Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.1.25
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Project Information:

Assessed By: Neil Ingham (STRO010943) **Building Type:** Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 755.97m²

Site Reference : Plot 1 North Thoresby **Plot Reference:** Plot 1 North Thoresby

Address : Plot 1, North Thoresby, Grimsby

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.47 (electricity)

Target Carbon Dioxide Emission Rate (TER)	17.8 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	1.18 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.7 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	47.4 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.26 (max. 0.30)	0.30 (max. 0.70)	**OK**
Floor	0.19 (max. 0.25)	0.20 (max. 0.70)	**OK**
Roof	0.17 (max. 0.20)	0.20 (max. 0.35)	**OK**
Openings	1.43 (max. 2.00)	3.00 (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	2.50 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:
Database: (rev 382, product index 100071):
Heat pumps with radiators or underfloor heating - electric
Brand name:
Model:
Model qualifier:
()
Minimum 88.0 %

Secondary heating system:
Room heaters - wood
Closed room heater
Efficiency 65.0 %
Minimum 65.0 % **OK**

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.80 kWh/day	
	Permitted by DBSCG: 2.86 kWh/day	
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

Continuous supply and extract system		
Specific fan power:	1.06	
Maximum	1.5	**OK**
MVHR efficiency:	83%	
Minimum	70%	**OK**

9 Summertime temperature

Overheating risk (East Pennines):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: South	30.83m²
Windows facing: West	27.79m²
Windows facing: East	2.37m²
Windows facing: North	36.89m²
Roof windows facing: South	2.55m²
Roof windows facing: West	1.5m²
Roof windows facing: North	1.45m²
Ventilation rate:	8.00
Blinds/curtains:	Closed 100% of daylight hours

10 Key features

Air permeablility	2.5 m³/m²h
Photovoltaic array	
Secondary heating (wood pellets (in bags, for secondary heating))	
Secondary heating fuel wood pellets (in bags, for secondary heating)	

Predicted Energy Assessment

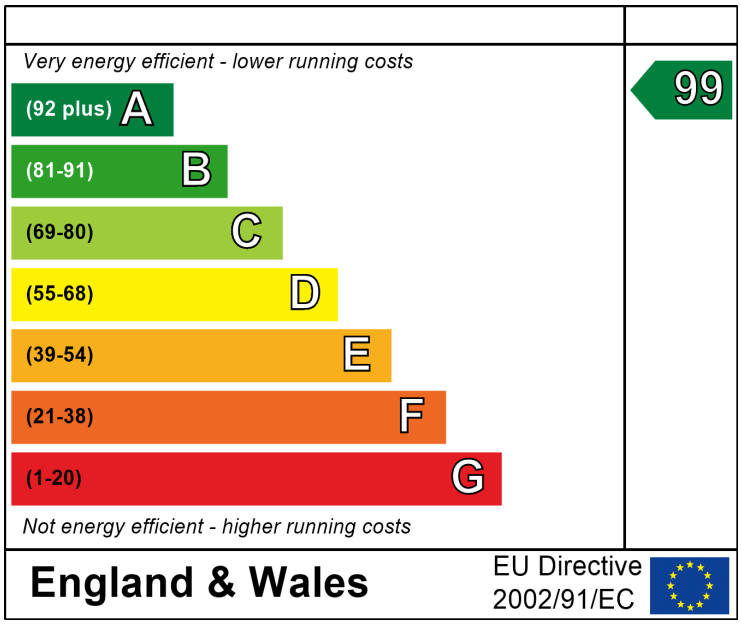
Plot 1
North Thoresby
Grimsby

Dwelling type: Detached House
Date of assessment: 23 September 2015
Produced by: Neil Ingham
Total floor area: 755.97 m²

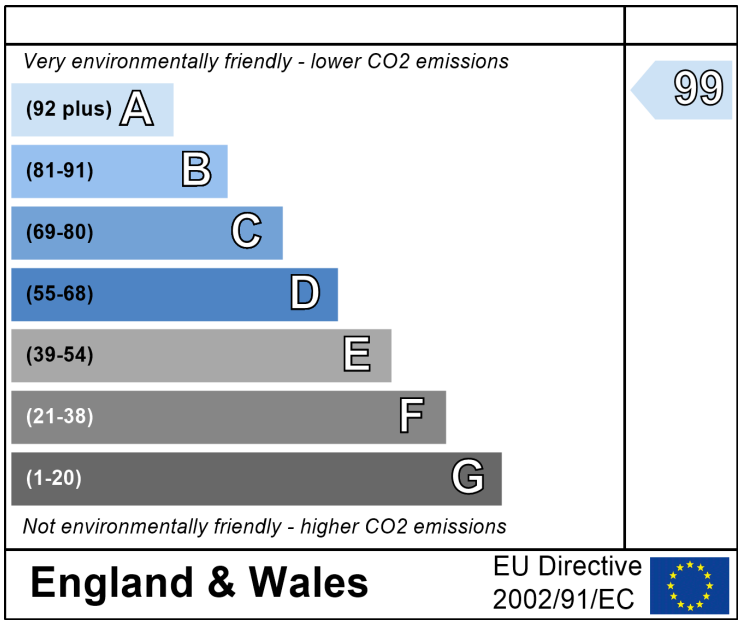
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about 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 1 North Thoresby

Address:	Plot 1, North Thoresby, Grimsby
Located in:	England
Region:	East Pennines
UPRN:	
Date of assessment:	23 September 2015
Date of certificate:	25 September 2015
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Calculated 120.44
Water use <= 125 litres/person/day:	True
PCDF Version:	382

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2015

Floor Location:	Floor area:	Storey height:
Basement floor	226.13 m²	2.53 m
Floor 1	270.6 m²	3.325 m
Floor 2	259.24 m²	2.46 m

