150.66	

Average = Sum(39)$_{1...12}$ /12= 149.87 (39)

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

(40)m=	1.08	1.08	1.08	1.07	1.07	1.06	1.06	1.06	1.06	1.07	1.07	1.08	

Average = Sum(40)$_{1...12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.92 (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) + 36 103.49 (43)

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

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

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

(44)m=	113.83	109.7	105.56	101.42	97.28	93.14	93.14	97.28	101.42	105.56	109.7	113.83	

Total = Sum(44)$_{1...12}$ = 1241.83 (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=	168.81	147.65	152.36	132.83	127.45	109.98	101.91	116.95	118.34	137.92	150.55	163.49	

Total = Sum(45)$_{1...12}$ = 1628.24 (45)

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

(46)m=	25.32	22.15	22.85	19.92	19.12	16.5	15.29	17.54	17.75	20.69	22.58	24.52	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 280 (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:

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a) If manufacturer's declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

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

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

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

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

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

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

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

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

(61)m=	34.21	30.89	34.19	33.08	34.17	33.05	34.15	34.16	33.07	34.18	33.09	34.2	(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=	203.02	178.54	186.55	165.91	161.62	143.03	136.06	151.11	151.41	172.1	183.64	197.69	(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=	203.02	178.54	186.55	165.91	161.62	143.03	136.06	151.11	151.41	172.1	183.64	197.69	

Output from water heater (annual)$_{1...12}$ 2030.68 (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=	64.68	56.81	59.21	52.43	50.92	44.83	42.42	47.43	47.62	54.4	58.33	62.91	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	175.04	175.04	175.04	175.04	175.04	175.04	175.04	175.04	175.04	175.04	175.04	175.04	(66)

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

(67)m=	70.54	62.65	50.95	38.57	28.83	24.34	26.3	34.19	45.89	58.27	68	72.5	(67)

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

(68)m=	462.01	466.81	454.73	429.01	396.54	366.03	345.64	340.85	352.93	378.65	411.11	441.63	(68)

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

(69)m=	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	(71)

Water heating gains (Table 5)

(72)m=	86.94	84.55	79.58	72.83	68.44	62.27	57.02	63.74	66.13	73.12	81.01	84.56	(72)

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

(73)m=	743.25	737.77	709.02	664.17	617.58	576.4	552.73	562.55	588.72	633.8	683.9	722.45	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x 0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x 0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x 0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x 0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x 0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x 0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x 0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x 0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x 0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x 0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x 0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x 0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x 0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x 0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x 0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x 0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x 0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x 0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x 0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x 0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x 0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x 0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
North	0.9x 0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
East	0.9x 1	x	0.68	x	19.64	x	0.63	x	0.7	=	4.05	(76)
East	0.9x 1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x 1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x 1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x 1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x 1	x	0.59	x	19.64	x	0.63	x	0.7	=	3.54	(76)

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East	0.9x	1	x	0.68	x	38.42	x	0.63	x	0.7	=	7.93	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	0.59	x	38.42	x	0.63	x	0.7	=	6.93	(76)
East	0.9x	1	x	0.68	x	63.27	x	0.63	x	0.7	=	13.05	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	0.59	x	63.27	x	0.63	x	0.7	=	11.41	(76)
East	0.9x	1	x	0.68	x	92.28	x	0.63	x	0.7	=	19.04	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	0.59	x	92.28	x	0.63	x	0.7	=	16.64	(76)
East	0.9x	1	x	0.68	x	113.09	x	0.63	x	0.7	=	23.33	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	0.59	x	113.09	x	0.63	x	0.7	=	20.39	(76)
East	0.9x	1	x	0.68	x	115.77	x	0.63	x	0.7	=	23.88	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	0.59	x	115.77	x	0.63	x	0.7	=	20.87	(76)
East	0.9x	1	x	0.68	x	110.22	x	0.63	x	0.7	=	22.74	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	0.59	x	110.22	x	0.63	x	0.7	=	19.87	(76)
East	0.9x	1	x	0.68	x	94.68	x	0.63	x	0.7	=	19.53	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)

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East	0.9x	1	x	0.59	x	94.68	x	0.63	x	0.7	=	17.07	(76)
East	0.9x	1	x	0.68	x	73.59	x	0.63	x	0.7	=	15.18	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	0.59	x	73.59	x	0.63	x	0.7	=	13.27	(76)
East	0.9x	1	x	0.68	x	45.59	x	0.63	x	0.7	=	9.4	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	0.59	x	45.59	x	0.63	x	0.7	=	8.22	(76)
East	0.9x	1	x	0.68	x	24.49	x	0.63	x	0.7	=	5.05	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	0.59	x	24.49	x	0.63	x	0.7	=	4.42	(76)
East	0.9x	1	x	0.68	x	16.15	x	0.63	x	0.7	=	3.33	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	0.59	x	16.15	x	0.63	x	0.7	=	2.91	(76)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)

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West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)

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West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)

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

(83)m=	134.13	262.18	432.22	632.47	777.9	797.76	758.89	649.86	503.25	311.13	167.18	110.35	(83)

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

(84)m=	877.38	999.95	1141.24	1296.64	1395.48	1374.16	1311.62	1212.4	1091.96	944.94	851.08	832.8	(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	0.84	0.66	0.49	0.55	0.82	0.97	0.99	1	(86)

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

(87)m=	19.87	20.02	20.27	20.6	20.85	20.97	20.99	20.99	20.91	20.57	20.16	19.84	(87)

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

(88)m=	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.04	20.03	20.03	20.02	20.02	(88)

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

(89)m=	1	0.99	0.98	0.93	0.79	0.57	0.39	0.44	0.74	0.96	0.99	1	(89)

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

(90)m=	18.51	18.73	19.1	19.56	19.89	20.01	20.03	20.03	19.96	19.52	18.93	18.48	(90)

fLA = Living area ÷ (4) = 0.09 (91)

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

(92)m=	18.64	18.85	19.21	19.66	19.98	20.1	20.12	20.12	20.05	19.62	19.05	18.61	(92)

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

(93)m=	18.49	18.7	19.06	19.51	19.83	19.95	19.97	19.97	19.9	19.47	18.9	18.46	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.91	0.78	0.57	0.38	0.43	0.73	0.95	0.99	1	(94)

