Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.18
Printed on 05 December 2023 at 08:49:30

Project Information:

Assessed By: Harry Hinchcliffe (STRO034627) **Building Type:** Detached House

Dwelling Details:

NEW DWELLING AS BUILT Total Floor Area: 446.42m²

Site Reference : 14505 - L1a Assessment **Plot Reference:** 14505 MVHR

Address : Edgecumbe, Heather Drive, SUNNINGDALE, SL5 0HP

Client Details:

Name:

Address :

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

1a TER and DER

Fuel for main heating system: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)	18.57 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	6.54 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.9 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	44.5 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.22 (max. 0.70)	**OK**
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	**OK**
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	**OK**
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.99	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:
Heat pumps with radiators or underfloor heating - electric
Daikin Altherma EDLA09DA3V3

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.68 kWh/day	
	Permitted by DBSCG: 2.86 kWh/day	**OK**
Primary pipework insulated:	Yes	**OK**

Regulations Compliance Report

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:	1.16	
Maximum	1.5	**OK**
MVHR efficiency:	85%	
Minimum	70%	**OK**

9 Summertime temperature

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

Based on:

Overshading:	Average or unknown
Windows facing: North	41.82m²
Windows facing: East	7.11m²
Windows facing: West	10.53m²
Windows facing: South	25.92m²
Roof windows facing: South	1.91m²
Roof windows facing: East	4.8m²
Roof windows facing: West	1.6m²
Ventilation rate:	4.00
Blinds/curtains:	None

10 Key features

Thermal bridging	0.038 W/m²K
Air permeablility	4.0 m³/m²h
External Walls U-value	0.12 W/m²K
Floors U-value	0.12 W/m²K
Photovoltaic array	

SAP Input

Property Details: 14505 MVHR

Address:	Edgecumbe, Heather Drive, SUNNINGDALE, SL5 0HP
Located in:	England
Region:	Thames valley
UPRN:	UPRN-556163292545
Date of assessment:	01 December 2023
Date of certificate:	05 December 2023
Assessment type:	New dwelling as built
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	510

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2023

Floor Location:	Floor area:	Storey height:
Floor 0	189.92 m²	2.9 m
Floor 1	150.87 m²	2.7 m
Floor 2	105.63 m²	2.28 m

Living area:	22.6 m² (fraction 0.051)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
N Windows	Manufacturer	Windows	double-glazed	No	
E Windows	Manufacturer	Windows	double-glazed	No	
W Windows	Manufacturer	Windows	double-glazed	No	
S Windows	Manufacturer	Windows	double-glazed	No	
S Rooflight	Manufacturer	Roof Windows	double-glazed	No	PVC-U
E Rooflights	Manufacturer	Roof Windows	double-glazed	No	PVC-U
W Rooflights	Manufacturer	Roof Windows	double-glazed	No	PVC-U

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
N Windows	16mm or more	0.7	0.63	1.4	41.82	1
E Windows	16mm or more	0.7	0.63	1.4	7.11	1
W Windows	16mm or more	0.7	0.63	1.4	10.53	1
S Windows	16mm or more	0.7	0.63	1.4	25.92	1
S Rooflight	16mm or more	0.7	0.63	1.4	1.91	1
E Rooflights	16mm or more	0.7	0.63	1.4	4.8	1
W Rooflights	16mm or more	0.7	0.63	1.4	1.6	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
N Windows		External Walls	North	0	0
E Windows		External Walls	East	0	0
W Windows		External Walls	West	0	0
S Windows		External Walls	South	0	0
S Rooflight		Flat Roof SF	South	0.001	0
E Rooflights		Flat Roof SF	East	0.001	0
W Rooflights		Flat Roof SF	West	0.001	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:

SAP Input

External Elements

External Walls	328.81	85.38	243.43	0.22	0	False	N/A
Dormer Walls	15.45	0	15.45	0.12	0	False	N/A
Flat Roof GF	39.05	0	39.05	0.16	0		N/A
Insulated Rafters	136	0	136	0.16	0		N/A
Flat Roof SF	29.46	8.31	21.15	0.16	0		N/A
Dormer Roofs	10.29	0	10.29	0.16	0		N/A
Ground Floor	189.92			0.12			N/A

Internal Elements

Party Elements

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0376

	Length	Psi-value		
	49.9	0.05	E2	Other lintels (including other steel lintels)
[Approved]	49.9	0.04	E3	Sill
[Approved]	99.8	0.05	E4	Jamb
[Approved]	65.35	0.16	E5	Ground floor (normal)
[Approved]	51.59	0.07	E6	Intermediate floor within a dwelling
[Approved]	51.59	0.04	E11	Eaves (insulation at rafter level)
	61.6	0	E14	Flat roof
[Approved]	45	0.09	E16	Corner (normal)
[Approved]	17	-0.09	E17	Corner (inverted internal area greater than external area)

Ventilation:

Pressure test: Yes (As built)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 4
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: 0

Pressure test: 3.99 (Assessed dwelling is tested)

Main heating system:

Main heating system: Heat pumps with radiators or underfloor heating
Electric heat pumps
Fuel: Electricity
Info Source: Boiler Database
Database: (rev 510, product index 105233, SEDBUK 446%):
Brand name: Daikin Altherma
Model: EDLA09DA3V3
Model qualifier: Underfloor
(provides DHW all year)
Underfloor heating and radiators, pipes in screed above insulation
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature<=35°C
Boiler interlock: Yes

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: None

SAP Input

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 300 litres Cylinder insulation: Measured loss, 1.68kWh/day Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Waste Water Heat Recovery System: Total rooms with shower and/or bath: 2 Product index: 080182, Showersave Blue QB1-21D System A Number of mixer showers in rooms with a bath: 2 Number of mixer showers in rooms without a bath: 0 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:	Photovoltaic 1 Installed Peak power: 2.46 Tilt of collector: Horizontal Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling as built

User Details:

Assessor Name:	Harry Hinchcliffe	**Stroma Number:**	STRO034627
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.18

Property Address: 14505 MVHR

Address : Edgecumbe, Heather Drive, SUNNINGDALE, SL5 0HP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	189.92	(1a) x	2.9	(2a) =	550.77	(3a)
First floor	150.87	(1b) x	2.7	(2b) =	407.35	(3b)
Second floor	105.63	(1c) x	2.28	(2c) =	240.84	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	446.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		1198.95	(5)

2. Ventilation rate:

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

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

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

Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3.99000000953674	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.2	(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 as built

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

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

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) = 72.25 (23c)

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

(24a)m=	0.39	0.39	0.38	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.36	0.37

(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=	0.39	0.39	0.38	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.36	0.37

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			41.82	x1/[1/(1.4)+ 0.04] =	55.44			(27)
Windows Type 2			7.11	x1/[1/(1.4)+ 0.04] =	9.43			(27)
Windows Type 3			10.53	x1/[1/(1.4)+ 0.04] =	13.96			(27)
Windows Type 4			25.92	x1/[1/(1.4)+ 0.04] =	34.36			(27)
Rooflights Type 1			1.91	x1/[1/(1.4) + 0.04] =	2.674			(27b)
Rooflights Type 2			4.8	x1/[1/(1.4) + 0.04] =	6.72			(27b)
Rooflights Type 3			1.6	x1/[1/(1.4) + 0.04] =	2.24			(27b)
Floor			189.92	x 0.12 =	22.7904			(28)
Walls Type1	328.81	85.38	243.43	x 0.22 =	53.55			(29)
Walls Type2	15.45	0	15.45	x 0.12 =	1.85			(29)
Roof Type1	39.05	0	39.05	x 0.16 =	6.25			(30)
Roof Type2	136	0	136	x 0.16 =	21.76			(30)
Roof Type3	29.46	8.31	21.15	x 0.16 =	3.38			(30)
Roof Type4	10.29	0	10.29	x 0.16 =	1.65			(30)
Total area of elements, m²			748.98					(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) = 235.45 (33)

