

Energy Efficiency Statement

Residential Development

For Mrs Denise Simpson

At

27 Central Drive
Elmer
PO22 7TT

IVON BLUMER ARCHITECTS



Our Ref: YF-38-A

Mr. Ivon Blumer

Ivon Blumer Architects,
The Studio, 41 West Drive,
Aldwick Bay,
Bognor Regis PO21 4LZ

Therm Energy Limited

1 Tarrant Street
Arundel
West Sussex
BN18 9DG

14th June 2021

Dear Mr. Blumer,

**Re: Deck House, 27 Central Drive, Elmer
Thermal Calculations - Part L1A of the Building Regulations**

Further to your instruction, we enclose revised SAP Design Calculation reference YF-38-01-A. This revision omits the use of solar panels and a whole house ventilation system.

The SAP Calculation confirms compliance with both the Target CO₂ Emission Rate and the Target Fabric Energy Efficiency (TFEE) rate, all in accordance with Approved Document L1A (2013 edition).

Attached is a Construction Specification showing the insulation levels and heating system assumed, please note the following:

- | | |
|----|--|
| 1) | Ground floor insulated with 130mm Celotex XR4000 or similar. |
| 2) | External walls insulated with 75 mm Celotex CW4000 partial cavity fill. |
| 3) | Windows & glazed doors to have an average U-value of 1.4 – 1.5, to be confirmed by supplier. |
| 4) | Thermal bridging junctions to be constructed in accordance with the Aircrete Constructive Details for partial cavity fill. |
| 5) | A design air permeability of 6.0m ³ /h/m ² , to be confirmed by air pressure testing. |
| 6) | Main heating from NIBE type air source heat pump or other type listed on the SAP Appendix Q Database, with underfloor heating. |
| 7) | Ventilation using System 1 ventilation including extract fans to wet rooms. |

Should you have any queries, please do not hesitate to contact us.

Yours sincerely

Colin Marshall SAP Assessor

1. Construction Specification for Part L1A (2013) Compliance

Project:	Date:	Our reference:	Version
Deck House, 27 Central Drive, Elmer	14th June 2021	YF-38	1
1. Construction and insulation			
Element	U-Value (W/m ² K)		
<u>a) Ground floor</u> 75mm screed on 130mm Celotex XR4000 or similar on a beam and block floor.			0.14
<u>b) Exposed floor – Garage / Store to First floor</u> 70mm screed on a beam and block floor, with 150mm Celotex XR4000 in ceiling void, 12.5mm plasterboard ceiling.			0.14
<u>c) External wall – Cedral cladding</u> Cedral cladding on battens on 100 mm Celcon standard concrete blocks, 100 mm cavity, with 75 mm Celotex CW4000 or similar, inner leaf to be 100 mm Celcon standard concrete blocks or similar, finished in 12.5 mm two coat plaster finish.			0.18
<u>d) External wall – Garage/Store to Dwelling</u> 150 mm Celcon standard concrete blocks or similar, lined on the cold side with 100 mm Celotex between 100 mm x 50 mm s/w battens fixed to blockwork, finished in 12.5 mm plasterboard.			0.24
<u>e) External wall – Stair Link to Garage ground floor</u> 100 mm Celcon standard concrete blocks or similar, lined with 100 mm Celotex between 100 mm x 50 mm s/w battens fixed to blockwork, finished in 12.5 mm plasterboard.			0.26
<u>f) External wall – Stud walls - Atrium to adjacent cold areas</u> 100mm Celotex GA4000 between studs, 12.5mm plasterboard finish.			0.31
<u>g) Cold roof</u> 200mm mineral wool quilt between joists, 200mm mineral wool quilt cross-laid over joists, 12.5mm plasterboard finish.			0.11
<u>h) Sloping ceilings</u> 150 mm Celotex FR4000 insulation boards to be laid between 200 mm deep rafters, with 50 mm Celotex insulation under rafters, 12.5mm plasterboard finish.			0.14
<u>i) Flat roof to Glazed Link</u> Roof coverings on 120mm Celotex or similar on timber joists, 12.5mm plasterboard finish.			0.18
<u>j) Windows</u> Aluminium framed double-glazed, low E glass, minimum 16mm air gap between panes. Manufacturer's U-value confirmation to be provided.			1.4

<u>k) Glazed sliding doors</u> Aluminium framed double-glazed, low E glass, minimum 16mm air gap between panes. Manufacturer's U-value confirmation to be provided.	1.5
<u>l) Glazed screens, including glazing to Link</u> Aluminium framed double-glazed, low E glass, minimum 16mm air gap between panes. Manufacturer's U-value confirmation to be provided. Timber framed, half-glazed or solid doors.	1.5
<u>m) Roof lights</u> Velux type, timber framed double-glazed, low E glass, minimum 16mm air gap between panes. Manufacturer's U-value confirmation to be provided.	1.3
<u>n) Roof light to Atrium</u> Proprietary type, double-glazed, low E glass, minimum 16mm air gap between panes. Manufacturer's U-value confirmation to be provided.	1.5
<u>o) Thermal Bridging Junctions</u> Thermal bridging junctions to be constructed in accordance with the Aircrete Constructive Details for partial cavity fill. Relevant site checklists to be completed by Builder as work proceeds.	
<u>p) Air tightness</u> A design air permeability of 6.0m³/h/m² to be confirmed by air pressure testing.	
2. Heating and Ventilation	
<u>a) Main Heating System</u> NIBE type air source heat pump or other type listed on the SAP Appendix Q Database, with underfloor heating.	
<u>b) Water Heating</u> From the main heating, circa 200 litre hot water cylinder assumed, with cylinderstat, located in a heated space, with a standing heat loss no greater than 2.1kWh/day. All primary pipework insulated.	
<u>c) Heating Controls</u> Fully independent time and temperature zone control by a suitable arrangement of plumbing and electrical services.	
<u>d) Secondary heating</u> None proposed.	
<u>e) Ventilation</u> System 1 natural ventilation including extract fans to wet rooms.	
3. Other energy related issues	
<u>a) Lighting (internal)</u> Minimum 75% Low-energy light fittings in accordance with Part L1A.	
<u>b) Electricity Tariff</u> Standard Tariff.	