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

(95)m=	872.81	989.24	1109.13	1185.36	1087.04	776.59	498.96	526.01	797.1	894.7	842.05	829.44	(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=	2154.37	2090.66	1899.02	1590.16	1215.91	794.87	500.73	529.49	863.32	1327.42	1771.41	2147.75	(97)

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

(98)m=	953.48	740.15	587.67	291.45	95.88	0	0	0	0	321.94	669.14	980.82	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4640.54 (98)

Space heating requirement in kWh/m²/year 33.12 (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		90.2 (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)	953.48	740.15	587.67	291.45	95.88	0	0	0	0	321.94	669.14	980.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1057.08	820.57	651.52	323.12	106.3	0	0	0	0	356.92	741.84	1087.38	(211)

Total (kWh/year) =Sum(211)$_{1..5,10...12}$= 5144.73 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	203.02	178.54	186.55	165.91	161.62	143.03	136.06	151.11	151.41	172.1	183.64	197.69	

Efficiency of water heater 87 (216)

(217)m=	89.62	89.56	89.41	89.01	88.16	87	87	87	87	89.06	89.49	89.65	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	226.53	199.35	208.65	186.39	183.32	164.41	156.39	173.69	174.03	193.24	205.21	220.52	

Total = Sum(219a)$_{1...12}$ = 2291.72 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		5144.73
Water heating fuel used		2291.72
Electricity for pumps, fans and electric keep-hot		
central heating pump:	120	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	165 (231)
Electricity for lighting		498.27 (232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	3.92 x 0.01 =	201.67 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)
Space heating - secondary	(215) x	16.96 x 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	3.92 x 0.01 =	89.84 (247)

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Pumps, fans and electric keep-hot	(231)	0	x 0.01 =	27.98	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	0	x 0.01 =	84.51	(250)
Additional standing charges (Table 12)				88	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =			492	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.06	(257)
SAP rating (Section 12)		85.24	(258)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	1111.26	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	495.01	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1606.27	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	85.64	(267)
Electricity for lighting	(232)	x	0.519	=	258.6	(268)
Total CO2, kg/year	sum of (265)…(271) =				1950.51	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =				13.92	(273)
EI rating (section 14)					86	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	1.22	=	6276.57	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	1.22	=	2795.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =				9072.47	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	506.55	(267)
Electricity for lighting	(232)	x	0	=	1529.69	(268)
'Total Primary Energy	sum of (265)…(271) =				11108.71	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =				79.28	(273)

Target Fabric Energy Efficiency WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Nicholas Cox	**Stroma Number:**	STRO005875
Software Name:	Stroma FSAP 2012	**Software Version:**	1.0.2.0

Property Address: Plot 5

Address : Plot 5, Land Off Feidr Eglwys,, Newport

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74 (1a)	x	2.4 (2a)	=	177.6	(3a)
First floor	66.12 (1b)	x	2.5 (2b)	=	165.3	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	140.12 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	342.9	(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							4	x 10 =	40	(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) =	40	÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

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Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

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

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 2			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 3			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 4			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 5			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 6			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 7			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 8			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 9			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 10			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 11			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 12			0.59	x1/[1/(1.4)+ 0.04]		=	0.78			(27)
Windows Type 13			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Floor			74	x	0.13	=	9.62			(28)
Walls	149.43	25.06	124.36	x	0.18	=	22.39			(29)
Roof Type1	64	0	64	x	0.13	=	8.32			(30)

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Roof Type2	2.08	0	2.08	x	0.13	=	0.27		(30)
Total area of elements, m²			289.51						(31)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	73.56	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	32364.07	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		10.92 (36)
if details of thermal bridging are not known (36) = 0.15 x (31)		
Total fabric heat loss	(33) + (36) =	84.48 (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=	65.51	65.17	64.83	63.23	62.93	61.54	61.54	61.28	62.07	62.93	63.53	64.17	(38)

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

(39)m=	149.99	149.65	149.31	147.71	147.41	146.02	146.02	145.76	146.55	147.41	148.01	148.65	

Average = Sum(39)$_{1...12}$ /12= 147.71 (39)

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

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

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N	2.92	(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	103.49	(43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	113.83	109.7	105.56	101.42	97.28	93.14	93.14	97.28	101.42	105.56	109.7	113.83	

Total = Sum(44)$_{1...12}$ = 1241.83 (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=	168.81	147.65	152.36	132.83	127.45	109.98	101.91	116.95	118.34	137.92	150.55	163.49	

Total = Sum(45)$_{1...12}$ = 1628.24 (45)

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

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

Water storage loss:

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

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

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

Water storage loss:

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a) If manufacturer's declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

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

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

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

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

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

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

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

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

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

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

(62)m=	143.49	125.5	129.5	112.9	108.33	93.48	86.63	99.41	100.59	117.23	127.97	138.96	(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=	143.49	125.5	129.5	112.9	108.33	93.48	86.63	99.41	100.59	117.23	127.97	138.96	

Output from water heater (annual)$_{1...12}$ 1384 (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=	35.87	31.37	32.38	28.23	27.08	23.37	21.66	24.85	25.15	29.31	31.99	34.74	(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=	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	(66)

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

(67)m=	28.21	25.06	20.38	15.43	11.53	9.74	10.52	13.68	18.36	23.31	27.2	29	(67)

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

(68)m=	309.55	312.76	304.67	287.43	265.68	245.24	231.58	228.37	236.46	253.69	275.45	295.89	(68)

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

(69)m=	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	(71)

Water heating gains (Table 5)

(72)m=	48.22	46.69	43.52	39.2	36.4	32.46	29.11	33.4	34.93	39.39	44.43	46.69	(72)

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

(73)m=	452.74	451.27	435.32	408.83	380.38	354.19	337.97	342.2	356.5	383.15	413.84	438.34	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x 0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x 0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x 0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x 0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x 0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x 0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x 0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x 0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x 0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x 0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x 0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x 0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x 0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x 0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x 0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x 0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x 0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x 0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x 0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x 0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x 0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x 0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
North	0.9x 0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
East	0.9x 1	x	0.68	x	19.64	x	0.63	x	0.7	=	4.05	(76)
East	0.9x 1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x 1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x 1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x 1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x 1	x	0.59	x	19.64	x	0.63	x	0.7	=	3.54	(76)