SAP WorkSheet: New dwelling as built

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 37494.46 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 28.13 (36)

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

Total fabric heat loss (33) + (36) = 263.58 (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=	155.54	153.56	151.59	141.72	139.75	129.88	129.88	127.91	133.83	139.75	143.7	147.64	(38)

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

(39)m=	419.12	417.14	415.17	405.3	403.33	393.46	393.46	391.49	397.41	403.33	407.28	411.22	

Average = Sum(39)$_{1...12}$ /12= 404.81 (39)

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

(40)m=	0.94	0.93	0.93	0.91	0.9	0.88	0.88	0.88	0.89	0.9	0.91	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.32 (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) + 36 113.1 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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=	124.41	119.89	115.37	110.84	106.32	101.79	101.79	106.32	110.84	115.37	119.89	124.41	

Total = Sum(44)$_{1...12}$ = 1357.25 (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=	184.5	161.37	166.52	145.17	139.3	120.2	111.39	127.82	129.34	150.74	164.54	178.68	

Total = Sum(45)$_{1...12}$ = 1779.57 (45)

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

(46)m=	27.68	24.21	24.98	21.78	20.89	18.03	16.71	19.17	19.4	22.61	24.68	26.8	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.68 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

SAP WorkSheet: New dwelling as built

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)		0.91	(55)

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

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(57)

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

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

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

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

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

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

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

(62)m=	235.89	207.78	217.9	194.9	190.68	169.93	162.77	179.2	179.07	202.12	214.27	230.07	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
WWHRS	-58.73	-51.68	-52.75	-43.36	-40.25	-33.19	-28.07	-33.99	-34.99	-43.28	-50.17	-56.77	(63) (G10)

Output from water heater

(64)m=	177.16	156.1	165.16	151.54	150.43	136.74	134.7	145.21	144.08	158.84	164.1	173.29	

Output from water heater (annual)$_{1...12}$	1857.35	(64)

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

(65)m=	102.46	90.78	96.48	88.05	87.42	79.75	78.14	83.61	82.79	91.23	94.49	100.52	(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=	199.34	199.34	199.34	199.34	199.34	199.34	199.34	199.34	199.34	199.34	199.34	199.34	(66)

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

(67)m=	126.87	112.68	91.64	69.38	51.86	43.78	47.31	61.49	82.54	104.8	122.31	130.39	(67)

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

(68)m=	848.19	856.99	834.81	787.6	727.99	671.97	634.55	625.75	647.93	695.14	754.75	810.77	(68)

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

(69)m=	58.26	58.26	58.26	58.26	58.26	58.26	58.26	58.26	58.26	58.26	58.26	58.26	(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=	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	(71)

Water heating gains (Table 5)

(72)m=	137.71	135.1	129.67	122.3	117.51	110.76	105.03	112.38	114.98	122.62	131.24	135.11	(72)

SAP WorkSheet: New dwelling as built

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

(73)m=	1237.47	1229.47	1180.83	1103.97	1022.06	951.22	911.59	924.32	970.15	1047.26	1133	1200.97	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	41.82	x	10.63	x	0.63	x	0.7	=	135.9	(74)
North	0.9x 0.77	x	41.82	x	20.32	x	0.63	x	0.7	=	259.72	(74)
North	0.9x 0.77	x	41.82	x	34.53	x	0.63	x	0.7	=	441.32	(74)
North	0.9x 0.77	x	41.82	x	55.46	x	0.63	x	0.7	=	708.88	(74)
North	0.9x 0.77	x	41.82	x	74.72	x	0.63	x	0.7	=	954.92	(74)
North	0.9x 0.77	x	41.82	x	79.99	x	0.63	x	0.7	=	1022.27	(74)
North	0.9x 0.77	x	41.82	x	74.68	x	0.63	x	0.7	=	954.42	(74)
North	0.9x 0.77	x	41.82	x	59.25	x	0.63	x	0.7	=	757.21	(74)
North	0.9x 0.77	x	41.82	x	41.52	x	0.63	x	0.7	=	530.61	(74)
North	0.9x 0.77	x	41.82	x	24.19	x	0.63	x	0.7	=	309.16	(74)
North	0.9x 0.77	x	41.82	x	13.12	x	0.63	x	0.7	=	167.65	(74)
North	0.9x 0.77	x	41.82	x	8.86	x	0.63	x	0.7	=	113.3	(74)
East	0.9x 0.77	x	7.11	x	19.64	x	0.63	x	0.7	=	42.68	(76)
East	0.9x 0.77	x	7.11	x	38.42	x	0.63	x	0.7	=	83.48	(76)
East	0.9x 0.77	x	7.11	x	63.27	x	0.63	x	0.7	=	137.49	(76)
East	0.9x 0.77	x	7.11	x	92.28	x	0.63	x	0.7	=	200.52	(76)
East	0.9x 0.77	x	7.11	x	113.09	x	0.63	x	0.7	=	245.74	(76)
East	0.9x 0.77	x	7.11	x	115.77	x	0.63	x	0.7	=	251.56	(76)
East	0.9x 0.77	x	7.11	x	110.22	x	0.63	x	0.7	=	239.49	(76)
East	0.9x 0.77	x	7.11	x	94.68	x	0.63	x	0.7	=	205.72	(76)
East	0.9x 0.77	x	7.11	x	73.59	x	0.63	x	0.7	=	159.9	(76)
East	0.9x 0.77	x	7.11	x	45.59	x	0.63	x	0.7	=	99.06	(76)
East	0.9x 0.77	x	7.11	x	24.49	x	0.63	x	0.7	=	53.21	(76)
East	0.9x 0.77	x	7.11	x	16.15	x	0.63	x	0.7	=	35.1	(76)
South	0.9x 0.77	x	25.92	x	46.75	x	0.63	x	0.7	=	370.35	(78)
South	0.9x 0.77	x	25.92	x	76.57	x	0.63	x	0.7	=	606.53	(78)
South	0.9x 0.77	x	25.92	x	97.53	x	0.63	x	0.7	=	772.61	(78)
South	0.9x 0.77	x	25.92	x	110.23	x	0.63	x	0.7	=	873.22	(78)
South	0.9x 0.77	x	25.92	x	114.87	x	0.63	x	0.7	=	909.95	(78)
South	0.9x 0.77	x	25.92	x	110.55	x	0.63	x	0.7	=	875.7	(78)
South	0.9x 0.77	x	25.92	x	108.01	x	0.63	x	0.7	=	855.62	(78)
South	0.9x 0.77	x	25.92	x	104.89	x	0.63	x	0.7	=	830.92	(78)
South	0.9x 0.77	x	25.92	x	101.89	x	0.63	x	0.7	=	807.09	(78)
South	0.9x 0.77	x	25.92	x	82.59	x	0.63	x	0.7	=	654.2	(78)