4. As- Built SAP and EPC - Deck House, 27 Central Drive, Elmer, Bognor Regis

This section is to be completed when the final SAP and EPC are required upon completion of the dwelling(s).

(1) Has there been any changes to the specification above (list changes above, or state 'no changes')

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, 1.0.2.0

Printed on 14 June 2021 at 08:53:41

Project Information

Assessed By: Colin Marshall (STRO004020)

Building Type: Detached House

Dwelling Details

NEW DWELLING DESIGN STAGE

Total Floor Area: 246.8m²

Site Reference : Deck House, Elmer

Plot Reference: YF-38-01-rev A - SAP Design

Address : Deck House, 27, Central Drive, Elmer, BOGNOR REGIS, PO22 7TT

Client Details

Name: Ivon Blumer Architects Ltd

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) 26.96 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 18.58 kg/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 74.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 74.7 kWh/m² OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.31 (max. 0.70)	OK
Party wall	0.20 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	6.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Heat pumps with radiators or underfloor heating - electric
Air source heat pump with flow temperature <= 35°C

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 2.10 kWh/day	
	Permitted by DBSCG: 2.24 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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England):	Not significant	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: North	6.78m ²	
Windows facing: North	22.9m ²	
Windows facing: South	23.6m ²	
Windows facing: East	2.17m ²	
Windows facing: East	2.31m ²	
Windows facing: West	1.41m ²	
Windows facing: West	1.89m ²	
Windows facing: West	13.92m ²	
Windows facing: North	15.6m ²	
Windows facing: South	15.6m ²	
Roof windows facing: North	2.25m ²	
Roof windows facing: North	2.6m ²	
Roof windows facing: South	2.25m ²	
Roof windows facing: North	2.6m ²	
Roof windows facing: South	3.6m ²	
Ventilation rate:	8.00	
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 100% of daylight hours	

10 Key features

Thermal bridging	0.031 W/m ² K
Roofs U-value	0.11 W/m ² K

SAP Input

Property Details: 7T-15-01-REV A - SAP Design

Address: Deck House, 27, Central Drive, Elmer, BOGNOR REGIS, PO22 7TT
Located in: England
Region: South East England
UPRN:
Date of assessment: 14 June 2021
Date of certificate: 14 June 2021
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/person/day: True
PCDF Version: 477

Property description

Dwelling type: House
Detachment: Detached
Year Completed: 2021
Floor Location: **Floor area:** **Storey height:**
 Floor 0 77.1 m² 2.4 m
 Floor 1 169.7 m² 3.39 m
Living area: 140 m² (fraction 0.543)
Front of dwelling faces: North

Opening types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
front D	Manufacturer	Solid			Wood
kitchen door	Manufacturer	Half glazed			Wood
Glazed link	Manufacturer	Half glazed			Wood
Glazed link	Manufacturer	Half glazed			Wood
Link to Garage	Manufacturer	Solid			Wood
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
entrance glazing	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
Patio	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
Patio	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
door panel	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
W	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
Patio	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
Link glazing	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
Link glazing	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
Roof light- VELUX	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood
Atrium RL	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
roof light - Velux	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Wood
Agtrium RL	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal, thermal break
Atrium RL	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:
front D	mm	0.7	0.7	1.6	1.97	1
kitchen door	mm	0.7	0.7	1.6	1.93	1
Glazed link	mm	0.7	0.7	1.6	1.83	1
Glazed link	mm	0.7	0.7	1.6	1.83	1
Link to Garage	mm	0.7	0.7	1.6	1.83	1
W	16mm or more	0.8	0.63	1.4	6.78	1

SAP Input

entrance glazing	16mm or more	0.8	0.63	1.5	22.9	1
Patio	16mm or more	0.8	0.63	1.5	23.6	1
W	16mm or more	0.8	0.63	1.4	2.17	1
Patio	16mm or more	0.8	0.63	1.5	2.31	1
door panel	16mm or more	0.8	0.63	1.5	1.41	1
W	16mm or more	0.8	0.63	1.4	1.89	1
Patio	16mm or more	0.8	0.63	1.5	13.92	1
Link glazing	16mm or more	0.8	0.63	1.5	15.6	1
Link glazing	16mm or more	0.8	0.63	1.5	15.6	1
Roof light- VELUX	16mm or more	0.7	0.63	1.5	2.25	1
Atrium RL	16mm or more	0.8	0.63	1.5	2.6	1
roof light - Velux	16mm or more	0.7	0.63	1.5	2.25	1
Agtrium RL	16mm or more	0.8	0.63	1.5	2.6	1
Atrium RL	16mm or more	0.8	0.63	1.5	3.6	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
front D		cedral clad	North	0	0
kitchen door		cedral clad	West	0	0
Glazed link		cedral clad	North	0	0
Glazed link		cedral clad	South	0	0
Link to Garage		Link to Garage	South	0	0
W		cedral clad	North	0	0
entrance glazing		cedral clad	North	0	0
Patio		cedral clad	South	0	0
W		cedral clad	East	0	0
Patio		cedral clad	East	0	0
door panel		cedral clad	West	0	0
W		cedral clad	West	0	0
Patio		cedral clad	West	0	0
Link glazing		cedral clad	North	0	0
Link glazing		cedral clad	South	0	0
Roof light- VELUX		roof - cold	North	0	0
Atrium RL		roof - warm	North	0	0
roof light - Velux		roof - cold	South	0	0
Agtrium RL		roof - warm	North	0	0
Atrium RL		roof - warm	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
cedral clad	188.8	113.74	75.06	0.18	0	False	N/A
garage to house	39.3	0	39.3	0.24	0	False	N/A
Glazed Link wall	39.2	0	39.2	0.18	0	False	N/A
Link to Garage	7.1	1.83	5.27	0.26	0	False	N/A
Stud - Atrium	55.3	0	55.3	0.31	0	False	N/A
Stud - RL	38.4	0	38.4	0.31	0	False	N/A
roof - warm	57.8	8.8	49	0.14	0		N/A
roof - cold	122.2	4.5	117.7	0.11	0		N/A
Stair Link	11.1	0	11.1	0.18	0		N/A
ground	77.1			0.14			N/A
exposed floor	80.1			0.14			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
No.25 to Link	15.9						N/A