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East	0.9x	1	x	0.68	x	38.42	x	0.63	x	0.7	=	7.93	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	0.59	x	38.42	x	0.63	x	0.7	=	6.93	(76)
East	0.9x	1	x	0.68	x	63.27	x	0.63	x	0.7	=	13.05	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	0.59	x	63.27	x	0.63	x	0.7	=	11.41	(76)
East	0.9x	1	x	0.68	x	92.28	x	0.63	x	0.7	=	19.04	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	0.59	x	92.28	x	0.63	x	0.7	=	16.64	(76)
East	0.9x	1	x	0.68	x	113.09	x	0.63	x	0.7	=	23.33	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	0.59	x	113.09	x	0.63	x	0.7	=	20.39	(76)
East	0.9x	1	x	0.68	x	115.77	x	0.63	x	0.7	=	23.88	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	0.59	x	115.77	x	0.63	x	0.7	=	20.87	(76)
East	0.9x	1	x	0.68	x	110.22	x	0.63	x	0.7	=	22.74	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	0.59	x	110.22	x	0.63	x	0.7	=	19.87	(76)
East	0.9x	1	x	0.68	x	94.68	x	0.63	x	0.7	=	19.53	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)

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East	0.9x	1	x	0.59	x	94.68	x	0.63	x	0.7	=	17.07	(76)
East	0.9x	1	x	0.68	x	73.59	x	0.63	x	0.7	=	15.18	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	0.59	x	73.59	x	0.63	x	0.7	=	13.27	(76)
East	0.9x	1	x	0.68	x	45.59	x	0.63	x	0.7	=	9.4	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	0.59	x	45.59	x	0.63	x	0.7	=	8.22	(76)
East	0.9x	1	x	0.68	x	24.49	x	0.63	x	0.7	=	5.05	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	0.59	x	24.49	x	0.63	x	0.7	=	4.42	(76)
East	0.9x	1	x	0.68	x	16.15	x	0.63	x	0.7	=	3.33	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	0.59	x	16.15	x	0.63	x	0.7	=	2.91	(76)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)

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West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)

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West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)

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

(83)m=	134.13	262.18	432.22	632.47	777.9	797.76	758.89	649.86	503.25	311.13	167.18	110.35	(83)

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

(84)m=	586.87	713.45	867.54	1041.29	1158.27	1151.95	1096.86	992.06	859.75	694.29	581.02	548.69	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.98	0.91	0.74	0.57	0.65	0.9	0.99	1	1	(86)

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

(87)m=	19.7	19.85	20.11	20.47	20.78	20.95	20.99	20.98	20.84	20.42	19.99	19.67	(87)

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

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

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

(89)m=	1	1	0.99	0.97	0.87	0.66	0.46	0.53	0.85	0.99	1	1	(89)

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

(90)m=	18.82	18.97	19.24	19.6	19.89	20.02	20.05	20.04	19.95	19.56	19.13	18.8	(90)

fLA = Living area ÷ (4) = 0.09 (91)

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

(92)m=	18.9	19.05	19.32	19.69	19.97	20.11	20.14	20.13	20.03	19.64	19.21	18.89	(92)

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

(93)m=	18.9	19.05	19.32	19.69	19.97	20.11	20.14	20.13	20.03	19.64	19.21	18.89	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.96	0.86	0.67	0.47	0.54	0.85	0.99	1	1	(94)

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

(95)m=	586.48	712.03	860.6	1002.29	1001.44	766.51	511.63	534.6	730.06	684.3	580.11	548.44	(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=	2190.3	2118.12	1914.62	1593.11	1219.32	804.73	516.18	544.1	869.59	1332.67	1792.26	2182.93	(97)

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

(98)m=	1193.24	944.9	784.2	425.39	162.1	0	0	0	0	482.39	872.75	1216.06	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6081.02 (98)

Space heating requirement in kWh/m²/year 43.4 (99)

Target Fabric Energy Efficiency WorkSheet: New dwelling design stage

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1372.57	1080.54	1107.78	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.87	0.93	0.9	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1196.85	1006.68	996.44	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1469.04	1401.84	1281.78	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	195.98	293.99	212.29	0	0	0	0	

Total = Sum(104) = 702.26 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

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

Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	48.99	73.5	53.07	0	0	0	0	

Total = Sum(107) = 175.57 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 1.25 (108)

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

Fabric Energy Efficiency — (99) + (108) = 44.65 (109)

Target Fabric Energy Efficiency (TFEE) 51.35 (109)

Dwelling Fabric Energy Efficiency WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Nicholas Cox	**Stroma Number:**	STRO005875
Software Name:	Stroma FSAP 2012	**Software Version:**	1.0.2.0

Property Address: Plot 5

Address : Plot 5, Land Off Feidr Eglwys,, Newport

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74 (1a)	x	2.4 (2a)	=	177.6	(3a)
First floor	66.12 (1b)	x	2.5 (2b)	=	165.3	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	140.12 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		342.9	(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							4	x 10 =	40	(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) =	40	÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Dwelling Fabric Energy Efficiency WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

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

(24d)

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

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

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.6	=	3.36			(26)
Windows Type 1			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 2			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 3			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 4			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 5			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 6			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 7			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 8			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 9			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 10			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 11			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 12			0.59	x1/[1/(1.4)+ 0.04]		=	0.78			(27)
Windows Type 13			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Floor			74	x	0.12	=	8.88			(28)
Walls	149.43	25.06	124.36	x	0.15	=	18.65			(29)
Roof Type1	64	0	64	x	0.1	=	6.4			(30)

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Roof Type2	2.08	0	2.08	x	0.15	=	0.31	(30)
Total area of elements, m²			289.51					(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 68.05 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 32364.07 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 19.61 (36)

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

Total fabric heat loss (33) + (36) = 87.66 (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=	65.51	65.17	64.83	63.23	62.93	61.54	61.54	61.28	62.07	62.93	63.53	64.17	(38)

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

(39)m=	153.17	152.82	152.48	150.89	150.59	149.2	149.2	148.94	149.73	150.59	151.19	151.82	

Average = Sum(39)$_{1...12}$ /12= 150.88 (39)

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

(40)m=	1.09	1.09	1.09	1.08	1.07	1.06	1.06	1.06	1.07	1.07	1.08	1.08	

Average = Sum(40)$_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.92 (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) + 36 103.49 (43)

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

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

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

(44)m=	113.83	109.7	105.56	101.42	97.28	93.14	93.14	97.28	101.42	105.56	109.7	113.83	

Total = Sum(44)$_{1...12}$ = 1241.83 (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=	168.81	147.65	152.36	132.83	127.45	109.98	101.91	116.95	118.34	137.92	150.55	163.49	