SAP WorkSheet: New dwelling as built

South	0.9x	0.77	x	25.92	x	55.42	x	0.63	x	0.7	=	438.99	(78)
South	0.9x	0.77	x	25.92	x	40.4	x	0.63	x	0.7	=	320.01	(78)
West	0.9x	0.77	x	10.53	x	19.64	x	0.63	x	0.7	=	63.2	(80)
West	0.9x	0.77	x	10.53	x	38.42	x	0.63	x	0.7	=	123.64	(80)
West	0.9x	0.77	x	10.53	x	63.27	x	0.63	x	0.7	=	203.62	(80)
West	0.9x	0.77	x	10.53	x	92.28	x	0.63	x	0.7	=	296.97	(80)
West	0.9x	0.77	x	10.53	x	113.09	x	0.63	x	0.7	=	363.94	(80)
West	0.9x	0.77	x	10.53	x	115.77	x	0.63	x	0.7	=	372.56	(80)
West	0.9x	0.77	x	10.53	x	110.22	x	0.63	x	0.7	=	354.69	(80)
West	0.9x	0.77	x	10.53	x	94.68	x	0.63	x	0.7	=	304.68	(80)
West	0.9x	0.77	x	10.53	x	73.59	x	0.63	x	0.7	=	236.82	(80)
West	0.9x	0.77	x	10.53	x	45.59	x	0.63	x	0.7	=	146.71	(80)
West	0.9x	0.77	x	10.53	x	24.49	x	0.63	x	0.7	=	78.81	(80)
West	0.9x	0.77	x	10.53	x	16.15	x	0.63	x	0.7	=	51.98	(80)
Rooflights	0.9x	1	x	1.91	x	43.99	x	0.63	x	0.7	=	33.35	(82)
Rooflights	0.9x	1	x	4.8	x	26.46	x	0.63	x	0.7	=	50.42	(82)
Rooflights	0.9x	1	x	1.6	x	26.46	x	0.63	x	0.7	=	16.81	(82)
Rooflights	0.9x	1	x	1.91	x	80.27	x	0.63	x	0.7	=	60.85	(82)
Rooflights	0.9x	1	x	4.8	x	53.3	x	0.63	x	0.7	=	101.55	(82)
Rooflights	0.9x	1	x	1.6	x	53.3	x	0.63	x	0.7	=	33.85	(82)
Rooflights	0.9x	1	x	1.91	x	121.32	x	0.63	x	0.7	=	91.97	(82)
Rooflights	0.9x	1	x	4.8	x	91.66	x	0.63	x	0.7	=	174.63	(82)
Rooflights	0.9x	1	x	1.6	x	91.66	x	0.63	x	0.7	=	58.21	(82)
Rooflights	0.9x	1	x	1.91	x	165.18	x	0.63	x	0.7	=	125.22	(82)
Rooflights	0.9x	1	x	4.8	x	139.87	x	0.63	x	0.7	=	266.47	(82)
Rooflights	0.9x	1	x	1.6	x	139.87	x	0.63	x	0.7	=	88.82	(82)
Rooflights	0.9x	1	x	1.91	x	195.41	x	0.63	x	0.7	=	148.14	(82)
Rooflights	0.9x	1	x	4.8	x	176.97	x	0.63	x	0.7	=	337.15	(82)
Rooflights	0.9x	1	x	1.6	x	176.97	x	0.63	x	0.7	=	112.38	(82)
Rooflights	0.9x	1	x	1.91	x	197.72	x	0.63	x	0.7	=	149.89	(82)
Rooflights	0.9x	1	x	4.8	x	183.63	x	0.63	x	0.7	=	349.84	(82)
Rooflights	0.9x	1	x	1.6	x	183.63	x	0.63	x	0.7	=	116.61	(82)
Rooflights	0.9x	1	x	1.91	x	189.14	x	0.63	x	0.7	=	143.38	(82)
Rooflights	0.9x	1	x	4.8	x	173.81	x	0.63	x	0.7	=	331.13	(82)
Rooflights	0.9x	1	x	1.6	x	173.81	x	0.63	x	0.7	=	110.38	(82)
Rooflights	0.9x	1	x	1.91	x	166.58	x	0.63	x	0.7	=	126.28	(82)
Rooflights	0.9x	1	x	4.8	x	145.57	x	0.63	x	0.7	=	277.32	(82)
Rooflights	0.9x	1	x	1.6	x	145.57	x	0.63	x	0.7	=	92.44	(82)
Rooflights	0.9x	1	x	1.91	x	136.8	x	0.63	x	0.7	=	103.71	(82)
Rooflights	0.9x	1	x	4.8	x	108.61	x	0.63	x	0.7	=	206.92	(82)
Rooflights	0.9x	1	x	1.6	x	108.61	x	0.63	x	0.7	=	68.97	(82)

SAP WorkSheet: New dwelling as built

Rooflights 0.9x	1	x	1.91	x	92.07	x	0.63	x	0.7	=	69.8	(82)
Rooflights 0.9x	1	x	4.8	x	64.26	x	0.63	x	0.7	=	122.43	(82)
Rooflights 0.9x	1	x	1.6	x	64.26	x	0.63	x	0.7	=	40.81	(82)
Rooflights 0.9x	1	x	1.91	x	53.73	x	0.63	x	0.7	=	40.73	(82)
Rooflights 0.9x	1	x	4.8	x	33.27	x	0.63	x	0.7	=	63.39	(82)
Rooflights 0.9x	1	x	1.6	x	33.27	x	0.63	x	0.7	=	21.13	(82)
Rooflights 0.9x	1	x	1.91	x	36.94	x	0.63	x	0.7	=	28	(82)
Rooflights 0.9x	1	x	4.8	x	21.59	x	0.63	x	0.7	=	41.13	(82)
Rooflights 0.9x	1	x	1.6	x	21.59	x	0.63	x	0.7	=	13.71	(82)

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

(83)m=	712.7	1269.63	1879.85	2560.09	3072.22	3138.44	2989.11	2594.58	2114.02	1442.17	863.91	603.22	(83)

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

(84)m=	1950.17	2499.1	3060.68	3664.06	4094.28	4089.66	3900.7	3518.89	3084.17	2489.44	1996.91	1804.19	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.93	0.85	0.72	0.55	0.42	0.48	0.71	0.91	0.97	0.99	(86)

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

(87)m=	19.96	19.51	19.88	20.32	20.65	20.83	20.89	20.88	20.73	20.28	19.68	19.24	(87)

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

(88)m=	20.13	20.14	20.14	20.16	20.16	20.18	20.18	20.19	20.18	20.16	20.16	20.15	(88)

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

(89)m=	0.98	0.96	0.92	0.83	0.68	0.5	0.35	0.4	0.66	0.89	0.97	0.99	(89)

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

(90)m=	17.99	18.13	18.66	19.3	19.73	19.98	20.04	20.03	19.86	19.24	18.4	17.74	(90)

fLA = Living area ÷ (4) = 0.05 (91)

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

(92)m=	18.09	18.2	18.72	19.35	19.78	20.02	20.08	20.07	19.9	19.3	18.47	17.81	(92)

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

(93)m=	18.09	18.2	18.72	19.35	19.78	20.02	20.08	20.07	19.9	19.3	18.47	17.81	(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=	0.97	0.95	0.9	0.8	0.66	0.49	0.34	0.39	0.64	0.86	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1898.34	2366.15	2751.67	2945.84	2709.37	1987.49	1334.32	1384.42	1964.1	2150.98	1904.97	1763.29	(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=	5780.11	5547.21	5072.33	4234.86	3259.22	2133.2	1369.38	1438.33	2306.21	3507.17	4630.47	5597.51	(97)

SAP WorkSheet: New dwelling as built

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	2888.03	2137.67	1726.57	928.09	409.09	0	0	0	0	1009.01	1962.36	2852.66	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 13913.48 (98)

Space heating requirement in kWh/m²/year 31.17 (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 1 446.44 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement (calculated above)													kWh/year
	2888.03	2137.67	1726.57	928.09	409.09	0	0	0	0	1009.01	1962.36	2852.66	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	646.9	478.82	386.74	207.89	91.63	0	0	0	0	226.01	439.56	638.98	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3116.53 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	177.16	156.1	165.16	151.54	150.43	136.74	134.7	145.21	144.08	158.84	164.1	173.29	

Efficiency of water heater 173.46 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	173.46	173.46	173.46	173.46	173.46	173.46	173.46	173.46	173.46	173.46	173.46	173.46	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(219)m=	102.13	89.99	95.21	87.36	86.73	78.83	77.66	83.71	83.06	91.57	94.6	99.9	