Thermal Bridges:

SAP Input

Thermal bridges:

User-defined (individual PSI-values) Y-Value = 0.0312

Length	Psi-value		
34.5	0.36	E1	Steel lintel with perforated steel base plate
9.04	0.046	E3	Sill
54.3	0.05	E4	Jamb
42	0.05	E5	Ground floor (normal)
25.2	0.044	E16	Corner (normal)
51.2	0	E6	Intermediate floor within a dwelling
25.8	0.036	E11	Eaves (insulation at rafter level)
29.16	0.069	E13	Gable (insulation at rafter level)
1.8	0.08	R1	Head
1.8	0.06	R2	Sill
2.4	0.06	R2	Sill
3.8	0.06	R6	Flat ceiling

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	4
Number of passive stacks:	0
Number of sides sheltered:	0
Pressure test:	6

Main heating system:

Main heating system:	Heat pumps with radiators or underfloor heating
	Electric heat pumps
	Fuel: Electricity
	Info Source: SAP Tables
	SAP Table: 214
	Air source heat pump with flow temperature <= 35°C
	Underfloor heating, pipes in screed above insulation
	Central heating pump : 2013 or later
	Design flow temperature: Design flow temperature<=45°C
	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:	None
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Water heating

Water heating:	From main heating system
	Water code: 901
	Fuel :Electricity
	Hot water cylinder
	Cylinder volume: 200 litres
	Cylinder insulation: Measured loss, 2.1kWh/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

SAP Input

Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Colin Marshall **Stroma Number:** STRO004020
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: (F-35.01-rev 4 - SAP Design)

Address : Deck House, 27, Central Drive, Elmer, BOGNOR REGIS, PO22 7TT

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.1 (1a) ×	2.4 (2a) =	185.04 (3a)
First floor	169.7 (1b) ×	3.39 (2b) =	575.28 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	246.8 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	760.32 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 × 40 =	0 (6a)
Number of open flues	0	0	0	0 × 20 =	0 (6b)
Number of intermittent fans				4 × 10 =	40 (7a)
Number of passive vents				0 × 10 =	0 (7b)
Number of flueless gas fires				0 × 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	× (5) =	0.05 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 × (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			6 (17)
If based on air permeability value, then (18) = [(17) + 20]÷(8), otherwise (18) = (16)			0.35 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 × (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.35 (21)
Infiltration rate modified for monthly wind speed			

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

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(23c)

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(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 × 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59
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(24d)

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

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59
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(25)

3. Heat losses and heat gains 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 Type 1			1.97	×	1.6	=	3.152
Doors Type 2			1.93	×	1.6	=	3.088
Doors Type 3			1.83	×	1.6	=	2.928
Doors Type 4			1.83	×	1.6	=	2.928
Doors Type 5			1.83	×	1.6	=	2.928
Windows Type 1			6.78	×	1/(1/(1.4) + 0.04)	=	8.99
Windows Type 2			22.9	×	1/(1/(1.5) + 0.04)	=	32.41
Windows Type 3			23.6	×	1/(1/(1.5) + 0.04)	=	33.4
Windows Type 4			2.17	×	1/(1/(1.4) + 0.04)	=	2.88
Windows Type 5			2.31	×	1/(1/(1.5) + 0.04)	=	3.27
Windows Type 6			1.41	×	1/(1/(1.5) + 0.04)	=	2
Windows Type 7			1.89	×	1/(1/(1.4) + 0.04)	=	2.51
Windows Type 8			13.92	×	1/(1/(1.5) + 0.04)	=	19.7
Windows Type 9			15.6	×	1/(1/(1.5) + 0.04)	=	22.08
Windows Type 10			15.6	×	1/(1/(1.5) + 0.04)	=	22.08
Rooflights Type 1			2.25	×	1/(1/(1.5) + 0.04)	=	3.375
Rooflights Type 2			2.6	×	1/(1/(1.5) + 0.04)	=	3.9

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(27b)

(27b)

SAP WorkSheet: New dwelling design stage

Rooflights Type 3			2.25	$\times 1/[1/(1.5) + 0.04]$	=	3.375			(27b)
Rooflights Type 4			2.6	$\times 1/[1/(1.5) + 0.04]$	=	3.9			(27b)
Rooflights Type 5			3.6	$\times 1/[1/(1.5) + 0.04]$	=	5.4			(27b)
Floor Type 1			77.1	$\times$	0.14	=	10.794		(28)
Floor Type 2			80.1	$\times$	0.14	=	11.214		(28)
Walls Type1	188.8	113.74	75.06	$\times$	0.18	=	13.51		(29)
Walls Type2	39.3	0	39.3	$\times$	0.24	=	9.43		(29)
Walls Type3	39.2	0	39.2	$\times$	0.18	=	7.06		(29)
Walls Type4	7.1	1.83	5.27	$\times$	0.26	=	1.37		(29)
Walls Type5	55.3	0	55.3	$\times$	0.31	=	17.14		(29)
Walls Type6	38.4	0	38.4	$\times$	0.31	=	11.9		(29)
Roof Type1	57.8	8.8	49	$\times$	0.14	=	6.86		(30)
Roof Type2	122.2	4.5	117.7	$\times$	0.11	=	12.95		(30)
Roof Type3	11.1	0	11.1	$\times$	0.18	=	2		(30)
Total area of elements, m ²			716.4						(31)
Party wall			15.9	$\times$	0.2	=	3.18		(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)...(30) + (32) =	290.54	(33)
Heat capacity Cm = S(A x k)	((28) ... (30) + (32) + (32a) ... (32e) =	40862.2	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		22.32	(36)
if details of thermal bridging are not known (36) = 0.05 x (31)			
Total fabric heat loss	(33) + (36) =	312.86	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	150.81	149.83	148.86	144.33	143.48	139.53	139.53	138.8	141.05	143.48	145.19	146.99	(38)