Living area:	172.18 m² (fraction 0.228)
Front of dwelling faces:	South

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
D1	SAP 2012	Solid			Wood
South	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
West	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
East	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
North	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
South	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
West	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
North	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
D1	mm	0.7	0	3	1.89	1
South	16mm or more	0.8	0.63	1.4	30.83	1
West	16mm or more	0.8	0.63	1.4	27.79	1
East	16mm or more	0.8	0.63	1.4	2.37	1
North	16mm or more	0.8	0.63	1.4	36.89	1
South	16mm or more	0.8	0.63	1.4	2.55	1
West	16mm or more	0.8	0.63	1.4	1.5	1
North	16mm or more	0.8	0.63	1.4	1.45	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
D1		Timber Clad Wall	East	0.9	2.1
South		Timber Clad Wall	South	0	0
West		Timber Clad Wall	West	0	0
East		Timber Clad Wall	East	0	0
North		Timber Clad Wall	North	0	0
South		Pitched Roof	South	0	0
West		Pitched Roof	West	0	0

SAP Input

North	Pitched Roof	North	0	0	

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
Timber Clad Wall	427.24	99.77	327.47	0.24	0	False	60
Basement Wall	136.66	0	136.66	0.3	0	False	60
Dormer Wall	7.16	0	7.16	0.25	0	False	9
Ceiling	121.09	0	121.09	0.17	0		9
Pitched Roof	168.65	5.5	163.15	0.17	0		9
Flat Roof	13.95	0	13.95	0.2	0		9
Basement Floor	226.13			0.2			75
Ground Floor	46.64			0.14			110
Internal Elements							
Stud	369.28						9
Block	200.04						75
Ceiling	742.02						9
Floor	742.02						18
Party Elements							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0429

	Length	Psi-value		
[Approved]	38.272	0.3	E2	Other lintels (including other steel lintels)
[Approved]	15.049	0.04	E3	Sill
[Approved]	113.776	0.05	E4	Jamb
	64.69	0.07	E22	Basement floor
[Approved]	142.31	0.07	E6	Intermediate floor within a dwelling
[Approved]	47.34	0.06	E10	Eaves (insulation at ceiling level)
[Approved]	42.81	0.04	E11	Eaves (insulation at rafter level)
[Approved]	27.49	0.24	E12	Gable (insulation at ceiling level)
[Approved]	36.9	0.04	E13	Gable (insulation at rafter level)
[Approved]	10.61	0	E14	Flat roof
[Approved]	57.86	0.09	E16	Corner (normal)
[Approved]	22.06	-0.09	E17	Corner (inverted internal area greater than external area)
	11.68	0.08	R4	Ridge (vaulted ceiling)
	5.81	0.04	R5	Ridge (inverted)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 2.5

Main heating system:

Main heating system: Heat pumps with radiators or underfloor heating
Electric heat pumps
Fuel: Electricity
Info Source: Boiler Database

SAP Input

	Database: (rev 382, product index 100071, SEDBUK 387%): Brand name: Vaillant Model: geoTHERM 10 kW Model qualifier: VWS 101/2 - Radiators (provides DHW all year) Underfloor heating, pipes in screed above insulation Central heating pump : 2013 or later Design flow temperature: Unknown Room-sealed Boiler interlock: Yes MCS Installation Certificate
Main heating Control:	
Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services Control code: 2207
Secondary heating system:	
Secondary heating system:	Room heaters Solid fuel room heaters Fuel :wood pellets (in bags, for secondary heating) Info Source: SAP Tables Closed room heater HETAS Approved
Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 300 litres Cylinder insulation: Measured loss, 1.8kWh/day 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:	Rural
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 14.88 Tilt of collector: 30° Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.1.25

Property Address: Plot 1 North Thoresby

Address : Plot 1, North Thoresby, Grimsby

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	226.13	(1a) x	2.53	(2a) =	572.11	(3a)
Ground floor	270.6	(1b) x	3.33	(2b) =	899.75	(3b)
First floor	259.24	(1c) x	2.46	(2c) =	637.73	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	755.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		2109.58	(5)

2. Ventilation rate:

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

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		2.5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.12	(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) =	0.11	(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

0.14	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.11	0.11	0.12	0.12

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 70.55 (23c)

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

(24a)m=	0.28	0.28	0.28	0.26	0.26	0.25	0.25	0.25	0.25	0.26	0.27	0.27

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

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

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

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	3	=	5.67			(26)
Windows Type 1			30.83	x1/[1/(1.4)+ 0.04]		=	40.87			(27)
Windows Type 2			27.79	x1/[1/(1.4)+ 0.04]		=	36.84			(27)
Windows Type 3			2.37	x1/[1/(1.4)+ 0.04]		=	3.14			(27)
Windows Type 4			36.89	x1/[1/(1.4)+ 0.04]		=	48.91			(27)
Rooflights Type 1			2.55	x1/[1/(1.4) + 0.04]		=	3.57			(27b)
Rooflights Type 2			1.5	x1/[1/(1.4) + 0.04]		=	2.1			(27b)
Rooflights Type 3			1.45	x1/[1/(1.4) + 0.04]		=	2.03			(27b)
Floor Type 1			226.13	x	0.2	=	45.226	75	16959.75	(28)
Floor Type 2			46.64	x	0.14	=	6.5296	110	5130.4	(28)
Walls Type1	427.24	99.77	327.47	x	0.24	=	78.59	60	19648.2	(29)
Walls Type2	136.66	0	136.66	x	0.3	=	41	60	8199.6	(29)
Walls Type3	7.16	0	7.16	x	0.25	=	1.79	9	64.44	(29)
Roof Type1	121.09	0	121.09	x	0.17	=	20.59	9	1089.81	(30)
Roof Type2	168.65	5.5	163.15	x	0.17	=	27.74	9	1468.35	(30)
Roof Type3	13.95	0	13.95	x	0.2	=	2.79	9	125.55	(30)
Total area of elements, m²			1147.52							(31)

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Internal wall **	369.28	9	3323.52	(32c)
Internal wall **	200.04	75	15003	(32c)
Internal floor	742.02	18	13356.36	(32d)
Internal ceiling	742.02	9	6678.18	(32e)

** 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) = 366.97 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 91047.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 120.44 (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 49.28 (36)

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

Total fabric heat loss (33) + (36) = 416.25 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	196.82	194.97	193.12	183.87	182.02	172.78	172.78	170.93	176.48	182.02	185.72	189.42	(38)