Total = Sum(219a)$_{1...12}$ = 1070.76 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3116.53
Water heating fuel used		1070.76
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	2120.95	(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		2120.95 (231)
Electricity for lighting		896.2 (232)
Electricity generated by PVs		-1870.81 (233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5333.63 (338)

10a. Fuel costs - individual heating systems:

SAP WorkSheet: New dwelling as built

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		13.19	x 0.01 =	411.07	(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)			13.19	x 0.01 =	141.23	(247)
Pumps, fans and electric keep-hot	(231)			13.19	x 0.01 =	279.75	(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 =	118.21	(250)
Additional standing charges (Table 12)						0	(251)
	one of (233) to (235)	x		13.19	x 0.01 =	-246.76	(252)
Appendix Q items: repeat lines (253) and (254) as needed							
Total energy cost	(245)...(247) + (250)…(254) =					703.51	(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] =	0.6	(257)
SAP rating (Section 12)	91.61	(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	=	1617.48	(261)
Space heating (secondary)	(215)	x		0.519	=	0	(263)
Water heating	(219)	x		0.519	=	555.73	(264)
Space and water heating	(261) + (262) + (263) + (264) =					2173.2	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	1100.77	(267)
Electricity for lighting	(232)	x		0.519	=	465.13	(268)
Energy saving/generation technologies Item 1				0.519	=	-970.95	(269)
Total CO2, kg/year	sum of (265)…(271) =					2768.15	(272)
CO2 emissions per m²	(272) ÷ (4) =					6.2	(273)
EI rating (section 14)						92	(274)

13a. Primary Energy

		Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x		3.07	=	9567.75	(261)
Space heating (secondary)	(215)	x		3.07	=	0	(263)
Energy for water heating	(219)	x		3.07	=	3287.24	(264)

SAP WorkSheet: New dwelling as built

Space and water heating	(261) + (262) + (263) + (264) =			12854.99	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	6511.31	(267)
Electricity for lighting	(232) x	0	=	2751.33	(268)
Energy saving/generation technologies Item 1		3.07	=	-5743.39	(269)
‘Total Primary Energy	sum of (265)…(271) =			16374.23	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			36.68	(273)

DER WorkSheet: New dwelling as built

User Details:

Assessor Name:	Harry Hinchcliffe	**Stroma Number:**	STRO034627
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.18

Property Address: 14505 MVHR

Address : Edgecumbe, Heather Drive, SUNNINGDALE, SL5 0HP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	189.92	(1a) x	2.9	(2a) =	550.77	(3a)
First floor	150.87	(1b) x	2.7	(2b) =	407.35	(3b)
Second floor	105.63	(1c) x	2.28	(2c) =	240.84	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	446.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		1198.95	(5)

2. Ventilation rate:

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3.99000000953674	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.2	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2	(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 as built

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

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

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) = 72.25 (23c)

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

(24a)m=	0.39	0.39	0.38	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.36	0.37

(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=	0.39	0.39	0.38	0.36	0.35	0.33	0.33	0.32	0.34	0.35	0.36	0.37

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			41.82	x1/[1/(1.4)+ 0.04] =	55.44			(27)
Windows Type 2			7.11	x1/[1/(1.4)+ 0.04] =	9.43			(27)
Windows Type 3			10.53	x1/[1/(1.4)+ 0.04] =	13.96			(27)
Windows Type 4			25.92	x1/[1/(1.4)+ 0.04] =	34.36			(27)
Rooflights Type 1			1.91	x1/[1/(1.4) + 0.04] =	2.674			(27b)
Rooflights Type 2			4.8	x1/[1/(1.4) + 0.04] =	6.72			(27b)
Rooflights Type 3			1.6	x1/[1/(1.4) + 0.04] =	2.24			(27b)
Floor			189.92	x 0.12 =	22.7904			(28)
Walls Type1	328.81	85.38	243.43	x 0.22 =	53.55			(29)
Walls Type2	15.45	0	15.45	x 0.12 =	1.85			(29)
Roof Type1	39.05	0	39.05	x 0.16 =	6.25			(30)
Roof Type2	136	0	136	x 0.16 =	21.76			(30)
Roof Type3	29.46	8.31	21.15	x 0.16 =	3.38			(30)
Roof Type4	10.29	0	10.29	x 0.16 =	1.65			(30)
Total area of elements, m²			748.98					(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) = 235.45 (33)

DER WorkSheet: New dwelling as built

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 37494.46 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

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

Thermal bridges : S (L x Y) calculated using Appendix K 28.13 (36)

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

Total fabric heat loss (33) + (36) = 263.58 (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=	155.54	153.56	151.59	141.72	139.75	129.88	129.88	127.91	133.83	139.75	143.7	147.64	(38)

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

(39)m=	419.12	417.14	415.17	405.3	403.33	393.46	393.46	391.49	397.41	403.33	407.28	411.22	

Average = Sum(39)$_{1...12}$ /12= 404.81 (39)

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

(40)m=	0.94	0.93	0.93	0.91	0.9	0.88	0.88	0.88	0.89	0.9	0.91	0.92	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.32 (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) + 36 113.1 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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=	124.41	119.89	115.37	110.84	106.32	101.79	101.79	106.32	110.84	115.37	119.89	124.41	

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

Total = Sum(44)$_{1...12}$ = 1357.25 (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=	184.5	161.37	166.52	145.17	139.3	120.2	111.39	127.82	129.34	150.74	164.54	178.68	

Total = Sum(45)$_{1...12}$ = 1779.57 (45)

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

(46)m=	27.68	24.21	24.98	21.78	20.89	18.03	16.71	19.17	19.4	22.61	24.68	26.8	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.68 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.91 (50)

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

DER WorkSheet: New dwelling as built

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)		0.91	(55)

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

(56)m=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(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=	28.12	25.4	28.12	27.22	28.12	27.22	28.12	28.12	27.22	28.12	27.22	28.12	(57)

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

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

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

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

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

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

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

(62)m=	235.89	207.78	217.9	194.9	190.68	169.93	162.77	179.2	179.07	202.12	214.27	230.07	(62)

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

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

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
WWHRS	-58.73	-51.68	-52.75	-43.36	-40.25	-33.19	-28.07	-33.99	-34.99	-43.28	-50.17	-56.77	(63) (G10)

Output from water heater

(64)m=	177.16	156.1	165.16	151.54	150.43	136.74	134.7	145.21	144.08	158.84	164.1	173.29	

Output from water heater (annual)$_{1...12}$ 1857.35 (64)

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

(65)m=	102.46	90.78	96.48	88.05	87.42	79.75	78.14	83.61	82.79	91.23	94.49	100.52	(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=	166.11	166.11	166.11	166.11	166.11	166.11	166.11	166.11	166.11	166.11	166.11	166.11	(66)

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

(67)m=	50.75	45.07	36.66	27.75	20.74	17.51	18.92	24.6	33.01	41.92	48.93	52.16	(67)

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

(68)m=	568.29	574.19	559.33	527.69	487.75	450.22	425.15	419.25	434.11	465.75	505.68	543.21	(68)

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

(69)m=	39.61	39.61	39.61	39.61	39.61	39.61	39.61	39.61	39.61	39.61	39.61	39.61	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	(71)

Water heating gains (Table 5)

(72)m=	137.71	135.1	129.67	122.3	117.51	110.76	105.03	112.38	114.98	122.62	131.24	135.11	(72)

DER WorkSheet: New dwelling as built

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

(73)m=	829.58	827.19	798.49	750.57	698.84	651.33	621.94	629.06	654.94	703.12	758.68	803.31