Total = Sum(45)$_{1...12}$ = 1628.24 (45)

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

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

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 280 (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:

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a) If manufacturer's declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

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

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

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

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

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

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

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

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

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

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

(62)m=	143.49	125.5	129.5	112.9	108.33	93.48	86.63	99.41	100.59	117.23	127.97	138.96	(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=	143.49	125.5	129.5	112.9	108.33	93.48	86.63	99.41	100.59	117.23	127.97	138.96	

Output from water heater (annual)$_{1...12}$ 1384 (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=	35.87	31.37	32.38	28.23	27.08	23.37	21.66	24.85	25.15	29.31	31.99	34.74	(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=	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	(66)

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

(67)m=	28.21	25.06	20.38	15.43	11.53	9.74	10.52	13.68	18.36	23.31	27.2	29	(67)

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

(68)m=	309.55	312.76	304.67	287.43	265.68	245.24	231.58	228.37	236.46	253.69	275.45	295.89	(68)

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

(69)m=	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	(71)

Water heating gains (Table 5)

(72)m=	48.22	46.69	43.52	39.2	36.4	32.46	29.11	33.4	34.93	39.39	44.43	46.69	(72)

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

(73)m=	452.74	451.27	435.32	408.83	380.38	354.19	337.97	342.2	356.5	383.15	413.84	438.34	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x 0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x 0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x 0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x 0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x 0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x 0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x 0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x 0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x 0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x 0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x 0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x 0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x 0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x 0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x 0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x 0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x 0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x 0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x 0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x 0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x 0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x 0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
North	0.9x 0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
East	0.9x 1	x	0.68	x	19.64	x	0.63	x	0.7	=	4.05	(76)
East	0.9x 1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x 1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x 1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x 1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x 1	x	0.59	x	19.64	x	0.63	x	0.7	=	3.54	(76)

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East	0.9x	1	x	0.68	x	38.42	x	0.63	x	0.7	=	7.93	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	0.59	x	38.42	x	0.63	x	0.7	=	6.93	(76)
East	0.9x	1	x	0.68	x	63.27	x	0.63	x	0.7	=	13.05	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	0.59	x	63.27	x	0.63	x	0.7	=	11.41	(76)
East	0.9x	1	x	0.68	x	92.28	x	0.63	x	0.7	=	19.04	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	0.59	x	92.28	x	0.63	x	0.7	=	16.64	(76)
East	0.9x	1	x	0.68	x	113.09	x	0.63	x	0.7	=	23.33	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	0.59	x	113.09	x	0.63	x	0.7	=	20.39	(76)
East	0.9x	1	x	0.68	x	115.77	x	0.63	x	0.7	=	23.88	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	0.59	x	115.77	x	0.63	x	0.7	=	20.87	(76)
East	0.9x	1	x	0.68	x	110.22	x	0.63	x	0.7	=	22.74	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	0.59	x	110.22	x	0.63	x	0.7	=	19.87	(76)
East	0.9x	1	x	0.68	x	94.68	x	0.63	x	0.7	=	19.53	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)

Dwelling Fabric Energy Efficiency WorkSheet: New dwelling design stage

East	0.9x	1	x	0.59	x	94.68	x	0.63	x	0.7	=	17.07	(76)
East	0.9x	1	x	0.68	x	73.59	x	0.63	x	0.7	=	15.18	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	0.59	x	73.59	x	0.63	x	0.7	=	13.27	(76)
East	0.9x	1	x	0.68	x	45.59	x	0.63	x	0.7	=	9.4	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	0.59	x	45.59	x	0.63	x	0.7	=	8.22	(76)
East	0.9x	1	x	0.68	x	24.49	x	0.63	x	0.7	=	5.05	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	0.59	x	24.49	x	0.63	x	0.7	=	4.42	(76)
East	0.9x	1	x	0.68	x	16.15	x	0.63	x	0.7	=	3.33	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	0.59	x	16.15	x	0.63	x	0.7	=	2.91	(76)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)

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West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)

Dwelling Fabric Energy Efficiency WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)

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

(83)m=	134.13	262.18	432.22	632.47	777.9	797.76	758.89	649.86	503.25	311.13	167.18	110.35	(83)

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

(84)m=	586.87	713.45	867.54	1041.29	1158.27	1151.95	1096.86	992.06	859.75	694.29	581.02	548.69	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.98	0.91	0.75	0.58	0.66	0.91	0.99	1	1	(86)

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

(87)m=	19.66	19.82	20.09	20.45	20.76	20.94	20.99	20.98	20.83	20.4	19.97	19.64	(87)

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

(88)m=	20.01	20.01	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.02	20.02	20.01	(88)

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

(89)m=	1	1	0.99	0.97	0.87	0.67	0.46	0.54	0.86	0.99	1	1	(89)

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

(90)m=	18.77	18.93	19.2	19.56	19.86	20	20.03	20.02	19.92	19.52	19.09	18.76	(90)

fLA = Living area ÷ (4) = 0.09 (91)

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

(92)m=	18.86	19.01	19.28	19.65	19.94	20.09	20.12	20.11	20.01	19.61	19.17	18.84	(92)

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

(93)m=	18.86	19.01	19.28	19.65	19.94	20.09	20.12	20.11	20.01	19.61	19.17	18.84	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.96	0.87	0.67	0.47	0.55	0.85	0.99	1	1	(94)

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

(95)m=	586.47	712.01	860.65	1003.35	1006.63	776.01	519.44	542.28	734.13	684.45	580.09	548.43	(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=	2229.95	2156.46	1949.11	1621.83	1241.25	819.2	524.8	553.28	884.72	1356.34	1824.77	2222.87	(97)

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

(98)m=	1222.75	970.67	809.81	445.31	174.56	0	0	0	0	499.89	896.17	1245.78	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6264.94 (98)

Space heating requirement in kWh/m²/year 44.71 (99)

Dwelling Fabric Energy Efficiency WorkSheet: New dwelling design stage

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1402.44	1104.05	1131.93	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.86	0.92	0.89	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1207.98	1020.25	1007.44	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1469.04	1401.84	1281.78	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	187.97	283.9	204.1	0	0	0	0	

Total = Sum(104) = 675.97 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

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

Total = Sum(104) = 0 (106)

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

(107)m=	0	0	0	0	0	46.99	70.98	51.03	0	0	0	0	

Total = Sum(107) = 168.99 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 1.21 (108)