Heat transfer coefficient, W/K											(39)m = (37) + (38)m		
(39)m=	463.67	462.69	461.72	457.19	456.34	452.4	452.4	451.66	453.92	456.34	458.06	459.85	
Average = Sum(39) _{1...12} / 12 =												457.19	(39)

Heat loss parameter (HLP), W/m²K												(40)m = (39)m + (4)		
(40)m=	1.88	1.87	1.87	1.85	1.85	1.83	1.83	1.83	1.84	1.85	1.86	1.86		
Average = Sum(40) _{1...12} / 12=												1.85	(40)	

Number of days in month (Table 1a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirement

N/A/m²/year

Assumed occupancy, N	3.06	(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	106.94	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)		

SAP WorkSheet: New dwelling design stage

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	174.45	152.57	157.44	137.26	131.71	113.65	105.32	120.85	122.3	142.52	155.58	168.94		
Total = Sum(45) _{1..12} =													1682.59	(45)

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

(46)m=	26.17	22.89	23.62	20.59	19.76	17.05	15.8	18.13	18.34	21.38	23.34	25.34	
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	200	(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):	2.1	(48)
---	-----	------

Temperature factor from Table 2b

0.54	(49)
------	------

Energy lost from water storage, kWh/year

(48) × (49) =	1.13	(50)
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b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
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If community heating see section 4.3

Volume factor from Table 2a

0	(52)
---	------

Temperature factor from Table 2b

0	(53)
---	------

Energy lost from water storage, kWh/year

(47) × (51) × (52) × (53) =	0	(54)
-----------------------------	---	------

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

1.13	(55)
------	------

Water storage loss calculated for each month

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

(56)m=	35.15	31.75	35.15	34.02	35.15	34.02	35.15	35.15	34.02	35.15	34.02	35.15	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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

(57)m=	35.15	31.75	35.15	34.02	35.15	34.02	35.15	35.15	34.02	35.15	34.02	35.15	
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Primary circuit loss (annual) from Table 3

0	(58)
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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	
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--

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

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

(62)m=	232.87	205.34	215.86	193.79	190.12	170.18	163.73	179.27	178.83	200.94	212.11	227.36	
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--

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

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

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

Output from water heater

(64)m=	232.87	205.34	215.86	193.79	190.12	170.18	163.73	179.27	178.83	200.94	212.11	227.36	
Output from water heater (annual) $\cdot \$													

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

(65)m=	104.74	92.94	99.08	90.87	90.53	83.02	81.75	86.92	85.89	94.12	96.95	102.91	
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and Sap)

Metabolic gains (Table 5), Watts

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

SAP WorkSheet: New dwelling design stage

(66)m=	183.77	183.77	183.77	183.77	183.77	183.77	183.77	183.77	183.77	183.77	183.77	(66)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(67)m=	92.18	81.88	66.59	50.41	37.68	31.81	34.37	44.68	59.97	76.15	88.87	94.74	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	617.31	623.72	607.58	573.21	529.83	489.06	461.82	455.42	471.56	505.93	549.31	590.08	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	56.44	56.44	56.44	56.44	56.44	56.44	56.44	56.44	56.44	56.44	56.44	56.44	(69)
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Pumps and fans gains (Table 5a)

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

(71)m=	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	(71)
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Water heating gains (Table 5)

(72)m=	140.78	138.31	133.18	126.2	121.67	115.3	109.88	116.82	119.29	126.51	134.66	138.32	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	970.97	964.6	928.03	870.52	809.88	756.87	726.77	737.62	771.52	829.28	893.53	943.83	(73)
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6. Solar gains

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

Orientation:	Access Factor		Area		Flux		g_		FF		Gains	
	Table 6d		m²		Table 6a		Table 6b		Table 6c		(W)	
North	0.9x	0.77	x	6.78	x	10.63	x	0.63	x	0.8	=	25.18 (74)
North	0.9x	0.77	x	22.9	x	10.63	x	0.63	x	0.8	=	85.05 (74)
North	0.9x	0.77	x	15.6	x	10.63	x	0.63	x	0.8	=	57.94 (74)
North	0.9x	0.77	x	6.78	x	20.32	x	0.63	x	0.8	=	48.12 (74)
North	0.9x	0.77	x	22.9	x	20.32	x	0.63	x	0.8	=	162.53 (74)
North	0.9x	0.77	x	15.6	x	20.32	x	0.63	x	0.8	=	110.72 (74)
North	0.9x	0.77	x	6.78	x	34.53	x	0.63	x	0.8	=	81.77 (74)
North	0.9x	0.77	x	22.9	x	34.53	x	0.63	x	0.8	=	276.18 (74)
North	0.9x	0.77	x	15.6	x	34.53	x	0.63	x	0.8	=	188.14 (74)
North	0.9x	0.77	x	6.78	x	55.46	x	0.63	x	0.8	=	131.34 (74)
North	0.9x	0.77	x	22.9	x	55.46	x	0.63	x	0.8	=	443.62 (74)
North	0.9x	0.77	x	15.6	x	55.46	x	0.63	x	0.8	=	302.21 (74)
North	0.9x	0.77	x	6.78	x	74.72	x	0.63	x	0.8	=	176.93 (74)
North	0.9x	0.77	x	22.9	x	74.72	x	0.63	x	0.8	=	597.6 (74)
North	0.9x	0.77	x	15.6	x	74.72	x	0.63	x	0.8	=	407.1 (74)
North	0.9x	0.77	x	6.78	x	79.99	x	0.63	x	0.8	=	189.41 (74)
North	0.9x	0.77	x	22.9	x	79.99	x	0.63	x	0.8	=	639.75 (74)
North	0.9x	0.77	x	15.6	x	79.99	x	0.63	x	0.8	=	435.81 (74)
North	0.9x	0.77	x	6.78	x	74.68	x	0.63	x	0.8	=	176.84 (74)
North	0.9x	0.77	x	22.9	x	74.68	x	0.63	x	0.8	=	597.29 (74)
North	0.9x	0.77	x	15.6	x	74.68	x	0.63	x	0.8	=	406.89 (74)

SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	6.78	x	59.25	x	0.63	x	0.8	=	140.3	(74)
North	0.9x	0.77	x	22.9	x	59.25	x	0.63	x	0.8	=	473.87	(74)
North	0.9x	0.77	x	15.6	x	59.25	x	0.63	x	0.8	=	322.81	(74)
North	0.9x	0.77	x	6.78	x	41.52	x	0.63	x	0.8	=	98.31	(74)
North	0.9x	0.77	x	22.9	x	41.52	x	0.63	x	0.8	=	332.06	(74)
North	0.9x	0.77	x	15.6	x	41.52	x	0.63	x	0.8	=	226.21	(74)
North	0.9x	0.77	x	6.78	x	24.19	x	0.63	x	0.8	=	57.28	(74)
North	0.9x	0.77	x	22.9	x	24.19	x	0.63	x	0.8	=	193.48	(74)
North	0.9x	0.77	x	15.6	x	24.19	x	0.63	x	0.8	=	131.8	(74)
North	0.9x	0.77	x	6.78	x	13.12	x	0.63	x	0.8	=	31.06	(74)
North	0.9x	0.77	x	22.9	x	13.12	x	0.63	x	0.8	=	104.92	(74)
North	0.9x	0.77	x	15.6	x	13.12	x	0.63	x	0.8	=	71.47	(74)
North	0.9x	0.77	x	6.78	x	8.86	x	0.63	x	0.8	=	20.99	(74)
North	0.9x	0.77	x	22.9	x	8.86	x	0.63	x	0.8	=	70.9	(74)
North	0.9x	0.77	x	15.6	x	8.86	x	0.63	x	0.8	=	48.3	(74)
East	0.9x	0.77	x	2.17	x	19.64	x	0.63	x	0.8	=	14.89	(76)
East	0.9x	0.77	x	2.31	x	19.64	x	0.63	x	0.8	=	15.85	(76)
East	0.9x	0.77	x	2.17	x	38.42	x	0.63	x	0.8	=	29.12	(76)
East	0.9x	0.77	x	2.31	x	38.42	x	0.63	x	0.8	=	31	(76)
East	0.9x	0.77	x	2.17	x	63.27	x	0.63	x	0.8	=	47.96	(76)
East	0.9x	0.77	x	2.31	x	63.27	x	0.63	x	0.8	=	51.05	(76)
East	0.9x	0.77	x	2.17	x	92.28	x	0.63	x	0.8	=	69.94	(76)
East	0.9x	0.77	x	2.31	x	92.28	x	0.63	x	0.8	=	74.45	(76)
East	0.9x	0.77	x	2.17	x	113.09	x	0.63	x	0.8	=	85.72	(76)
East	0.9x	0.77	x	2.31	x	113.09	x	0.63	x	0.8	=	91.25	(76)
East	0.9x	0.77	x	2.17	x	115.77	x	0.63	x	0.8	=	87.74	(76)
East	0.9x	0.77	x	2.31	x	115.77	x	0.63	x	0.8	=	93.41	(76)
East	0.9x	0.77	x	2.17	x	110.22	x	0.63	x	0.8	=	83.54	(76)
East	0.9x	0.77	x	2.31	x	110.22	x	0.63	x	0.8	=	88.93	(76)
East	0.9x	0.77	x	2.17	x	94.68	x	0.63	x	0.8	=	71.76	(76)
East	0.9x	0.77	x	2.31	x	94.68	x	0.63	x	0.8	=	76.39	(76)
East	0.9x	0.77	x	2.17	x	73.59	x	0.63	x	0.8	=	55.77	(76)
East	0.9x	0.77	x	2.31	x	73.59	x	0.63	x	0.8	=	59.37	(76)
East	0.9x	0.77	x	2.17	x	45.59	x	0.63	x	0.8	=	34.55	(76)
East	0.9x	0.77	x	2.31	x	45.59	x	0.63	x	0.8	=	36.78	(76)
East	0.9x	0.77	x	2.17	x	24.49	x	0.63	x	0.8	=	18.56	(76)
East	0.9x	0.77	x	2.31	x	24.49	x	0.63	x	0.8	=	19.76	(76)
East	0.9x	0.77	x	2.17	x	16.15	x	0.63	x	0.8	=	12.24	(76)
East	0.9x	0.77	x	2.31	x	16.15	x	0.63	x	0.8	=	13.03	(76)
South	0.9x	0.77	x	23.6	x	46.75	x	0.63	x	0.8	=	385.37	(78)
South	0.9x	0.77	x	15.6	x	46.75	x	0.63	x	0.8	=	254.74	(78)

SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	23.6	x	76.57	x	0.63	x	0.8	=	631.13	(78)
South	0.9x	0.77	x	15.6	x	76.57	x	0.63	x	0.8	=	417.19	(78)
South	0.9x	0.77	x	23.6	x	97.53	x	0.63	x	0.8	=	803.95	(78)
South	0.9x	0.77	x	15.6	x	97.53	x	0.63	x	0.8	=	531.43	(78)
South	0.9x	0.77	x	23.6	x	110.23	x	0.63	x	0.8	=	908.64	(78)
South	0.9x	0.77	x	15.6	x	110.23	x	0.63	x	0.8	=	600.63	(78)
South	0.9x	0.77	x	23.6	x	114.87	x	0.63	x	0.8	=	946.86	(78)
South	0.9x	0.77	x	15.6	x	114.87	x	0.63	x	0.8	=	625.89	(78)
South	0.9x	0.77	x	23.6	x	110.55	x	0.63	x	0.8	=	911.23	(78)
South	0.9x	0.77	x	15.6	x	110.55	x	0.63	x	0.8	=	602.34	(78)
South	0.9x	0.77	x	23.6	x	108.01	x	0.63	x	0.8	=	890.32	(78)
South	0.9x	0.77	x	15.6	x	108.01	x	0.63	x	0.8	=	588.52	(78)
South	0.9x	0.77	x	23.6	x	104.89	x	0.63	x	0.8	=	864.63	(78)
South	0.9x	0.77	x	15.6	x	104.89	x	0.63	x	0.8	=	571.53	(78)
South	0.9x	0.77	x	23.6	x	101.89	x	0.63	x	0.8	=	839.82	(78)
South	0.9x	0.77	x	15.6	x	101.89	x	0.63	x	0.8	=	555.14	(78)
South	0.9x	0.77	x	23.6	x	82.59	x	0.63	x	0.8	=	680.74	(78)
South	0.9x	0.77	x	15.6	x	82.59	x	0.63	x	0.8	=	449.98	(78)
South	0.9x	0.77	x	23.6	x	55.42	x	0.63	x	0.8	=	456.79	(78)
South	0.9x	0.77	x	15.6	x	55.42	x	0.63	x	0.8	=	301.95	(78)
South	0.9x	0.77	x	23.6	x	40.4	x	0.63	x	0.8	=	332.99	(78)
South	0.9x	0.77	x	15.6	x	40.4	x	0.63	x	0.8	=	220.11	(78)
West	0.9x	0.77	x	1.41	x	19.64	x	0.63	x	0.8	=	9.67	(80)
West	0.9x	0.77	x	1.89	x	19.64	x	0.63	x	0.8	=	12.97	(80)
West	0.9x	0.77	x	13.92	x	19.64	x	0.63	x	0.8	=	95.49	(80)
West	0.9x	0.77	x	1.41	x	38.42	x	0.63	x	0.8	=	18.92	(80)
West	0.9x	0.77	x	1.89	x	38.42	x	0.63	x	0.8	=	25.36	(80)
West	0.9x	0.77	x	13.92	x	38.42	x	0.63	x	0.8	=	186.8	(80)
West	0.9x	0.77	x	1.41	x	63.27	x	0.63	x	0.8	=	31.16	(80)
West	0.9x	0.77	x	1.89	x	63.27	x	0.63	x	0.8	=	41.77	(80)
West	0.9x	0.77	x	13.92	x	63.27	x	0.63	x	0.8	=	307.63	(80)
West	0.9x	0.77	x	1.41	x	92.28	x	0.63	x	0.8	=	45.45	(80)
West	0.9x	0.77	x	1.89	x	92.28	x	0.63	x	0.8	=	60.92	(80)
West	0.9x	0.77	x	13.92	x	92.28	x	0.63	x	0.8	=	448.65	(80)
West	0.9x	0.77	x	1.41	x	113.09	x	0.63	x	0.8	=	55.7	(80)
West	0.9x	0.77	x	1.89	x	113.09	x	0.63	x	0.8	=	74.66	(80)
West	0.9x	0.77	x	13.92	x	113.09	x	0.63	x	0.8	=	549.84	(80)
West	0.9x	0.77	x	1.41	x	115.77	x	0.63	x	0.8	=	57.01	(80)
West	0.9x	0.77	x	1.89	x	115.77	x	0.63	x	0.8	=	76.42	(80)
West	0.9x	0.77	x	13.92	x	115.77	x	0.63	x	0.8	=	562.86	(80)
West	0.9x	0.77	x	1.41	x	110.22	x	0.63	x	0.8	=	54.28	(80)