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

(39)m=	613.07	611.22	609.37	600.13	598.28	589.03	589.03	587.18	592.73	598.28	601.97	605.67	

Average = Sum(39)$_{1...12}$ /12= 599.66 (39)

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

(40)m=	0.81	0.81	0.81	0.79	0.79	0.78	0.78	0.78	0.78	0.79	0.8	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (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 3.72 (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) + 36 122.66 (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=	134.93	130.02	125.11	120.21	115.3	110.4	110.4	115.3	120.21	125.11	130.02	134.93	

Total = Sum(44)$_{1...12}$ = 1471.94 (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=	200.09	175	180.59	157.44	151.07	130.36	120.8	138.62	140.27	163.47	178.45	193.78	

Total = Sum(45)$_{1...12}$ = 1929.94 (45)

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

(46)m=	30.01	26.25	27.09	23.62	22.66	19.55	18.12	20.79	21.04	24.52	26.77	29.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):		1.8	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.97	(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)		0.97	(55)

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

(56)m=	30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13 (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=	30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13 (57)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26 (59)

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

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

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

(62)m=	253.49	223.23	233.98	209.11	204.46	159.52	150.93	168.75	169.43	216.87	230.12	247.17 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	253.49	223.23	233.98	209.11	204.46	0	0	0	0	216.87	230.12	247.17

Output from water heater (annual)$_{1...12}$: 1818.44 (64)

Output immersion

(64)m=	0	0	0	0	0	159.52	150.93	168.75	169.43	0	0	0

Output from immersion (annual)$_{1...12}$: 648.632524238295 (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=	109.25	96.77	102.76	93.69	92.95	66.67	64.27	70.2	69.97	97.07	100.67	107.15 (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=	223.48	223.48	223.48	223.48	223.48	223.48	223.48	223.48	223.48	223.48	223.48	223.48 (66)

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

(67)m=	179.21	159.18	129.45	98	73.26	61.85	66.83	86.87	116.59	148.04	172.78	184.19 (67)

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

(68)m=	1147.47	1159.37	1129.37	1065.49	984.85	909.07	858.44	846.53	876.54	940.42	1021.05	1096.84 (68)

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

(69)m=	61.07	61.07	61.07	61.07	61.07	61.07	61.07	61.07	61.07	61.07	61.07	61.07	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	(71)

Water heating gains (Table 5)

(72)m=	146.84	144	138.12	130.12	124.93	92.6	86.39	94.35	97.18	130.47	139.82	144.02	(72)

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

(73)m=	1609.08	1598.12	1532.5	1429.18	1318.61	1199.08	1147.22	1163.31	1225.88	1354.49	1469.22	1560.61	(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 36.89	x	10.63	x	0.63	x	0.8	=	137.01	(74)
North	0.9x	0.77	x 36.89	x	20.32	x	0.63	x	0.8	=	261.83	(74)
North	0.9x	0.77	x 36.89	x	34.53	x	0.63	x	0.8	=	444.91	(74)
North	0.9x	0.77	x 36.89	x	55.46	x	0.63	x	0.8	=	714.64	(74)
North	0.9x	0.77	x 36.89	x	74.72	x	0.63	x	0.8	=	962.69	(74)
North	0.9x	0.77	x 36.89	x	79.99	x	0.63	x	0.8	=	1030.58	(74)
North	0.9x	0.77	x 36.89	x	74.68	x	0.63	x	0.8	=	962.18	(74)
North	0.9x	0.77	x 36.89	x	59.25	x	0.63	x	0.8	=	763.37	(74)
North	0.9x	0.77	x 36.89	x	41.52	x	0.63	x	0.8	=	534.93	(74)
North	0.9x	0.77	x 36.89	x	24.19	x	0.63	x	0.8	=	311.67	(74)
North	0.9x	0.77	x 36.89	x	13.12	x	0.63	x	0.8	=	169.02	(74)
North	0.9x	0.77	x 36.89	x	8.86	x	0.63	x	0.8	=	114.22	(74)
East	0.9x	1	x 2.37	x	19.64	x	0.63	x	0.8	=	16.26	(76)
East	0.9x	1	x 2.37	x	38.42	x	0.63	x	0.8	=	31.8	(76)
East	0.9x	1	x 2.37	x	63.27	x	0.63	x	0.8	=	52.38	(76)
East	0.9x	1	x 2.37	x	92.28	x	0.63	x	0.8	=	76.39	(76)
East	0.9x	1	x 2.37	x	113.09	x	0.63	x	0.8	=	93.62	(76)
East	0.9x	1	x 2.37	x	115.77	x	0.63	x	0.8	=	95.83	(76)
East	0.9x	1	x 2.37	x	110.22	x	0.63	x	0.8	=	91.24	(76)
East	0.9x	1	x 2.37	x	94.68	x	0.63	x	0.8	=	78.37	(76)
East	0.9x	1	x 2.37	x	73.59	x	0.63	x	0.8	=	60.92	(76)
East	0.9x	1	x 2.37	x	45.59	x	0.63	x	0.8	=	37.74	(76)
East	0.9x	1	x 2.37	x	24.49	x	0.63	x	0.8	=	20.27	(76)
East	0.9x	1	x 2.37	x	16.15	x	0.63	x	0.8	=	13.37	(76)
South	0.9x	0.77	x 30.83	x	46.75	x	0.63	x	0.8	=	503.43	(78)
South	0.9x	0.77	x 30.83	x	76.57	x	0.63	x	0.8	=	824.49	(78)