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

Fabric Energy Efficiency — (99) + (108) = 45.92 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Nicholas Cox	**Stroma Number:**	STRO005875
Software Name:	Stroma FSAP 2012	**Software Version:**	1.0.2.0

Property Address: Plot 5

Address : Plot 5, Land Off Feidr Eglwys,, Newport

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74	(1a) x	2.4	(2a) =	177.6	(3a)
First floor	66.12	(1b) x	2.5	(2b) =	165.3	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	140.12	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		342.9	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.09 (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)		0.34 (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) =		0.29 (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

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Wind Factor (22a)m = (22)m ÷ 4

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

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

0.37	0.36	0.35	0.32	0.31	0.27	0.27	0.27	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	(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	0.54	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	0.56	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	
Doors			2.1	x	1.6	=	3.36			(26)
Windows Type 1			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 2			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 3			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 4			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 5			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 6			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 7			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 8			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 9			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 10			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 11			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 12			0.59	x1/[1/(1.4)+ 0.04]		=	0.78			(27)
Windows Type 13			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Floor			74	x	0.12	=	8.88			(28)
Walls	149.43	25.06	124.36	x	0.15	=	18.65			(29)
Roof Type1	64	0	64	x	0.1	=	6.4			(30)

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Roof Type2	2.08	0	2.08	x	0.15	=	0.31		(30)
Total area of elements, m²			289.51						(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 68.05 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 32364.07 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 19.61 (36)

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

Total fabric heat loss (33) + (36) = 87.66 (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=	64.15	63.85	63.57	62.21	61.96	60.78	60.78	60.56	61.23	61.96	62.47	63.01	(38)

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

(39)m=	151.81	151.51	151.22	149.87	149.62	148.44	148.44	148.22	148.89	149.62	150.13	150.66	

Average = Sum(39)$_{1...12}$ /12= 149.87 (39)

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

(40)m=	1.08	1.08	1.08	1.07	1.07	1.06	1.06	1.06	1.06	1.07	1.07	1.08	

Average = Sum(40)$_{1...12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.92 (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) + 36 103.49 (43)

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

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

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

(44)m=	113.83	109.7	105.56	101.42	97.28	93.14	93.14	97.28	101.42	105.56	109.7	113.83	

Total = Sum(44)$_{1...12}$ = 1241.83 (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=	168.81	147.65	152.36	132.83	127.45	109.98	101.91	116.95	118.34	137.92	150.55	163.49	

Total = Sum(45)$_{1...12}$ = 1628.24 (45)

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

(46)m=	25.32	22.15	22.85	19.92	19.12	16.5	15.29	17.54	17.75	20.69	22.58	24.52	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 280 (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:

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a) If manufacturer's declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

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

(56)

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

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

(57)

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

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

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

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

(59)

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

(61)m=	34.21	30.89	34.19	33.08	34.17	33.05	34.15	34.16	33.07	34.18	33.09	34.2

(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=	203.02	178.54	186.55	165.91	161.62	143.03	136.06	151.11	151.41	172.1	183.64	197.69

(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=	203.02	178.54	186.55	165.91	161.62	143.03	136.06	151.11	151.41	172.1	183.64	197.69

Output from water heater (annual)$_{1...12}$ 2030.68 (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=	64.68	56.81	59.21	52.43	50.92	44.83	42.42	47.43	47.62	54.4	58.33	62.91

(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87

(66)

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

(67)m=	28.21	25.06	20.38	15.43	11.53	9.74	10.52	13.68	18.36	23.31	27.2	29

(67)

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

(68)m=	309.55	312.76	304.67	287.43	265.68	245.24	231.58	228.37	236.46	253.69	275.45	295.89

(68)

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

(69)m=	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59

(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10

(70)

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

(71)m=	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	(71)

Water heating gains (Table 5)

(72)m=	86.94	84.55	79.58	72.83	68.44	62.27	57.02	63.74	66.13	73.12	81.01	84.56	(72)

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

(73)m=	501.46	499.13	481.38	452.45	422.42	394	375.88	382.55	397.71	426.88	460.42	486.2	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x 0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x 0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x 0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x 0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x 0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x 0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x 0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x 0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x 0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x 0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x 0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x 0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x 0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x 0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x 0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x 0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x 0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x 0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x 0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x 0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x 0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x 0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
North	0.9x 0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
East	0.9x 1	x	0.68	x	19.64	x	0.63	x	0.7	=	4.05	(76)
East	0.9x 1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x 1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x 1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x 1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x 1	x	0.59	x	19.64	x	0.63	x	0.7	=	3.54	(76)

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East	0.9x	1	x	0.68	x	38.42	x	0.63	x	0.7	=	7.93	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	0.59	x	38.42	x	0.63	x	0.7	=	6.93	(76)
East	0.9x	1	x	0.68	x	63.27	x	0.63	x	0.7	=	13.05	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	0.59	x	63.27	x	0.63	x	0.7	=	11.41	(76)
East	0.9x	1	x	0.68	x	92.28	x	0.63	x	0.7	=	19.04	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	0.59	x	92.28	x	0.63	x	0.7	=	16.64	(76)
East	0.9x	1	x	0.68	x	113.09	x	0.63	x	0.7	=	23.33	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	0.59	x	113.09	x	0.63	x	0.7	=	20.39	(76)
East	0.9x	1	x	0.68	x	115.77	x	0.63	x	0.7	=	23.88	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	0.59	x	115.77	x	0.63	x	0.7	=	20.87	(76)
East	0.9x	1	x	0.68	x	110.22	x	0.63	x	0.7	=	22.74	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	0.59	x	110.22	x	0.63	x	0.7	=	19.87	(76)
East	0.9x	1	x	0.68	x	94.68	x	0.63	x	0.7	=	19.53	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)

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East	0.9x	1	x	0.59	x	94.68	x	0.63	x	0.7	=	17.07	(76)
East	0.9x	1	x	0.68	x	73.59	x	0.63	x	0.7	=	15.18	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	0.59	x	73.59	x	0.63	x	0.7	=	13.27	(76)
East	0.9x	1	x	0.68	x	45.59	x	0.63	x	0.7	=	9.4	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	0.59	x	45.59	x	0.63	x	0.7	=	8.22	(76)
East	0.9x	1	x	0.68	x	24.49	x	0.63	x	0.7	=	5.05	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	0.59	x	24.49	x	0.63	x	0.7	=	4.42	(76)
East	0.9x	1	x	0.68	x	16.15	x	0.63	x	0.7	=	3.33	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	0.59	x	16.15	x	0.63	x	0.7	=	2.91	(76)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)