(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	41.82	x	10.63	x	0.63	x	0.7	=	135.9	(74)
North	0.9x 0.77	x	41.82	x	20.32	x	0.63	x	0.7	=	259.72	(74)
North	0.9x 0.77	x	41.82	x	34.53	x	0.63	x	0.7	=	441.32	(74)
North	0.9x 0.77	x	41.82	x	55.46	x	0.63	x	0.7	=	708.88	(74)
North	0.9x 0.77	x	41.82	x	74.72	x	0.63	x	0.7	=	954.92	(74)
North	0.9x 0.77	x	41.82	x	79.99	x	0.63	x	0.7	=	1022.27	(74)
North	0.9x 0.77	x	41.82	x	74.68	x	0.63	x	0.7	=	954.42	(74)
North	0.9x 0.77	x	41.82	x	59.25	x	0.63	x	0.7	=	757.21	(74)
North	0.9x 0.77	x	41.82	x	41.52	x	0.63	x	0.7	=	530.61	(74)
North	0.9x 0.77	x	41.82	x	24.19	x	0.63	x	0.7	=	309.16	(74)
North	0.9x 0.77	x	41.82	x	13.12	x	0.63	x	0.7	=	167.65	(74)
North	0.9x 0.77	x	41.82	x	8.86	x	0.63	x	0.7	=	113.3	(74)
East	0.9x 0.77	x	7.11	x	19.64	x	0.63	x	0.7	=	42.68	(76)
East	0.9x 0.77	x	7.11	x	38.42	x	0.63	x	0.7	=	83.48	(76)
East	0.9x 0.77	x	7.11	x	63.27	x	0.63	x	0.7	=	137.49	(76)
East	0.9x 0.77	x	7.11	x	92.28	x	0.63	x	0.7	=	200.52	(76)
East	0.9x 0.77	x	7.11	x	113.09	x	0.63	x	0.7	=	245.74	(76)
East	0.9x 0.77	x	7.11	x	115.77	x	0.63	x	0.7	=	251.56	(76)
East	0.9x 0.77	x	7.11	x	110.22	x	0.63	x	0.7	=	239.49	(76)
East	0.9x 0.77	x	7.11	x	94.68	x	0.63	x	0.7	=	205.72	(76)
East	0.9x 0.77	x	7.11	x	73.59	x	0.63	x	0.7	=	159.9	(76)
East	0.9x 0.77	x	7.11	x	45.59	x	0.63	x	0.7	=	99.06	(76)
East	0.9x 0.77	x	7.11	x	24.49	x	0.63	x	0.7	=	53.21	(76)
East	0.9x 0.77	x	7.11	x	16.15	x	0.63	x	0.7	=	35.1	(76)
South	0.9x 0.77	x	25.92	x	46.75	x	0.63	x	0.7	=	370.35	(78)
South	0.9x 0.77	x	25.92	x	76.57	x	0.63	x	0.7	=	606.53	(78)
South	0.9x 0.77	x	25.92	x	97.53	x	0.63	x	0.7	=	772.61	(78)
South	0.9x 0.77	x	25.92	x	110.23	x	0.63	x	0.7	=	873.22	(78)
South	0.9x 0.77	x	25.92	x	114.87	x	0.63	x	0.7	=	909.95	(78)
South	0.9x 0.77	x	25.92	x	110.55	x	0.63	x	0.7	=	875.7	(78)
South	0.9x 0.77	x	25.92	x	108.01	x	0.63	x	0.7	=	855.62	(78)
South	0.9x 0.77	x	25.92	x	104.89	x	0.63	x	0.7	=	830.92	(78)
South	0.9x 0.77	x	25.92	x	101.89	x	0.63	x	0.7	=	807.09	(78)
South	0.9x 0.77	x	25.92	x	82.59	x	0.63	x	0.7	=	654.2	(78)

DER WorkSheet: New dwelling as built

South	0.9x	0.77	x	25.92	x	55.42	x	0.63	x	0.7	=	438.99	(78)
South	0.9x	0.77	x	25.92	x	40.4	x	0.63	x	0.7	=	320.01	(78)
West	0.9x	0.77	x	10.53	x	19.64	x	0.63	x	0.7	=	63.2	(80)
West	0.9x	0.77	x	10.53	x	38.42	x	0.63	x	0.7	=	123.64	(80)
West	0.9x	0.77	x	10.53	x	63.27	x	0.63	x	0.7	=	203.62	(80)
West	0.9x	0.77	x	10.53	x	92.28	x	0.63	x	0.7	=	296.97	(80)
West	0.9x	0.77	x	10.53	x	113.09	x	0.63	x	0.7	=	363.94	(80)
West	0.9x	0.77	x	10.53	x	115.77	x	0.63	x	0.7	=	372.56	(80)
West	0.9x	0.77	x	10.53	x	110.22	x	0.63	x	0.7	=	354.69	(80)
West	0.9x	0.77	x	10.53	x	94.68	x	0.63	x	0.7	=	304.68	(80)
West	0.9x	0.77	x	10.53	x	73.59	x	0.63	x	0.7	=	236.82	(80)
West	0.9x	0.77	x	10.53	x	45.59	x	0.63	x	0.7	=	146.71	(80)
West	0.9x	0.77	x	10.53	x	24.49	x	0.63	x	0.7	=	78.81	(80)
West	0.9x	0.77	x	10.53	x	16.15	x	0.63	x	0.7	=	51.98	(80)
Rooflights	0.9x	1	x	1.91	x	43.99	x	0.63	x	0.7	=	33.35	(82)
Rooflights	0.9x	1	x	4.8	x	26.46	x	0.63	x	0.7	=	50.42	(82)
Rooflights	0.9x	1	x	1.6	x	26.46	x	0.63	x	0.7	=	16.81	(82)
Rooflights	0.9x	1	x	1.91	x	80.27	x	0.63	x	0.7	=	60.85	(82)
Rooflights	0.9x	1	x	4.8	x	53.3	x	0.63	x	0.7	=	101.55	(82)
Rooflights	0.9x	1	x	1.6	x	53.3	x	0.63	x	0.7	=	33.85	(82)
Rooflights	0.9x	1	x	1.91	x	121.32	x	0.63	x	0.7	=	91.97	(82)
Rooflights	0.9x	1	x	4.8	x	91.66	x	0.63	x	0.7	=	174.63	(82)
Rooflights	0.9x	1	x	1.6	x	91.66	x	0.63	x	0.7	=	58.21	(82)
Rooflights	0.9x	1	x	1.91	x	165.18	x	0.63	x	0.7	=	125.22	(82)
Rooflights	0.9x	1	x	4.8	x	139.87	x	0.63	x	0.7	=	266.47	(82)
Rooflights	0.9x	1	x	1.6	x	139.87	x	0.63	x	0.7	=	88.82	(82)
Rooflights	0.9x	1	x	1.91	x	195.41	x	0.63	x	0.7	=	148.14	(82)
Rooflights	0.9x	1	x	4.8	x	176.97	x	0.63	x	0.7	=	337.15	(82)
Rooflights	0.9x	1	x	1.6	x	176.97	x	0.63	x	0.7	=	112.38	(82)
Rooflights	0.9x	1	x	1.91	x	197.72	x	0.63	x	0.7	=	149.89	(82)
Rooflights	0.9x	1	x	4.8	x	183.63	x	0.63	x	0.7	=	349.84	(82)
Rooflights	0.9x	1	x	1.6	x	183.63	x	0.63	x	0.7	=	116.61	(82)
Rooflights	0.9x	1	x	1.91	x	189.14	x	0.63	x	0.7	=	143.38	(82)
Rooflights	0.9x	1	x	4.8	x	173.81	x	0.63	x	0.7	=	331.13	(82)
Rooflights	0.9x	1	x	1.6	x	173.81	x	0.63	x	0.7	=	110.38	(82)
Rooflights	0.9x	1	x	1.91	x	166.58	x	0.63	x	0.7	=	126.28	(82)
Rooflights	0.9x	1	x	4.8	x	145.57	x	0.63	x	0.7	=	277.32	(82)
Rooflights	0.9x	1	x	1.6	x	145.57	x	0.63	x	0.7	=	92.44	(82)
Rooflights	0.9x	1	x	1.91	x	136.8	x	0.63	x	0.7	=	103.71	(82)
Rooflights	0.9x	1	x	4.8	x	108.61	x	0.63	x	0.7	=	206.92	(82)
Rooflights	0.9x	1	x	1.6	x	108.61	x	0.63	x	0.7	=	68.97	(82)