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South	0.9x	0.77	x	30.83	x	97.53	x	0.63	x	0.8	=	1050.25	(78)
South	0.9x	0.77	x	30.83	x	110.23	x	0.63	x	0.8	=	1187.01	(78)
South	0.9x	0.77	x	30.83	x	114.87	x	0.63	x	0.8	=	1236.94	(78)
South	0.9x	0.77	x	30.83	x	110.55	x	0.63	x	0.8	=	1190.38	(78)
South	0.9x	0.77	x	30.83	x	108.01	x	0.63	x	0.8	=	1163.08	(78)
South	0.9x	0.77	x	30.83	x	104.89	x	0.63	x	0.8	=	1129.51	(78)
South	0.9x	0.77	x	30.83	x	101.89	x	0.63	x	0.8	=	1097.11	(78)
South	0.9x	0.77	x	30.83	x	82.59	x	0.63	x	0.8	=	889.29	(78)
South	0.9x	0.77	x	30.83	x	55.42	x	0.63	x	0.8	=	596.73	(78)
South	0.9x	0.77	x	30.83	x	40.4	x	0.63	x	0.8	=	435.01	(78)
West	0.9x	0.77	x	27.79	x	19.64	x	0.63	x	0.8	=	190.63	(80)
West	0.9x	0.77	x	27.79	x	38.42	x	0.63	x	0.8	=	372.92	(80)
West	0.9x	0.77	x	27.79	x	63.27	x	0.63	x	0.8	=	614.15	(80)
West	0.9x	0.77	x	27.79	x	92.28	x	0.63	x	0.8	=	895.7	(80)
West	0.9x	0.77	x	27.79	x	113.09	x	0.63	x	0.8	=	1097.71	(80)
West	0.9x	0.77	x	27.79	x	115.77	x	0.63	x	0.8	=	1123.7	(80)
West	0.9x	0.77	x	27.79	x	110.22	x	0.63	x	0.8	=	1069.81	(80)
West	0.9x	0.77	x	27.79	x	94.68	x	0.63	x	0.8	=	918.95	(80)
West	0.9x	0.77	x	27.79	x	73.59	x	0.63	x	0.8	=	714.28	(80)
West	0.9x	0.77	x	27.79	x	45.59	x	0.63	x	0.8	=	442.5	(80)
West	0.9x	0.77	x	27.79	x	24.49	x	0.63	x	0.8	=	237.7	(80)
West	0.9x	0.77	x	27.79	x	16.15	x	0.63	x	0.8	=	156.77	(80)
Rooflights	0.9x	1	x	2.55	x	43.99	x	0.63	x	0.8	=	50.88	(82)
Rooflights	0.9x	1	x	1.5	x	26.46	x	0.63	x	0.8	=	18.01	(82)
Rooflights	0.9x	1	x	1.45	x	16.18	x	0.63	x	0.8	=	10.64	(82)
Rooflights	0.9x	1	x	2.55	x	80.27	x	0.63	x	0.8	=	92.85	(82)
Rooflights	0.9x	1	x	1.5	x	53.3	x	0.63	x	0.8	=	36.27	(82)
Rooflights	0.9x	1	x	1.45	x	30.63	x	0.63	x	0.8	=	20.15	(82)
Rooflights	0.9x	1	x	2.55	x	121.32	x	0.63	x	0.8	=	140.32	(82)
Rooflights	0.9x	1	x	1.5	x	91.66	x	0.63	x	0.8	=	62.37	(82)
Rooflights	0.9x	1	x	1.45	x	55.7	x	0.63	x	0.8	=	36.64	(82)
Rooflights	0.9x	1	x	2.55	x	165.18	x	0.63	x	0.8	=	191.06	(82)
Rooflights	0.9x	1	x	1.5	x	139.87	x	0.63	x	0.8	=	95.17	(82)
Rooflights	0.9x	1	x	1.45	x	101.28	x	0.63	x	0.8	=	66.62	(82)
Rooflights	0.9x	1	x	2.55	x	195.41	x	0.63	x	0.8	=	226.03	(82)
Rooflights	0.9x	1	x	1.5	x	176.97	x	0.63	x	0.8	=	120.41	(82)
Rooflights	0.9x	1	x	1.45	x	149.52	x	0.63	x	0.8	=	98.34	(82)
Rooflights	0.9x	1	x	2.55	x	197.72	x	0.63	x	0.8	=	228.7	(82)
Rooflights	0.9x	1	x	1.5	x	183.63	x	0.63	x	0.8	=	124.94	(82)
Rooflights	0.9x	1	x	1.45	x	166.08	x	0.63	x	0.8	=	109.23	(82)
Rooflights	0.9x	1	x	2.55	x	189.14	x	0.63	x	0.8	=	218.77	(82)

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Rooflights 0.9x	1	x	1.5	x	173.81	x	0.63	x	0.8	=	118.26	(82)
Rooflights 0.9x	1	x	1.45	x	152.65	x	0.63	x	0.8	=	100.4	(82)
Rooflights 0.9x	1	x	2.55	x	166.58	x	0.63	x	0.8	=	192.68	(82)
Rooflights 0.9x	1	x	1.5	x	145.57	x	0.63	x	0.8	=	99.04	(82)
Rooflights 0.9x	1	x	1.45	x	112.79	x	0.63	x	0.8	=	74.19	(82)
Rooflights 0.9x	1	x	2.55	x	136.8	x	0.63	x	0.8	=	158.24	(82)
Rooflights 0.9x	1	x	1.5	x	108.61	x	0.63	x	0.8	=	73.9	(82)
Rooflights 0.9x	1	x	1.45	x	70.26	x	0.63	x	0.8	=	46.21	(82)
Rooflights 0.9x	1	x	2.55	x	92.07	x	0.63	x	0.8	=	106.5	(82)
Rooflights 0.9x	1	x	1.5	x	64.26	x	0.63	x	0.8	=	43.73	(82)
Rooflights 0.9x	1	x	1.45	x	37.03	x	0.63	x	0.8	=	24.36	(82)
Rooflights 0.9x	1	x	2.55	x	53.73	x	0.63	x	0.8	=	62.15	(82)
Rooflights 0.9x	1	x	1.5	x	33.27	x	0.63	x	0.8	=	22.64	(82)
Rooflights 0.9x	1	x	1.45	x	19.8	x	0.63	x	0.8	=	13.02	(82)
Rooflights 0.9x	1	x	2.55	x	36.94	x	0.63	x	0.8	=	42.73	(82)
Rooflights 0.9x	1	x	1.5	x	21.59	x	0.63	x	0.8	=	14.69	(82)
Rooflights 0.9x	1	x	1.45	x	13.64	x	0.63	x	0.8	=	8.97	(82)