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West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)

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West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)

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

(83)m=	134.13	262.18	432.22	632.47	777.9	797.76	758.89	649.86	503.25	311.13	167.18	110.35	(83)

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

(84)m=	635.59	761.31	913.6	1084.92	1200.31	1191.76	1134.77	1032.4	900.96	738.02	627.61	596.55	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.9	0.73	0.56	0.63	0.89	0.99	1	1	(86)

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

(87)m=	19.71	19.86	20.13	20.48	20.79	20.95	20.99	20.98	20.85	20.44	20.01	19.69	(87)

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

(88)m=	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.04	20.03	20.03	20.02	20.02	(88)

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

(89)m=	1	1	0.99	0.96	0.86	0.65	0.45	0.51	0.83	0.98	1	1	(89)

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

(90)m=	18.27	18.49	18.89	19.4	19.81	20	20.03	20.03	19.9	19.35	18.72	18.24	(90)

fLA = Living area ÷ (4) = 0.09 (91)

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

(92)m=	18.41	18.62	19	19.51	19.9	20.09	20.12	20.12	19.99	19.45	18.84	18.38	(92)

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

(93)m=	18.26	18.47	18.85	19.36	19.75	19.94	19.97	19.97	19.84	19.3	18.69	18.23	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.95	0.84	0.64	0.44	0.51	0.82	0.98	1	1	(94)

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

(95)m=	634.81	758.78	902.87	1032.79	1012.8	760.46	496.94	521.65	738.44	722.1	625.84	596.03	(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=	2119.34	2056.6	1868.18	1567.15	1204.94	792.54	500.41	528.82	854.62	1301.55	1739.7	2113.64	(97)

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

(98)m=	1104.49	872.13	718.19	384.74	142.95	0	0	0	0	431.11	801.98	1129.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5584.7 (98)

Space heating requirement in kWh/m²/year 39.86 (99)

DER WorkSheet: New dwelling design stage

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

Space heating:

Fraction of space heat from secondary/supplementary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		90.2 (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)												
1104.49	872.13	718.19	384.74	142.95	0	0	0	0	431.11	801.98	1129.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)												(211)
1224.49	966.89	796.22	426.54	158.48	0	0	0	0	477.95	889.12	1251.77	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 6191.46 (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)

203.02	178.54	186.55	165.91	161.62	143.03	136.06	151.11	151.41	172.1	183.64	197.69

Efficiency of water heater 87 (216)

(217)m=	89.69	89.64	89.52	89.21	88.47	87	87	87	87	89.26	89.59	89.71

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

(219)m=	226.36	199.17	208.39	185.97	182.68	164.41	156.39	173.69	174.03	192.8	204.99	220.37

Total = Sum(219a)$_{1...12}$ = 2289.25 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		6191.46
Water heating fuel used		2289.25
Electricity for pumps, fans and electric keep-hot		
central heating pump:	120	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	165 (231)
Electricity for lighting		498.27 (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 =	1337.35 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	494.48 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1831.83 (265)

DER WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	85.64	(267)
Electricity for lighting	(232)	x	0.519	=	258.6	(268)
Total CO2, kg/year			sum of (265)…(271) =		2176.07	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		15.53	(273)
EI rating (section 14)					84	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Nicholas Cox	**Stroma Number:**	STRO005875
Software Name:	Stroma FSAP 2012	**Software Version:**	1.0.2.0

Property Address: Plot 5

Address : Plot 5, Land Off Feidr Eglwys,, Newport

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	74	(1a) x	2.4	(2a) =	177.6	(3a)
First floor	66.12	(1b) x	2.5	(2b) =	165.3	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	140.12	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		342.9	(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							4	x 10 =	40	(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) =	40	÷ (5) =	0.12 (8)

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

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

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

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

(24d)

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

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

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.1	x	1.2	=	2.52			(26)
Windows Type 1			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 2			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 3			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 4			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 5			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 6			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 7			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 8			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 9			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 10			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 11			1.19	x1/[1/(1.4)+ 0.04]		=	1.58			(27)
Windows Type 12			0.59	x1/[1/(1.4)+ 0.04]		=	0.78			(27)
Windows Type 13			0.675	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Floor			74	x	0.13	=	9.62			(28)
Walls	149.43	25.06	124.36	x	0.18	=	22.39			(29)
Roof Type1	64	0	64	x	0.13	=	8.32			(30)

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Roof Type2	2.08	0	2.08	x	0.13	=	0.27		(30)
Total area of elements, m²			289.51						(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 73.56 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 32364.07 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 10.92 (36)

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

Total fabric heat loss (33) + (36) = 84.48 (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=	65.51	65.17	64.83	63.23	62.93	61.54	61.54	61.28	62.07	62.93	63.53	64.17	(38)

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

(39)m=	149.99	149.65	149.31	147.71	147.41	146.02	146.02	145.76	146.55	147.41	148.01	148.65	

Average = Sum(39)$_{1...12}$ /12= 147.71 (39)

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

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

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.92 (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) + 36 103.49 (43)

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

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

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

(44)m=	113.83	109.7	105.56	101.42	97.28	93.14	93.14	97.28	101.42	105.56	109.7	113.83	

Total = Sum(44)$_{1...12}$ = 1241.83 (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=	168.81	147.65	152.36	132.83	127.45	109.98	101.91	116.95	118.34	137.92	150.55	163.49	

Total = Sum(45)$_{1...12}$ = 1628.24 (45)

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

(46)m=	25.32	22.15	22.85	19.92	19.12	16.5	15.29	17.54	17.75	20.69	22.58	24.52	(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:

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a) If manufacturer's declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

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

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

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

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

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

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

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

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

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

(61)m=	50.96	46.03	50.96	49.32	49.57	45.93	47.46	49.57	49.32	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=	219.77	193.67	203.32	182.14	177.02	155.91	149.38	166.52	167.66	188.88	199.86	214.45	(62)

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

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

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

Output from water heater

(64)m=	219.77	193.67	203.32	182.14	177.02	155.91	149.38	166.52	167.66	188.88	199.86	214.45	