DER WorkSheet: New dwelling as built

Rooflights 0.9x	1	x	1.91	x	92.07	x	0.63	x	0.7	=	69.8	(82)
Rooflights 0.9x	1	x	4.8	x	64.26	x	0.63	x	0.7	=	122.43	(82)
Rooflights 0.9x	1	x	1.6	x	64.26	x	0.63	x	0.7	=	40.81	(82)
Rooflights 0.9x	1	x	1.91	x	53.73	x	0.63	x	0.7	=	40.73	(82)
Rooflights 0.9x	1	x	4.8	x	33.27	x	0.63	x	0.7	=	63.39	(82)
Rooflights 0.9x	1	x	1.6	x	33.27	x	0.63	x	0.7	=	21.13	(82)
Rooflights 0.9x	1	x	1.91	x	36.94	x	0.63	x	0.7	=	28	(82)
Rooflights 0.9x	1	x	4.8	x	21.59	x	0.63	x	0.7	=	41.13	(82)
Rooflights 0.9x	1	x	1.6	x	21.59	x	0.63	x	0.7	=	13.71	(82)

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

(83)m=	712.7	1269.63	1879.85	2560.09	3072.22	3138.44	2989.11	2594.58	2114.02	1442.17	863.91	603.22	(83)

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

(84)m=	1542.28	2096.82	2678.34	3310.66	3771.06	3789.77	3611.04	3223.63	2768.96	2145.29	1622.59	1406.53	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.75	0.59	0.45	0.51	0.75	0.93	0.98	0.99	(86)

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

(87)m=	19.88	19.4	19.78	20.25	20.61	20.82	20.88	20.87	20.69	20.19	19.57	19.12	(87)

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

(88)m=	20.13	20.14	20.14	20.16	20.16	20.18	20.18	20.19	20.18	20.16	20.16	20.15	(88)

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

(89)m=	0.99	0.98	0.94	0.86	0.71	0.53	0.38	0.44	0.7	0.92	0.98	0.99	(89)

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

(90)m=	17.83	17.96	18.51	19.2	19.69	19.96	20.03	20.02	19.82	19.13	18.24	17.55	(90)

fLA = Living area ÷ (4) = 0.05 (91)

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

(92)m=	17.93	18.03	18.58	19.26	19.74	20.01	20.08	20.07	19.86	19.18	18.31	17.63	(92)

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

(93)m=	17.93	18.03	18.58	19.26	19.74	20.01	20.08	20.07	19.86	19.18	18.31	17.63	(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	0.96	0.92	0.83	0.69	0.52	0.37	0.42	0.68	0.9	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	1519.18	2021.28	2470.13	2759.32	2615.07	1955.65	1325.07	1368.91	1880.97	1923.73	1576.34	1389.4	(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=	5712.53	5477.3	5014.63	4197.44	3241.15	2127.48	1367.72	1435.54	2290.38	3461.32	4565.13	5523.82	(97)

DER WorkSheet: New dwelling as built

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

(98)m=	3119.85	2322.44	1893.11	1035.45	465.8	0	0	0	0	1143.97	2151.93	3076.01

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 15208.56 (98)

Space heating requirement in kWh/m²/year 34.07 (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 1 446.44 (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)	3119.85	2322.44	1893.11	1035.45	465.8	0	0	0	0	1143.97	2151.93	3076.01	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	698.83	520.21	424.04	231.93	104.34	0	0	0	0	256.24	482.02	689.01	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3406.62 (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)

	177.16	156.1	165.16	151.54	150.43	136.74	134.7	145.21	144.08	158.84	164.1	173.29

Efficiency of water heater 173.46 (216)

(217)m=	173.46	173.46	173.46	173.46	173.46	173.46	173.46	173.46	173.46	173.46	173.46	173.46

(217)

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

(219)m=	102.13	89.99	95.21	87.36	86.73	78.83	77.66	83.71	83.06	91.57	94.6	99.9

Total = Sum(219a)$_{1...12}$ = 1070.76 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3406.62
Water heating fuel used		1070.76
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	2120.95	(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		2120.95 (231)
Electricity for lighting		896.2 (232)
Electricity generated by PVs		-1870.81 (233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5623.72 (338)

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

DER WorkSheet: New dwelling as built

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	1768.04	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	555.73	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2323.76	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	1100.77	(267)
Electricity for lighting	(232) x		0.519	=	465.13	(268)
Energy saving/generation technologies Item 1			0.519	=	-970.95	(269)
Total CO2, kg/year		sum of (265)…(271) =			2918.71	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			6.54	(273)
EI rating (section 14)					92	(274)

TER WorkSheet: New dwelling as built

User Details:

Assessor Name:	Harry Hinchcliffe	**Stroma Number:**	STRO034627
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.18

Property Address: 14505 MVHR

Address : Edgecumbe, Heather Drive, SUNNINGDALE, SL5 0HP

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	189.92	(1a) x	2.9	(2a) =	550.77	(3a)
First floor	150.87	(1b) x	2.7	(2b) =	407.35	(3b)
Second floor	105.63	(1c) x	2.28	(2c) =	240.84	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	446.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		1198.95	(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) =	0.03 (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)		0.28 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.28 (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 as built

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

0.36	0.35	0.35	0.31	0.3	0.27	0.27	0.26	0.28	0.3	0.32	0.33

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	0.53	0.54	0.55	0.55	0.56	(24d)

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

(25)m=	0.57	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			41.82	x1/[1/(1.4)+ 0.04] =	55.44			(27)
Windows Type 2			7.11	x1/[1/(1.4)+ 0.04] =	9.43			(27)
Windows Type 3			10.53	x1/[1/(1.4)+ 0.04] =	13.96			(27)
Windows Type 4			25.92	x1/[1/(1.4)+ 0.04] =	34.36			(27)
Rooflights Type 1			1.91	x1/[1/(1.7) + 0.04] =	3.247			(27b)
Rooflights Type 2			4.8	x1/[1/(1.7) + 0.04] =	8.160001			(27b)
Rooflights Type 3			1.6	x1/[1/(1.7) + 0.04] =	2.72			(27b)
Floor			189.92	x 0.13 =	24.6896			(28)
Walls Type1	328.81	85.38	243.43	x 0.18 =	43.82			(29)
Walls Type2	15.45	0	15.45	x 0.18 =	2.78			(29)
Roof Type1	39.05	0	39.05	x 0.13 =	5.08			(30)
Roof Type2	136	0	136	x 0.13 =	17.68			(30)
Roof Type3	29.46	8.31	21.15	x 0.13 =	2.75			(30)
Roof Type4	10.29	0	10.29	x 0.13 =	1.34			(30)
Total area of elements, m²			748.98					(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) = 224.55 (33)

TER WorkSheet: New dwelling as built

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 37494.46 (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 29.95 (36)

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

Total fabric heat loss (33) + (36) = 254.5 (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=	223.65	222.65	221.66	217.05	216.18	212.16	212.16	211.42	213.71	216.18	217.93	219.76	(38)