SAP WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.89	x	110.22	x	0.63	x	0.8	=	72.76	(80)
West	0.9x	0.77	x	13.92	x	110.22	x	0.63	x	0.8	=	535.87	(80)
West	0.9x	0.77	x	1.41	x	94.68	x	0.63	x	0.8	=	46.63	(80)
West	0.9x	0.77	x	1.89	x	94.68	x	0.63	x	0.8	=	62.5	(80)
West	0.9x	0.77	x	13.92	x	94.68	x	0.63	x	0.8	=	460.3	(80)
West	0.9x	0.77	x	1.41	x	73.59	x	0.63	x	0.8	=	36.24	(80)
West	0.9x	0.77	x	1.89	x	73.59	x	0.63	x	0.8	=	48.58	(80)
West	0.9x	0.77	x	13.92	x	73.59	x	0.63	x	0.8	=	357.78	(80)
West	0.9x	0.77	x	1.41	x	45.59	x	0.63	x	0.8	=	22.45	(80)
West	0.9x	0.77	x	1.89	x	45.59	x	0.63	x	0.8	=	30.09	(80)
West	0.9x	0.77	x	13.92	x	45.59	x	0.63	x	0.8	=	221.65	(80)
West	0.9x	0.77	x	1.41	x	24.49	x	0.63	x	0.8	=	12.06	(80)
West	0.9x	0.77	x	1.89	x	24.49	x	0.63	x	0.8	=	16.17	(80)
West	0.9x	0.77	x	13.92	x	24.49	x	0.63	x	0.8	=	119.06	(80)
West	0.9x	0.77	x	1.41	x	16.15	x	0.63	x	0.8	=	7.95	(80)
West	0.9x	0.77	x	1.89	x	16.15	x	0.63	x	0.8	=	10.66	(80)
West	0.9x	0.77	x	13.92	x	16.15	x	0.63	x	0.8	=	78.52	(80)
Rooflights	0.9x	1	x	2.25	x	15.52	x	0.63	x	0.7	=	13.86	(82)
Rooflights	0.9x	1	x	2.6	x	15.52	x	0.63	x	0.8	=	18.31	(82)
Rooflights	0.9x	1	x	2.25	x	46.22	x	0.63	x	0.7	=	41.28	(82)
Rooflights	0.9x	1	x	2.6	x	15.52	x	0.63	x	0.8	=	18.31	(82)
Rooflights	0.9x	1	x	3.6	x	46.22	x	0.63	x	0.8	=	75.48	(82)
Rooflights	0.9x	1	x	2.25	x	29.02	x	0.63	x	0.7	=	25.92	(82)
Rooflights	0.9x	1	x	2.6	x	29.02	x	0.63	x	0.8	=	34.23	(82)
Rooflights	0.9x	1	x	2.25	x	83.02	x	0.63	x	0.7	=	74.14	(82)
Rooflights	0.9x	1	x	2.6	x	29.02	x	0.63	x	0.8	=	34.23	(82)
Rooflights	0.9x	1	x	3.6	x	83.02	x	0.63	x	0.8	=	135.56	(82)
Rooflights	0.9x	1	x	2.25	x	51.71	x	0.63	x	0.7	=	46.17	(82)
Rooflights	0.9x	1	x	2.6	x	51.71	x	0.63	x	0.8	=	60.98	(82)
Rooflights	0.9x	1	x	2.25	x	122.59	x	0.63	x	0.7	=	109.48	(82)
Rooflights	0.9x	1	x	2.6	x	51.71	x	0.63	x	0.8	=	60.98	(82)
Rooflights	0.9x	1	x	3.6	x	122.59	x	0.63	x	0.8	=	200.19	(82)
Rooflights	0.9x	1	x	2.25	x	92.56	x	0.63	x	0.7	=	82.66	(82)
Rooflights	0.9x	1	x	2.6	x	92.56	x	0.63	x	0.8	=	109.16	(82)
Rooflights	0.9x	1	x	2.25	x	163.13	x	0.63	x	0.7	=	145.68	(82)
Rooflights	0.9x	1	x	2.6	x	92.56	x	0.63	x	0.8	=	109.16	(82)
Rooflights	0.9x	1	x	3.6	x	163.13	x	0.63	x	0.8	=	266.39	(82)
Rooflights	0.9x	1	x	2.25	x	135.76	x	0.63	x	0.7	=	121.24	(82)
Rooflights	0.9x	1	x	2.6	x	135.76	x	0.63	x	0.8	=	160.11	(82)
Rooflights	0.9x	1	x	2.25	x	190.18	x	0.63	x	0.7	=	169.83	(82)
Rooflights	0.9x	1	x	2.6	x	135.76	x	0.63	x	0.8	=	160.11	(82)

SAP WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	3.6	x	190.18	x	0.63	x	0.8	=	310.55	(82)
Rooflights 0.9x	1	x	2.25	x	150.52	x	0.63	x	0.7	=	134.42	(82)
Rooflights 0.9x	1	x	2.6	x	150.52	x	0.63	x	0.8	=	177.51	(82)
Rooflights 0.9x	1	x	2.25	x	191.34	x	0.63	x	0.7	=	170.87	(82)
Rooflights 0.9x	1	x	2.6	x	150.52	x	0.63	x	0.8	=	177.51	(82)
Rooflights 0.9x	1	x	3.6	x	191.34	x	0.63	x	0.8	=	312.44	(82)
Rooflights 0.9x	1	x	2.25	x	138.45	x	0.63	x	0.7	=	123.64	(82)
Rooflights 0.9x	1	x	2.6	x	138.45	x	0.63	x	0.8	=	163.28	(82)
Rooflights 0.9x	1	x	2.25	x	183.47	x	0.63	x	0.7	=	163.84	(82)
Rooflights 0.9x	1	x	2.6	x	138.45	x	0.63	x	0.8	=	163.28	(82)
Rooflights 0.9x	1	x	3.6	x	183.47	x	0.63	x	0.8	=	299.6	(82)
Rooflights 0.9x	1	x	2.25	x	102.74	x	0.63	x	0.7	=	91.75	(82)
Rooflights 0.9x	1	x	2.6	x	102.74	x	0.63	x	0.8	=	121.17	(82)
Rooflights 0.9x	1	x	2.25	x	163.4	x	0.63	x	0.7	=	145.92	(82)
Rooflights 0.9x	1	x	2.6	x	102.74	x	0.63	x	0.8	=	121.17	(82)
Rooflights 0.9x	1	x	3.6	x	163.4	x	0.63	x	0.8	=	266.82	(82)
Rooflights 0.9x	1	x	2.25	x	64.74	x	0.63	x	0.7	=	57.81	(82)
Rooflights 0.9x	1	x	2.6	x	64.74	x	0.63	x	0.8	=	76.35	(82)
Rooflights 0.9x	1	x	2.25	x	136.91	x	0.63	x	0.7	=	122.26	(82)
Rooflights 0.9x	1	x	2.6	x	64.74	x	0.63	x	0.8	=	76.35	(82)
Rooflights 0.9x	1	x	3.6	x	136.91	x	0.63	x	0.8	=	223.57	(82)
Rooflights 0.9x	1	x	2.25	x	34.81	x	0.63	x	0.7	=	31.09	(82)
Rooflights 0.9x	1	x	2.6	x	34.81	x	0.63	x	0.8	=	41.06	(82)
Rooflights 0.9x	1	x	2.25	x	94.41	x	0.63	x	0.7	=	84.31	(82)
Rooflights 0.9x	1	x	2.6	x	34.81	x	0.63	x	0.8	=	41.06	(82)
Rooflights 0.9x	1	x	3.6	x	94.41	x	0.63	x	0.8	=	154.17	(82)
Rooflights 0.9x	1	x	2.25	x	18.94	x	0.63	x	0.7	=	16.91	(82)
Rooflights 0.9x	1	x	2.6	x	18.94	x	0.63	x	0.8	=	22.34	(82)
Rooflights 0.9x	1	x	2.25	x	56.2	x	0.63	x	0.7	=	50.19	(82)
Rooflights 0.9x	1	x	2.6	x	18.94	x	0.63	x	0.8	=	22.34	(82)
Rooflights 0.9x	1	x	3.6	x	56.2	x	0.63	x	0.8	=	91.78	(82)
Rooflights 0.9x	1	x	2.25	x	13.13	x	0.63	x	0.7	=	11.72	(82)
Rooflights 0.9x	1	x	2.6	x	13.13	x	0.63	x	0.8	=	15.48	(82)
Rooflights 0.9x	1	x	2.25	x	38.99	x	0.63	x	0.7	=	34.81	(82)
Rooflights 0.9x	1	x	2.6	x	13.13	x	0.63	x	0.8	=	15.48	(82)
Rooflights 0.9x	1	x	3.6	x	38.99	x	0.63	x	0.8	=	63.66	(82)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 1124.37 1964.98 2838.84 3798.91 4533.39 4628.74 4408.85 3837.53 3165.65 2210.49 1355.36 956.88 (83)