Output from water heater (annual)$_{1...12}$ 2218.58 (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=	68.87	60.6	63.4	56.49	54.77	48.05	45.75	51.28	51.68	58.6	62.39	67.1	(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=	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	145.87	(66)

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

(67)m=	28.21	25.06	20.38	15.43	11.53	9.74	10.52	13.68	18.36	23.31	27.2	29	(67)

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

(68)m=	309.55	312.76	304.67	287.43	265.68	245.24	231.58	228.37	236.46	253.69	275.45	295.89	(68)

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

(69)m=	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	37.59	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	-116.69	(71)

Water heating gains (Table 5)

(72)m=	92.57	90.18	85.21	78.46	73.62	66.74	61.49	68.92	71.78	78.76	86.65	90.19	(72)

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

(73)m=	507.09	504.76	487.02	458.09	427.59	398.47	380.35	387.72	403.35	432.52	466.06	491.84	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x	0.77	x	0.68	x	10.63	x	0.63	x	0.7	=	2.19	(74)
North	0.9x	0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x	0.77	x	0.68	x	20.32	x	0.63	x	0.7	=	4.19	(74)
North	0.9x	0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x	0.77	x	0.68	x	34.53	x	0.63	x	0.7	=	7.12	(74)
North	0.9x	0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x	0.77	x	0.68	x	55.46	x	0.63	x	0.7	=	11.44	(74)
North	0.9x	0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x	0.77	x	0.68	x	74.72	x	0.63	x	0.7	=	15.41	(74)
North	0.9x	0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x	0.77	x	0.68	x	79.99	x	0.63	x	0.7	=	16.5	(74)
North	0.9x	0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x	0.77	x	0.68	x	74.68	x	0.63	x	0.7	=	15.4	(74)
North	0.9x	0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x	0.77	x	0.68	x	59.25	x	0.63	x	0.7	=	12.22	(74)
North	0.9x	0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x	0.77	x	0.68	x	41.52	x	0.63	x	0.7	=	8.56	(74)
North	0.9x	0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x	0.77	x	0.68	x	24.19	x	0.63	x	0.7	=	4.99	(74)
North	0.9x	0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x	0.77	x	0.68	x	13.12	x	0.63	x	0.7	=	2.71	(74)
North	0.9x	0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
North	0.9x	0.77	x	0.68	x	8.86	x	0.63	x	0.7	=	1.83	(74)
East	0.9x	1	x	0.68	x	19.64	x	0.63	x	0.7	=	4.05	(76)
East	0.9x	1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x	1	x	4.2	x	19.64	x	0.63	x	0.7	=	25.21	(76)
East	0.9x	1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x	1	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(76)
East	0.9x	1	x	0.59	x	19.64	x	0.63	x	0.7	=	3.54	(76)

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East	0.9x	1	x	0.68	x	38.42	x	0.63	x	0.7	=	7.93	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	4.2	x	38.42	x	0.63	x	0.7	=	49.32	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(76)
East	0.9x	1	x	0.59	x	38.42	x	0.63	x	0.7	=	6.93	(76)
East	0.9x	1	x	0.68	x	63.27	x	0.63	x	0.7	=	13.05	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	4.2	x	63.27	x	0.63	x	0.7	=	81.22	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(76)
East	0.9x	1	x	0.59	x	63.27	x	0.63	x	0.7	=	11.41	(76)
East	0.9x	1	x	0.68	x	92.28	x	0.63	x	0.7	=	19.04	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	4.2	x	92.28	x	0.63	x	0.7	=	118.45	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(76)
East	0.9x	1	x	0.59	x	92.28	x	0.63	x	0.7	=	16.64	(76)
East	0.9x	1	x	0.68	x	113.09	x	0.63	x	0.7	=	23.33	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	4.2	x	113.09	x	0.63	x	0.7	=	145.16	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(76)
East	0.9x	1	x	0.59	x	113.09	x	0.63	x	0.7	=	20.39	(76)
East	0.9x	1	x	0.68	x	115.77	x	0.63	x	0.7	=	23.88	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	4.2	x	115.77	x	0.63	x	0.7	=	148.6	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(76)
East	0.9x	1	x	0.59	x	115.77	x	0.63	x	0.7	=	20.87	(76)
East	0.9x	1	x	0.68	x	110.22	x	0.63	x	0.7	=	22.74	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	4.2	x	110.22	x	0.63	x	0.7	=	141.47	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(76)
East	0.9x	1	x	0.59	x	110.22	x	0.63	x	0.7	=	19.87	(76)
East	0.9x	1	x	0.68	x	94.68	x	0.63	x	0.7	=	19.53	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	4.2	x	94.68	x	0.63	x	0.7	=	121.52	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)
East	0.9x	1	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(76)

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East	0.9x	1	x	0.59	x	94.68	x	0.63	x	0.7	=	17.07	(76)
East	0.9x	1	x	0.68	x	73.59	x	0.63	x	0.7	=	15.18	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	4.2	x	73.59	x	0.63	x	0.7	=	94.46	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(76)
East	0.9x	1	x	0.59	x	73.59	x	0.63	x	0.7	=	13.27	(76)
East	0.9x	1	x	0.68	x	45.59	x	0.63	x	0.7	=	9.4	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	4.2	x	45.59	x	0.63	x	0.7	=	58.52	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(76)
East	0.9x	1	x	0.59	x	45.59	x	0.63	x	0.7	=	8.22	(76)
East	0.9x	1	x	0.68	x	24.49	x	0.63	x	0.7	=	5.05	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	4.2	x	24.49	x	0.63	x	0.7	=	31.43	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(76)
East	0.9x	1	x	0.59	x	24.49	x	0.63	x	0.7	=	4.42	(76)
East	0.9x	1	x	0.68	x	16.15	x	0.63	x	0.7	=	3.33	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	4.2	x	16.15	x	0.63	x	0.7	=	20.73	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(76)
East	0.9x	1	x	0.59	x	16.15	x	0.63	x	0.7	=	2.91	(76)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	1.19	x	19.64	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	1.19	x	38.42	x	0.63	x	0.7	=	13.97	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	1.19	x	63.27	x	0.63	x	0.7	=	23.01	(80)
West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)