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

(83)m=	926.86	1640.3	2401.01	3226.58	3835.72	3903.37	3723.73	3256.1	2685.58	1855.78	1121.53	785.75	(83)

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

(84)m=	2535.94	3238.42	3933.52	4655.76	5154.33	5102.46	4870.95	4419.42	3911.45	3210.27	2590.75	2346.37	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.93	0.82	0.66	0.51	0.57	0.81	0.96	0.99	1	(86)

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

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

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

(88)m=	20.24	20.25	20.25	20.26	20.26	20.27	20.27	20.27	20.27	20.26	20.26	20.25	(88)

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

(89)m=	1	0.99	0.97	0.91	0.79	0.6	0.43	0.49	0.77	0.95	0.99	1	(89)

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

(90)m=	20.24	20.25	20.25	20.26	20.26	20.27	20.27	20.27	20.27	20.26	20.26	20.25	(90)

fLA = Living area ÷ (4) = 0.23 (91)

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

(92)m=	20.42	20.42	20.42	20.43	20.43	20.44	20.44	20.44	20.43	20.43	20.43	20.42	(92)

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

(93)m=	20.42	20.42	20.42	20.43	20.43	20.44	20.44	20.44	20.43	20.43	20.43	20.42	(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

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.97	0.92	0.8	0.62	0.45	0.51	0.78	0.95	0.99	1	(94)

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

(95)m=	2524.43	3200.62	3813.74	4260.06	4111.21	3152.27	2196.36	2267.9	3039.26	3057.47	2566.75	2338.44	(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=	9880.27	9484.74	8482.04	6917.96	5222.45	3438.38	2260.32	2371.63	3754.39	5880.55	8021.84	9825.59	(97)

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

(98)m=	5472.74	4222.92	3473.21	1913.69	826.76	0	0	0	0	2100.37	3927.67	5570.44	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 27507.81 (98)

Space heating requirement in kWh/m²/year 36.39 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 387.03 (206)

Efficiency of secondary/supplementary heating system, % 65 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	5472.74	4222.92	3473.21	1913.69	826.76	0	0	0	0	2100.37	3927.67	5570.44	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1414.05	1091.12	897.41	494.46	213.62	0	0	0	0	542.7	1014.83	1439.3	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 7107.5 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	253.49	223.23	233.98	209.11	204.46	0	0	0	0	216.87	230.12	247.17	

Efficiency of water heater 121.26 (216)

(217)m=	121.26	121.26	121.26	121.26	121.26	121.26	121.26	121.26	121.26	121.26	121.26	121.26	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	209.05	184.09	192.96	172.45	168.61	0	0	0	0	178.85	189.77	203.84	

Total = Sum(219a)$_{1...12}$ = 1499.62 (219)

Water heating requirement (immersion)

	0	0	0	0	0	159.52	150.93	168.75	169.43	0	0	0	

Efficiency of water heater (Immersion) 100 (216)

(217)m=	0	0	0	0	0	100	100	100	100	0	0	0	(217)

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Fuel for water heating (Immersion), kWh/month
(219)m = [(64)m + (218) m] x 100 ÷ (217)m

(219)m=	0	0	0	0	0	159.52	150.93	168.75	169.43	0	0	0

Total = Sum(219a)$_{1...12}$ = 648.63 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		7107.5	
Water heating fuel used		1499.62	
Water heating fuel used (Immersion)		648.63	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	3410.14		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		3410.14	(231)
Electricity for lighting		1265.99	(232)
Electricity generated by PVs		-12850.66	(233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =	937.48	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	5.81	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	13.19	x 0.01 =	197.8	(247)
Water heating cost (Immersion)	(219)	0	x 0.01 =	85.55	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	449.8	(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 =	166.98	(250)
Additional standing charges (Table 12)				0	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	-1695	(252)

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

Total energy cost (245)...(247) + (250)...(254) = 142.61 (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] =	0.07	(257)
SAP rating (Section 12)		98.96	(258)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	3688.79	(261)
Space heating (secondary)	(215) x	0.039	=	0	(263)

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Water heating	(219) x	0.519	=	778.3	(264)
Water heating (Immersion)	(219) x	0.519	=	336.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4803.73	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	1769.86	(267)
Electricity for lighting	(232) x	0.519	=	657.05	(268)
Energy saving/generation technologies Item 1		0.519	=	-6669.49	(269)
Total CO2, kg/year	sum of (265)…(271) =			561.15	(272)
CO2 emissions per m²	(272) ÷ (4) =			0.74	(273)
EI rating (section 14)				99	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	3.07	=	21820.01	(261)
Space heating (secondary)	(215) x	1.26	=	0	(263)
Energy for water heating	(219) x	3.07	=	4603.83	(264)
Energy for water heating (Immersion)	(219) x	3.07	=	1991.3	(264)
Space and water heating	(261) + (262) + (263) + (264) =			28415.14	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	10469.14	(267)
Electricity for lighting	(232) x	0	=	3886.58	(268)
Energy saving/generation technologies Item 1		3.07	=	-39451.53	(269)
‘Total Primary Energy	sum of (265)…(271) =			3319.32	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			4.39	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Neil Ingham	**Stroma Number:**	STRO010943
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.1.25

Property Address: Plot 1 North Thoresby

Address : Plot 1, North Thoresby, Grimsby

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Basement	226.13	(1a) x	2.53	(2a) =	572.11	(3a)
Ground floor	270.6	(1b) x	3.33	(2b) =	899.75	(3b)
First floor	259.24	(1c) x	2.46	(2c) =	637.73	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	755.97	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		2109.58	(5)

2. Ventilation rate:

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		2.5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.12	(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) =	0.11	(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

DER 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

0.14	0.13	0.13	0.12	0.11	0.1	0.1	0.1	0.11	0.11	0.12	0.12

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 70.55 (23c)