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

(39)m=	478.15	477.15	476.16	471.55	470.68	466.66	466.66	465.92	468.21	470.68	472.43	474.26	

Average = Sum(39)$_{1...12}$ /12= 471.54 (39)

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

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

Average = Sum(40)$_{1...12}$ /12= 1.06 (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 3.32 (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) + 36 113.1 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more 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=	124.41	119.89	115.37	110.84	106.32	101.79	101.79	106.32	110.84	115.37	119.89	124.41	

Total = Sum(44)$_{1...12}$ = 1357.25 (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=	184.5	161.37	166.52	145.17	139.3	120.2	111.39	127.82	129.34	150.74	164.54	178.68	

Total = Sum(45)$_{1...12}$ = 1779.57 (45)

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

(46)m=	27.68	24.21	24.98	21.78	20.89	18.03	16.71	19.17	19.4	22.61	24.68	26.8	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 2.11 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.14 (50)

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

TER WorkSheet: New dwelling as built

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)		1.14	(55)

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

(56)m=	35.37	31.94	35.37	34.23	35.37	34.23	35.37	35.37	34.23	35.37	34.23	35.37	(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=	35.37	31.94	35.37	34.23	35.37	34.23	35.37	35.37	34.23	35.37	34.23	35.37	(57)

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

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

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

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

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

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

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

(62)m=	243.13	214.32	225.15	201.91	197.93	176.94	170.01	186.45	186.08	209.37	221.28	237.31	(62)

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

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

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

Output from water heater

(64)m=	243.13	214.32	225.15	201.91	197.93	176.94	170.01	186.45	186.08	209.37	221.28	237.31	

Output from water heater (annual)$_{1...12}$	2469.87	(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=	108.25	96.02	102.27	93.66	93.22	85.36	83.94	89.4	88.4	97.02	100.1	106.31	(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=	166.11	166.11	166.11	166.11	166.11	166.11	166.11	166.11	166.11	166.11	166.11	166.11	(66)

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

(67)m=	50.75	45.07	36.66	27.75	20.74	17.51	18.92	24.6	33.01	41.92	48.93	52.16	(67)

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

(68)m=	568.29	574.19	559.33	527.69	487.75	450.22	425.15	419.25	434.11	465.75	505.68	543.21	(68)

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

(69)m=	39.61	39.61	39.61	39.61	39.61	39.61	39.61	39.61	39.61	39.61	39.61	39.61	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	-132.89	(71)

Water heating gains (Table 5)

(72)m=	145.5	142.89	137.46	130.08	125.29	118.55	112.82	120.16	122.77	130.41	139.03	142.9	(72)

TER WorkSheet: New dwelling as built

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

(73)m=	840.37	837.98	809.27	761.36	709.63	662.12	632.73	639.85	665.73	713.91	769.47	814.1	(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	41.82	x	10.63	x	0.63	x	0.7	=	135.9	(74)
North	0.9x 0.77	x	41.82	x	20.32	x	0.63	x	0.7	=	259.72	(74)
North	0.9x 0.77	x	41.82	x	34.53	x	0.63	x	0.7	=	441.32	(74)
North	0.9x 0.77	x	41.82	x	55.46	x	0.63	x	0.7	=	708.88	(74)
North	0.9x 0.77	x	41.82	x	74.72	x	0.63	x	0.7	=	954.92	(74)
North	0.9x 0.77	x	41.82	x	79.99	x	0.63	x	0.7	=	1022.27	(74)
North	0.9x 0.77	x	41.82	x	74.68	x	0.63	x	0.7	=	954.42	(74)
North	0.9x 0.77	x	41.82	x	59.25	x	0.63	x	0.7	=	757.21	(74)
North	0.9x 0.77	x	41.82	x	41.52	x	0.63	x	0.7	=	530.61	(74)
North	0.9x 0.77	x	41.82	x	24.19	x	0.63	x	0.7	=	309.16	(74)
North	0.9x 0.77	x	41.82	x	13.12	x	0.63	x	0.7	=	167.65	(74)
North	0.9x 0.77	x	41.82	x	8.86	x	0.63	x	0.7	=	113.3	(74)
East	0.9x 0.77	x	7.11	x	19.64	x	0.63	x	0.7	=	42.68	(76)
East	0.9x 0.77	x	7.11	x	38.42	x	0.63	x	0.7	=	83.48	(76)
East	0.9x 0.77	x	7.11	x	63.27	x	0.63	x	0.7	=	137.49	(76)
East	0.9x 0.77	x	7.11	x	92.28	x	0.63	x	0.7	=	200.52	(76)
East	0.9x 0.77	x	7.11	x	113.09	x	0.63	x	0.7	=	245.74	(76)
East	0.9x 0.77	x	7.11	x	115.77	x	0.63	x	0.7	=	251.56	(76)
East	0.9x 0.77	x	7.11	x	110.22	x	0.63	x	0.7	=	239.49	(76)
East	0.9x 0.77	x	7.11	x	94.68	x	0.63	x	0.7	=	205.72	(76)
East	0.9x 0.77	x	7.11	x	73.59	x	0.63	x	0.7	=	159.9	(76)
East	0.9x 0.77	x	7.11	x	45.59	x	0.63	x	0.7	=	99.06	(76)
East	0.9x 0.77	x	7.11	x	24.49	x	0.63	x	0.7	=	53.21	(76)
East	0.9x 0.77	x	7.11	x	16.15	x	0.63	x	0.7	=	35.1	(76)
South	0.9x 0.77	x	25.92	x	46.75	x	0.63	x	0.7	=	370.35	(78)
South	0.9x 0.77	x	25.92	x	76.57	x	0.63	x	0.7	=	606.53	(78)
South	0.9x 0.77	x	25.92	x	97.53	x	0.63	x	0.7	=	772.61	(78)
South	0.9x 0.77	x	25.92	x	110.23	x	0.63	x	0.7	=	873.22	(78)
South	0.9x 0.77	x	25.92	x	114.87	x	0.63	x	0.7	=	909.95	(78)
South	0.9x 0.77	x	25.92	x	110.55	x	0.63	x	0.7	=	875.7	(78)
South	0.9x 0.77	x	25.92	x	108.01	x	0.63	x	0.7	=	855.62	(78)
South	0.9x 0.77	x	25.92	x	104.89	x	0.63	x	0.7	=	830.92	(78)
South	0.9x 0.77	x	25.92	x	101.89	x	0.63	x	0.7	=	807.09	(78)
South	0.9x 0.77	x	25.92	x	82.59	x	0.63	x	0.7	=	654.2	(78)