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West	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	1.19	x	92.28	x	0.63	x	0.7	=	33.56	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	1.19	x	113.09	x	0.63	x	0.7	=	41.13	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	1.19	x	115.77	x	0.63	x	0.7	=	42.1	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	1.19	x	110.22	x	0.63	x	0.7	=	40.08	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	1.19	x	94.68	x	0.63	x	0.7	=	34.43	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	1.19	x	73.59	x	0.63	x	0.7	=	26.76	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	1.19	x	45.59	x	0.63	x	0.7	=	16.58	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	1.19	x	24.49	x	0.63	x	0.7	=	8.91	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)
West	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(80)

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West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)
West	0.9x	0.77	x	1.19	x	16.15	x	0.63	x	0.7	=	5.87	(80)

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

(83)m=	134.13	262.18	432.22	632.47	777.9	797.76	758.89	649.86	503.25	311.13	167.18	110.35	(83)

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

(84)m=	641.22	766.94	919.24	1090.56	1205.49	1196.23	1139.25	1037.58	906.6	743.65	633.24	602.18	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.89	0.73	0.55	0.62	0.89	0.99	1	1	(86)

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

(87)m=	19.73	19.88	20.15	20.5	20.8	20.95	20.99	20.98	20.86	20.46	20.03	19.71	(87)

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

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

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

(89)m=	1	1	0.99	0.96	0.85	0.64	0.44	0.51	0.83	0.98	1	1	(89)

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

(90)m=	18.31	18.53	18.92	19.44	19.84	20.02	20.05	20.04	19.92	19.38	18.76	18.29	(90)

fLA = Living area ÷ (4) = 0.09 (91)

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

(92)m=	18.45	18.66	19.04	19.54	19.93	20.11	20.13	20.13	20.01	19.48	18.88	18.42	(92)

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

(93)m=	18.45	18.66	19.04	19.54	19.93	20.11	20.13	20.13	20.01	19.48	18.88	18.42	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.95	0.85	0.64	0.45	0.52	0.82	0.98	1	1	(94)

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

(95)m=	640.45	764.46	908.68	1039.06	1020.3	771.1	512.3	536.2	747.63	728.1	631.5	601.67	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	2122.1	2059.34	1872.29	1571.86	1213.01	803.95	516.12	543.99	866.46	1309.35	1743.02	2113.71	(97)

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

(98)m=	1102.35	870.16	716.93	383.62	143.37	0	0	0	0	432.45	800.29	1124.95	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5574.13 (98)

Space heating requirement in kWh/m²/year 39.78 (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)	1102.35	870.16	716.93	383.62	143.37	0	0	0	0	432.45	800.29	1124.95	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1180.24	931.65	767.59	410.73	153.51	0	0	0	0	463.01	856.85	1204.45	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 5968.01 (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)

	219.77	193.67	203.32	182.14	177.02	155.91	149.38	166.52	167.66	188.88	199.86	214.45	

Efficiency of water heater 80.3 (216)

(217)m=	88.55	88.38	87.96	86.88	84.53	80.3	80.3	80.3	80.3	87.07	88.18	88.62	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	248.19	219.15	231.16	209.65	209.43	194.16	186.02	207.37	208.79	216.92	226.65	242	

Total = Sum(219a)$_{1...12}$ = 2599.49 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		5968.01
Water heating fuel used		2599.49
Electricity for pumps, fans and electric keep-hot		
central heating pump:	120	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	165 (231)
Electricity for lighting		498.27 (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 =	1289.09 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	561.49 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1850.58 (265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	85.64	(267)
Electricity for lighting	(232)	x	0.519	=	258.6	(268)
Total CO2, kg/year			sum of (265)…(271) =		2194.82	(272)

TER = 15.66 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 16 January 2019

Property Details: Plot 5

Dwelling type:	Detached House
Located in:	Wales
Region:	Wales
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	6 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	678.94	**(P1)**
Transmission heat loss coefficient:	87.7	
Summer heat loss coefficient:	766.6	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
West (W1)	0	1
West (W2)	0	1
East (W3)	0	1
East (D02)	0	1
East (D03)	0	1
North (W4)	0	1
West (W5)	0	1
West (W6)	0	1
West (W7)	0	1
East (W8)	0	1
East (W9)	0	1
East (W10)	0	1
North (W11)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
West (W1)	1	0.9	1	0.9	**(P8)**
West (W2)	1	0.9	1	0.9	**(P8)**
East (W3)	1	0.9	1	0.9	**(P8)**
East (D02)	1	0.9	1	0.9	**(P8)**
East (D03)	1	0.9	1	0.9	**(P8)**
North (W4)	1	0.9	1	0.9	**(P8)**
West (W5)	1	0.9	1	0.9	**(P8)**
West (W6)	1	0.9	1	0.9	**(P8)**
West (W7)	1	0.9	1	0.9	**(P8)**
East (W8)	1	0.9	1	0.9	**(P8)**
East (W9)	1	0.9	1	0.9	**(P8)**
East (W10)	1	0.9	1	0.9	**(P8)**
North (W11)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains

SAP 2012 Overheating Assessment

West (W1)	0.9 x	3	115.64	0.63	0.7	0.9	123.92	
West (W2)	0.9 x	3	115.64	0.63	0.7	0.9	123.92	
East (W3)	0.9 x	0.68	115.64	0.63	0.7	0.9	27.88	
East (D02)	0.9 x	4.2	115.64	0.63	0.7	0.9	173.49	
East (D03)	0.9 x	4.2	115.64	0.63	0.7	0.9	173.49	
North (W4)	0.9 x	0.68	79.08	0.63	0.7	0.9	19.07	
West (W5)	0.9 x	1.19	115.64	0.63	0.7	0.9	49.15	
West (W6)	0.9 x	1.19	115.64	0.63	0.7	0.9	49.15	
West (W7)	0.9 x	1.19	115.64	0.63	0.7	0.9	49.15	
East (W8)	0.9 x	1.19	115.64	0.63	0.7	0.9	49.15	
East (W9)	0.9 x	1.19	115.64	0.63	0.7	0.9	49.15	
East (W10)	0.9 x	0.59	115.64	0.63	0.7	0.9	24.37	
North (W11)	0.9 x	0.68	79.08	0.63	0.7	0.9	19.07	
						Total	930.97	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	566.4	542.73	552.55	
Total summer gains	1589.03	1473.7	1357.27	**(P5)**
Summer gain/loss ratio	2.07	1.92	1.77	**(P6)**
Mean summer external temperature (Wales)	13.7	15.3	15.3	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	16.02	17.47	17.32	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Not significant**	**Not significant**	

Assessment of likelihood of high internal temperature: Not significant