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

(24a)m=	0.28	0.28	0.28	0.26	0.26	0.25	0.25	0.25	0.25	0.26	0.27	0.27

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

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

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

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.89	x	3	=	5.67			(26)
Windows Type 1			30.83	x	1/[1/(1.4)+ 0.04]	=	40.87			(27)
Windows Type 2			27.79	x	1/[1/(1.4)+ 0.04]	=	36.84			(27)
Windows Type 3			2.37	x	1/[1/(1.4)+ 0.04]	=	3.14			(27)
Windows Type 4			36.89	x	1/[1/(1.4)+ 0.04]	=	48.91			(27)
Rooflights Type 1			2.55	x	1/[1/(1.4) + 0.04]	=	3.57			(27b)
Rooflights Type 2			1.5	x	1/[1/(1.4) + 0.04]	=	2.1			(27b)
Rooflights Type 3			1.45	x	1/[1/(1.4) + 0.04]	=	2.03			(27b)
Floor Type 1			226.13	x	0.2	=	45.226	75	16959.75	(28)
Floor Type 2			46.64	x	0.14	=	6.5296	110	5130.4	(28)
Walls Type1	427.24	99.77	327.47	x	0.24	=	78.59	60	19648.2	(29)
Walls Type2	136.66	0	136.66	x	0.3	=	41	60	8199.6	(29)
Walls Type3	7.16	0	7.16	x	0.25	=	1.79	9	64.44	(29)
Roof Type1	121.09	0	121.09	x	0.17	=	20.59	9	1089.81	(30)
Roof Type2	168.65	5.5	163.15	x	0.17	=	27.74	9	1468.35	(30)
Roof Type3	13.95	0	13.95	x	0.2	=	2.79	9	125.55	(30)
Total area of elements, m²			1147.52							(31)

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Internal wall **	369.28	9	3323.52	(32c)
Internal wall **	200.04	75	15003	(32c)
Internal floor	742.02	18	13356.36	(32d)
Internal ceiling	742.02	9	6678.18	(32e)

** 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) = 366.97 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 91047.16 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 120.44 (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 49.28 (36)

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

Total fabric heat loss (33) + (36) = 416.25 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	196.82	194.97	193.12	183.87	182.02	172.78	172.78	170.93	176.48	182.02	185.72	189.42	(38)

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

(39)m=	613.07	611.22	609.37	600.13	598.28	589.03	589.03	587.18	592.73	598.28	601.97	605.67	

Average = Sum(39)$_{1...12}$ /12= 599.66 (39)

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

(40)m=	0.81	0.81	0.81	0.79	0.79	0.78	0.78	0.78	0.78	0.79	0.8	0.8	

Average = Sum(40)$_{1...12}$ /12= 0.79 (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 3.72 (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) + 36 122.66 (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=	134.93	130.02	125.11	120.21	115.3	110.4	110.4	115.3	120.21	125.11	130.02	134.93	

Total = Sum(44)$_{1...12}$ = 1471.94 (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=	200.09	175	180.59	157.44	151.07	130.36	120.8	138.62	140.27	163.47	178.45	193.78	

Total = Sum(45)$_{1...12}$ = 1929.94 (45)

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

(46)m=	30.01	26.25	27.09	23.62	22.66	19.55	18.12	20.79	21.04	24.52	26.77	29.07	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 300 (47)

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If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):		1.8	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.97	(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)		0.97	(55)

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

(56)m=	30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13 (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=	30.13	27.22	30.13	29.16	30.13	29.16	30.13	30.13	29.16	30.13	29.16	30.13 (57)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26 (59)

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

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

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

(62)m=	253.49	223.23	233.98	209.11	204.46	159.52	150.93	168.75	169.43	216.87	230.12	247.17 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

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

Output from water heater

(64)m=	253.49	223.23	233.98	209.11	204.46	0	0	0	0	216.87	230.12	247.17

Output from water heater (annual)$_{1...12}$ 1818.44 (64)

Output immersion

(64)m=	0	0	0	0	0	159.52	150.93	168.75	169.43	0	0	0

Output from immersion (annual)$_{1...12}$ 648.632524238295 (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=	109.25	96.77	102.76	93.69	92.95	66.67	64.27	70.2	69.97	97.07	100.67	107.15 (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=	186.23	186.23	186.23	186.23	186.23	186.23	186.23	186.23	186.23	186.23	186.23	186.23 (66)

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

(67)m=	71.69	63.67	51.78	39.2	29.3	24.74	26.73	34.75	46.64	59.22	69.11	73.68 (67)

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

(68)m=	768.8	776.78	756.68	713.88	659.85	609.08	575.15	567.18	587.28	630.08	684.1	734.88 (68)

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

(69)m=	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	41.62	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	-148.99	(71)

Water heating gains (Table 5)

(72)m=	146.84	144	138.12	130.12	124.93	92.6	86.39	94.35	97.18	130.47	139.82	144.02	(72)

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

(73)m=	1066.19	1063.32	1025.45	962.07	892.95	805.29	767.14	775.14	809.97	898.64	971.91	1031.44	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x 36.89	x	10.63	x	0.63	x	0.8	=	137.01	(74)
North	0.9x	0.77	x 36.89	x	20.32	x	0.63	x	0.8	=	261.83	(74)
North	0.9x	0.77	x 36.89	x	34.53	x	0.63	x	0.8	=	444.91	(74)
North	0.9x	0.77	x 36.89	x	55.46	x	0.63	x	0.8	=	714.64	(74)
North	0.9x	0.77	x 36.89	x	74.72	x	0.63	x	0.8	=	962.69	(74)
North	0.9x	0.77	x 36.89	x	79.99	x	0.63	x	0.8	=	1030.58	(74)
North	0.9x	0.77	x 36.89	x	74.68	x	0.63	x	0.8	=	962.18	(74)
North	0.9x	0.77	x 36.89	x	59.25	x	0.63	x	0.8	=	763.37	(74)
North	0.9x	0.77	x 36.89	x	41.52	x	0.63	x	0.8	=	534.93	(74)
North	0.9x	0.77	x 36.89	x	24.19	x	0.63	x	0.8	=	311.67	(74)
North	0.9x	0.77	x 36.89	x	13.12	x	0.63	x	0.8	=	169.02	(74)
North	0.9x	0.77	x 36.89	x	8.86	x	0.63	x	0.8	=	114.22	(74)
East	0.9x	1	x 2.37	x	19.64	x	0.63	x	0.8	=	16.26	(76)
East	0.9x	1	x 2.37	x	38.42	x	0.63	x	0.8	=	31.8	(76)
East	0.9x	1	x 2.37	x	63.27	x	0.63	x	0.8	=	52.38	(76)
East	0.9x	1	x 2.37	x	92.28	x	0.63	x	0.8	=	76.39	(76)
East	0.9x	1	x 2.37	x	113.09	x	0.63	x	0.8	=	93.62	(76)
East	0.9x	1	x 2.37	x	115.77	x	0.63	x	0.8	=	95.83	(76)
East	0.9x	1	x 2.37	x	110.22	x	0.63	x	0.8	=	91.24	(76)
East	0.9x	1	x 2.37	x	94.68	x	0.63	x	0.8	=	78.37	(76)
East	0.9x	1	x 2.37	x	73.59	x	0.63	x	0.8	=	60.92	(76)
East	0.9x	1	x 2.37	x	45.59	x	0.63	x	0.8	=	37.74	(76)
East	0.9x	1	x 2.37	x	24.49	x	0.63	x	0.8	=	20.27	(76)
East	0.9x	1	x 2.37	x	16.15	x	0.63	x	0.8	=	13.37	(76)
South	0.9x	0.77	x 30.83	x	46.75	x	0.63	x	0.8	=	503.43	(78)
South	0.9x	0.77	x 30.83	x	76.57	x	0.63	x	0.8	=	824.49	(78)