TER WorkSheet: New dwelling as built

South	0.9x	0.77	x	25.92	x	55.42	x	0.63	x	0.7	=	438.99	(78)
South	0.9x	0.77	x	25.92	x	40.4	x	0.63	x	0.7	=	320.01	(78)
West	0.9x	0.77	x	10.53	x	19.64	x	0.63	x	0.7	=	63.2	(80)
West	0.9x	0.77	x	10.53	x	38.42	x	0.63	x	0.7	=	123.64	(80)
West	0.9x	0.77	x	10.53	x	63.27	x	0.63	x	0.7	=	203.62	(80)
West	0.9x	0.77	x	10.53	x	92.28	x	0.63	x	0.7	=	296.97	(80)
West	0.9x	0.77	x	10.53	x	113.09	x	0.63	x	0.7	=	363.94	(80)
West	0.9x	0.77	x	10.53	x	115.77	x	0.63	x	0.7	=	372.56	(80)
West	0.9x	0.77	x	10.53	x	110.22	x	0.63	x	0.7	=	354.69	(80)
West	0.9x	0.77	x	10.53	x	94.68	x	0.63	x	0.7	=	304.68	(80)
West	0.9x	0.77	x	10.53	x	73.59	x	0.63	x	0.7	=	236.82	(80)
West	0.9x	0.77	x	10.53	x	45.59	x	0.63	x	0.7	=	146.71	(80)
West	0.9x	0.77	x	10.53	x	24.49	x	0.63	x	0.7	=	78.81	(80)
West	0.9x	0.77	x	10.53	x	16.15	x	0.63	x	0.7	=	51.98	(80)
Rooflights	0.9x	1	x	1.91	x	43.99	x	0.63	x	0.7	=	33.35	(82)
Rooflights	0.9x	1	x	4.8	x	26.46	x	0.63	x	0.7	=	50.42	(82)
Rooflights	0.9x	1	x	1.6	x	26.46	x	0.63	x	0.7	=	16.81	(82)
Rooflights	0.9x	1	x	1.91	x	80.27	x	0.63	x	0.7	=	60.85	(82)
Rooflights	0.9x	1	x	4.8	x	53.3	x	0.63	x	0.7	=	101.55	(82)
Rooflights	0.9x	1	x	1.6	x	53.3	x	0.63	x	0.7	=	33.85	(82)
Rooflights	0.9x	1	x	1.91	x	121.32	x	0.63	x	0.7	=	91.97	(82)
Rooflights	0.9x	1	x	4.8	x	91.66	x	0.63	x	0.7	=	174.63	(82)
Rooflights	0.9x	1	x	1.6	x	91.66	x	0.63	x	0.7	=	58.21	(82)
Rooflights	0.9x	1	x	1.91	x	165.18	x	0.63	x	0.7	=	125.22	(82)
Rooflights	0.9x	1	x	4.8	x	139.87	x	0.63	x	0.7	=	266.47	(82)
Rooflights	0.9x	1	x	1.6	x	139.87	x	0.63	x	0.7	=	88.82	(82)
Rooflights	0.9x	1	x	1.91	x	195.41	x	0.63	x	0.7	=	148.14	(82)
Rooflights	0.9x	1	x	4.8	x	176.97	x	0.63	x	0.7	=	337.15	(82)
Rooflights	0.9x	1	x	1.6	x	176.97	x	0.63	x	0.7	=	112.38	(82)
Rooflights	0.9x	1	x	1.91	x	197.72	x	0.63	x	0.7	=	149.89	(82)
Rooflights	0.9x	1	x	4.8	x	183.63	x	0.63	x	0.7	=	349.84	(82)
Rooflights	0.9x	1	x	1.6	x	183.63	x	0.63	x	0.7	=	116.61	(82)
Rooflights	0.9x	1	x	1.91	x	189.14	x	0.63	x	0.7	=	143.38	(82)
Rooflights	0.9x	1	x	4.8	x	173.81	x	0.63	x	0.7	=	331.13	(82)
Rooflights	0.9x	1	x	1.6	x	173.81	x	0.63	x	0.7	=	110.38	(82)
Rooflights	0.9x	1	x	1.91	x	166.58	x	0.63	x	0.7	=	126.28	(82)
Rooflights	0.9x	1	x	4.8	x	145.57	x	0.63	x	0.7	=	277.32	(82)
Rooflights	0.9x	1	x	1.6	x	145.57	x	0.63	x	0.7	=	92.44	(82)
Rooflights	0.9x	1	x	1.91	x	136.8	x	0.63	x	0.7	=	103.71	(82)
Rooflights	0.9x	1	x	4.8	x	108.61	x	0.63	x	0.7	=	206.92	(82)
Rooflights	0.9x	1	x	1.6	x	108.61	x	0.63	x	0.7	=	68.97	(82)

TER WorkSheet: New dwelling as built

Rooflights 0.9x	1	x	1.91	x	92.07	x	0.63	x	0.7	=	69.8	(82)
Rooflights 0.9x	1	x	4.8	x	64.26	x	0.63	x	0.7	=	122.43	(82)
Rooflights 0.9x	1	x	1.6	x	64.26	x	0.63	x	0.7	=	40.81	(82)
Rooflights 0.9x	1	x	1.91	x	53.73	x	0.63	x	0.7	=	40.73	(82)
Rooflights 0.9x	1	x	4.8	x	33.27	x	0.63	x	0.7	=	63.39	(82)
Rooflights 0.9x	1	x	1.6	x	33.27	x	0.63	x	0.7	=	21.13	(82)
Rooflights 0.9x	1	x	1.91	x	36.94	x	0.63	x	0.7	=	28	(82)
Rooflights 0.9x	1	x	4.8	x	21.59	x	0.63	x	0.7	=	41.13	(82)
Rooflights 0.9x	1	x	1.6	x	21.59	x	0.63	x	0.7	=	13.71	(82)

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

(83)m=	712.7	1269.63	1879.85	2560.09	3072.22	3138.44	2989.11	2594.58	2114.02	1442.17	863.91	603.22	(83)

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

(84)m=	1553.07	2107.61	2689.13	3321.45	3781.85	3800.56	3621.83	3234.42	2779.75	2156.08	1633.38	1417.32	(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	0.9	0.73	0.56	0.64	0.9	0.99	1	1	(86)

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

(87)m=	19.63	19.81	20.1	20.47	20.79	20.95	20.99	20.98	20.84	20.41	19.94	19.6	(87)

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

(88)m=	20.02	20.03	20.03	20.04	20.04	20.05	20.05	20.05	20.04	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	0.86	0.64	0.44	0.52	0.84	0.99	1	1	(89)

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

(90)m=	18.16	18.43	18.85	19.4	19.83	20.01	20.04	20.04	19.91	19.31	18.63	18.12	(90)

fLA = Living area ÷ (4) = 0.05 (91)

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

(92)m=	18.23	18.5	18.91	19.45	19.87	20.06	20.09	20.09	19.95	19.37	18.7	18.2	(92)

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

(93)m=	18.23	18.5	18.91	19.45	19.87	20.06	20.09	20.09	19.95	19.37	18.7	18.2	(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	0.85	0.64	0.45	0.52	0.84	0.99	1	1	(94)

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

(95)m=	1552.56	2104.06	2667.12	3185.78	3217.29	2444.64	1617.02	1691.58	2329.65	2124.52	1631.66	1417.04	(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=	6662.42	6488.02	5910.45	4975.67	3847.73	2548.49	1628.8	1717.86	2740.8	4127.74	5479.31	6639.18	(97)

TER WorkSheet: New dwelling as built

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

(98)m=	3801.74	2946.02	2413.04	1288.72	469.04	0	0	0	0	1490.4	2770.31	3885.27

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 19064.54 (98)

Space heating requirement in kWh/m²/year 42.71 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	3801.74	2946.02	2413.04	1288.72	469.04	0	0	0	0	1490.4	2770.31	3885.27	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	4066.03	3150.83	2580.79	1378.31	501.65	0	0	0	0	1594.01	2962.89	4155.37	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 20389.88 (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)

	243.13	214.32	225.15	201.91	197.93	176.94	170.01	186.45	186.08	209.37	221.28	237.31

Efficiency of water heater 79.8 (216)

(217)m=	89.78	89.68	89.48	88.89	87.04	79.8	79.8	79.8	79.8	89.03	89.61	89.81

(217)

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

(219)m=	270.82	238.97	251.63	227.16	227.41	221.73	213.05	233.64	233.18	235.16	246.93	264.25

Total = Sum(219a)$_{1...12}$ = 2863.93 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		20389.88
Water heating fuel used		2863.93
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		896.2 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		24225.01 (338)

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

TER WorkSheet: New dwelling as built

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	4404.21	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	618.61	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5022.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	465.13	(268)
Total CO2, kg/year		sum of (265)…(271) =			5526.87	(272)

TER = 18.57 (273)