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South	0.9x	0.77	x	30.83	x	97.53	x	0.63	x	0.8	=	1050.25	(78)
South	0.9x	0.77	x	30.83	x	110.23	x	0.63	x	0.8	=	1187.01	(78)
South	0.9x	0.77	x	30.83	x	114.87	x	0.63	x	0.8	=	1236.94	(78)
South	0.9x	0.77	x	30.83	x	110.55	x	0.63	x	0.8	=	1190.38	(78)
South	0.9x	0.77	x	30.83	x	108.01	x	0.63	x	0.8	=	1163.08	(78)
South	0.9x	0.77	x	30.83	x	104.89	x	0.63	x	0.8	=	1129.51	(78)
South	0.9x	0.77	x	30.83	x	101.89	x	0.63	x	0.8	=	1097.11	(78)
South	0.9x	0.77	x	30.83	x	82.59	x	0.63	x	0.8	=	889.29	(78)
South	0.9x	0.77	x	30.83	x	55.42	x	0.63	x	0.8	=	596.73	(78)
South	0.9x	0.77	x	30.83	x	40.4	x	0.63	x	0.8	=	435.01	(78)
West	0.9x	0.77	x	27.79	x	19.64	x	0.63	x	0.8	=	190.63	(80)
West	0.9x	0.77	x	27.79	x	38.42	x	0.63	x	0.8	=	372.92	(80)
West	0.9x	0.77	x	27.79	x	63.27	x	0.63	x	0.8	=	614.15	(80)
West	0.9x	0.77	x	27.79	x	92.28	x	0.63	x	0.8	=	895.7	(80)
West	0.9x	0.77	x	27.79	x	113.09	x	0.63	x	0.8	=	1097.71	(80)
West	0.9x	0.77	x	27.79	x	115.77	x	0.63	x	0.8	=	1123.7	(80)
West	0.9x	0.77	x	27.79	x	110.22	x	0.63	x	0.8	=	1069.81	(80)
West	0.9x	0.77	x	27.79	x	94.68	x	0.63	x	0.8	=	918.95	(80)
West	0.9x	0.77	x	27.79	x	73.59	x	0.63	x	0.8	=	714.28	(80)
West	0.9x	0.77	x	27.79	x	45.59	x	0.63	x	0.8	=	442.5	(80)
West	0.9x	0.77	x	27.79	x	24.49	x	0.63	x	0.8	=	237.7	(80)
West	0.9x	0.77	x	27.79	x	16.15	x	0.63	x	0.8	=	156.77	(80)
Rooflights	0.9x	1	x	2.55	x	43.99	x	0.63	x	0.8	=	50.88	(82)
Rooflights	0.9x	1	x	1.5	x	26.46	x	0.63	x	0.8	=	18.01	(82)
Rooflights	0.9x	1	x	1.45	x	16.18	x	0.63	x	0.8	=	10.64	(82)
Rooflights	0.9x	1	x	2.55	x	80.27	x	0.63	x	0.8	=	92.85	(82)
Rooflights	0.9x	1	x	1.5	x	53.3	x	0.63	x	0.8	=	36.27	(82)
Rooflights	0.9x	1	x	1.45	x	30.63	x	0.63	x	0.8	=	20.15	(82)
Rooflights	0.9x	1	x	2.55	x	121.32	x	0.63	x	0.8	=	140.32	(82)
Rooflights	0.9x	1	x	1.5	x	91.66	x	0.63	x	0.8	=	62.37	(82)
Rooflights	0.9x	1	x	1.45	x	55.7	x	0.63	x	0.8	=	36.64	(82)
Rooflights	0.9x	1	x	2.55	x	165.18	x	0.63	x	0.8	=	191.06	(82)
Rooflights	0.9x	1	x	1.5	x	139.87	x	0.63	x	0.8	=	95.17	(82)
Rooflights	0.9x	1	x	1.45	x	101.28	x	0.63	x	0.8	=	66.62	(82)
Rooflights	0.9x	1	x	2.55	x	195.41	x	0.63	x	0.8	=	226.03	(82)
Rooflights	0.9x	1	x	1.5	x	176.97	x	0.63	x	0.8	=	120.41	(82)
Rooflights	0.9x	1	x	1.45	x	149.52	x	0.63	x	0.8	=	98.34	(82)
Rooflights	0.9x	1	x	2.55	x	197.72	x	0.63	x	0.8	=	228.7	(82)
Rooflights	0.9x	1	x	1.5	x	183.63	x	0.63	x	0.8	=	124.94	(82)
Rooflights	0.9x	1	x	1.45	x	166.08	x	0.63	x	0.8	=	109.23	(82)
Rooflights	0.9x	1	x	2.55	x	189.14	x	0.63	x	0.8	=	218.77	(82)

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Rooflights 0.9x	1	x	1.5	x	173.81	x	0.63	x	0.8	=	118.26	(82)
Rooflights 0.9x	1	x	1.45	x	152.65	x	0.63	x	0.8	=	100.4	(82)
Rooflights 0.9x	1	x	2.55	x	166.58	x	0.63	x	0.8	=	192.68	(82)
Rooflights 0.9x	1	x	1.5	x	145.57	x	0.63	x	0.8	=	99.04	(82)
Rooflights 0.9x	1	x	1.45	x	112.79	x	0.63	x	0.8	=	74.19	(82)
Rooflights 0.9x	1	x	2.55	x	136.8	x	0.63	x	0.8	=	158.24	(82)
Rooflights 0.9x	1	x	1.5	x	108.61	x	0.63	x	0.8	=	73.9	(82)
Rooflights 0.9x	1	x	1.45	x	70.26	x	0.63	x	0.8	=	46.21	(82)
Rooflights 0.9x	1	x	2.55	x	92.07	x	0.63	x	0.8	=	106.5	(82)
Rooflights 0.9x	1	x	1.5	x	64.26	x	0.63	x	0.8	=	43.73	(82)
Rooflights 0.9x	1	x	1.45	x	37.03	x	0.63	x	0.8	=	24.36	(82)
Rooflights 0.9x	1	x	2.55	x	53.73	x	0.63	x	0.8	=	62.15	(82)
Rooflights 0.9x	1	x	1.5	x	33.27	x	0.63	x	0.8	=	22.64	(82)
Rooflights 0.9x	1	x	1.45	x	19.8	x	0.63	x	0.8	=	13.02	(82)
Rooflights 0.9x	1	x	2.55	x	36.94	x	0.63	x	0.8	=	42.73	(82)
Rooflights 0.9x	1	x	1.5	x	21.59	x	0.63	x	0.8	=	14.69	(82)
Rooflights 0.9x	1	x	1.45	x	13.64	x	0.63	x	0.8	=	8.97	(82)

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

(83)m=	926.86	1640.3	2401.01	3226.58	3835.72	3903.37	3723.73	3256.1	2685.58	1855.78	1121.53	785.75	(83)

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

(84)m=	1993.05	2703.63	3426.46	4188.65	4728.68	4708.66	4490.87	4031.25	3495.54	2754.42	2093.44	1817.2	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.85	0.7	0.55	0.62	0.85	0.97	1	1	(86)

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

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

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

(88)m=	20.24	20.25	20.25	20.26	20.26	20.27	20.27	20.27	20.27	20.26	20.26	20.25	(88)

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

(89)m=	1	0.99	0.98	0.93	0.82	0.64	0.47	0.54	0.81	0.97	1	1	(89)

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

(90)m=	20.24	20.25	20.25	20.26	20.26	20.27	20.27	20.27	20.27	20.26	20.26	20.25	(90)

fLA = Living area ÷ (4) = 0.23 (91)

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

(92)m=	20.42	20.42	20.42	20.43	20.43	20.44	20.44	20.44	20.43	20.43	20.43	20.42	(92)

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

(93)m=	20.42	20.42	20.42	20.43	20.43	20.44	20.44	20.44	20.43	20.43	20.43	20.42	(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

DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.83	0.66	0.49	0.55	0.82	0.97	1	1	(94)

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

(95)m=	1989.12	2686.3	3358.37	3920.25	3924.13	3086.74	2178.23	2236.19	2869.58	2671.37	2084.05	1814.7	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	9880.27	9484.74	8482.04	6917.96	5222.45	3438.38	2260.32	2371.63	3754.39	5880.55	8021.84	9825.59	(97)

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

(98)m=	5871.02	4568.55	3812.01	2158.35	965.95	0	0	0	0	2387.63	4275.21	5960.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 29998.82 (98)

Space heating requirement in kWh/m²/year 39.68 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 387.03 (206)

Efficiency of secondary/supplementary heating system, % 65 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	5871.02	4568.55	3812.01	2158.35	965.95	0	0	0	0	2387.63	4275.21	5960.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1516.96	1180.43	984.95	557.68	249.58	0	0	0	0	616.92	1104.63	1539.98	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 7751.12 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	253.49	223.23	233.98	209.11	204.46	0	0	0	0	216.87	230.12	247.17	

Efficiency of water heater 121.26 (216)

(217)m=	121.26	121.26	121.26	121.26	121.26	121.26	121.26	121.26	121.26	121.26	121.26	121.26	(217)

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

(219)m=	209.05	184.09	192.96	172.45	168.61	0	0	0	0	178.85	189.77	203.84	

Total = Sum(219a)$_{1...12}$ = 1499.62 (219)

Water heating requirement (immersion)

	0	0	0	0	0	159.52	150.93	168.75	169.43	0	0	0	

Efficiency of water heater (Immersion) 100 (216)

(217)m=	0	0	0	0	0	100	100	100	100	0	0	0	(217)

DER WorkSheet: New dwelling design stage

Fuel for water heating (Immersion), kWh/month
(219)m = [(64)m + (218) m] x 100 ÷ (217)m

(219)m=	0	0	0	0	0	159.52	150.93	168.75	169.43	0	0	0

Total = Sum(219a)$_{1...12}$ = 648.63 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		7751.12	
Water heating fuel used		1499.62	
Water heating fuel used (Immersion)		648.63	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	3410.14		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		3410.14	(231)
Electricity for lighting		1265.99	(232)
Electricity generated by PVs		-12850.66	(233)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	4022.83	(261)
Space heating (secondary)	(215)	x	0.039	=	0	(263)
Water heating	(219)	x	0.519	=	778.3	(264)
Water heating (Immersion)	(219)	x	0.519	=	336.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5137.78	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	1769.86	(267)
Electricity for lighting	(232)	x	0.519	=	657.05	(268)
Energy saving/generation technologies Item 1			0.519	=	-6669.49	(269)
Total CO2, kg/year	sum of (265)…(271) =				895.19	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =				1.18	(273)
EI rating (section 14)					99	(274)