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

(84)m= 2095.34 2929.57 3766.88 4669.43 5343.28 5385.6 5135.63 4575.15 3937.16 3039.76 2248.89 1900.71 (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)

SAP WorkSheet: New dwelling design stage

(86)m=	0.99	0.98	0.94	0.84	0.68	0.51	0.38	0.44	0.68	0.91	0.98	0.99	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.49	19.76	20.12	20.51	20.77	20.88	20.91	20.91	20.81	20.42	19.87	19.45	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.42	19.42	19.42	19.43	19.44	19.45	19.45	19.44	19.44	19.43	19.43	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.79	0.6	0.4	0.25	0.3	0.57	0.87	0.98	0.99	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.48	17.87	18.38	18.9	19.2	19.31	19.33	19.33	19.26	18.81	18.04	17.42	(90)
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fLA = Living area + (4) = 0.57 (91)

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

(92)m=	18.62	18.95	19.37	19.82	20.09	20.2	20.23	20.22	20.14	19.73	19.08	18.57	(92)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	18.62	18.95	19.37	19.82	20.09	20.2	20.23	20.22	20.14	19.73	19.08	18.57	(93)
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8. Space heating requirement

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, hm:

(94)m=	0.99	0.96	0.91	0.8	0.64	0.45	0.32	0.37	0.62	0.88	0.97	0.99	(94)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

Useful gains, hmGm, W = (94)m × (84)m

(95)m=	2068.81	2825.2	3441.44	3748.97	3394.58	2437.82	1621.38	1692.37	2451.86	2680.28	2189.01	1883.04	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm, W = [(93)m – (96)m]

(97)m=	6641.16	6498.5	5940.83	4990.89	3829.07	2535.24	1641.52	1727.34	2741.34	4164.74	5486.78	6608.43	(97)
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Space heating requirement for each month, kWh/month = 0.024 × [(97)m – (95)m] × (41)m

(98)m=	3401.83	2468.46	1859.54	894.18	323.26	0	0	0	0	1104.44	2374.4	3515.69	(98)
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Total per year (kWh/year) = Sum(98)_{1..5,9..12} = 15941.79 (98)

Space heating requirement in kWh/m²/year

64.59 (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 1 249.9 (206)

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

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

3401.83	2468.46	1859.54	894.18	323.26	0	0	0	0	1104.44	2374.4	3515.69
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(211)m = [(98)m × (204)] × 100 ÷ (206) (211)

1361.28	987.78	744.11	357.81	129.36	0	0	0	0	441.95	950.14	1406.84
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Total (kWh/year) = Sum(211)_{1..5,10..12} = 6379.27 (211)

SAP WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) = Sum(215) _{1, 3, 12, ... 12} =													0	(215)

Water heating

Output from water heater (calculated above)

	232.87	205.34	215.86	193.79	190.12	170.18	163.73	179.27	178.83	200.94	212.11	227.36		
Efficiency of water heater													175.1	(216)
(217)m=	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1		(217)

Fuel for water heating, kWh/month

$$(219)m = (64)m \times 100 \div (217)m$$

(219)m=	132.99	117.27	123.28	110.68	108.58	97.19	93.51	102.38	102.13	114.76	121.13	129.85		
Total = Sum(219a) _{1, 12} =													1353.74	(219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

Total electricity for the above, kWh/year

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

30 (231)

Electricity for lighting

651.19 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

8414.19 (338)

10a. Fuel costs - individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) ×	13.19	× 0.01 =	841.43 (240)
Space heating - main system 2	(213) ×	0	× 0.01 =	0 (241)
Space heating - secondary	(215) ×	13.19	× 0.01 =	0 (242)
Water heating cost (other fuel)	(219)	13.19	× 0.01 =	178.56 (247)
Pumps, fans and electric keep-hot	(231)	13.19	× 0.01 =	3.96 (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	× 0.01 =	85.89 (250)
Additional standing charges (Table 12)				0 (251)

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

Total energy cost (245)...(247) + (250)...(254) = 1109.83 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) × (256)] ÷ [(4) + 45.0] =	1.6	(257)
SAP rating (Section 12)		77.72	(258)

12a. CO2 emissions - individual heating systems including micro-CHP

SAP WorkSheet: New dwelling design stage

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.519	::	3310.84	(261)
Space heating (secondary)	(215) x	0.519	::	0	(263)
Water heating	(219) x	0.519	::	702.59	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4013.43	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	::	15.57	(267)
Electricity for lighting	(232) x	0.519	::	337.97	(268)
Total CO2, kg/year		sum of (265)...(271) =		4366.97	(272)
CO2 emissions per m²		(272) ÷ (4) =		17.69	(273)
EI rating (section 14)				80	(274)

13a Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	::	19584.35	(261)
Space heating (secondary)	(215) x	3.07	::	0	(263)
Energy for water heating	(219) x	3.07	::	4155.99	(264)
Space and water heating	(261) + (262) + (263) + (264) =			23740.33	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	::	92.1	(267)
Electricity for lighting	(232) x	0	::	1999.14	(268)
'Total Primary Energy		sum of (265)...(271) =		25831.57	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		104.67	(273)

DER WorkSheet: New dwelling design stage

User Details

Assessor Name: Colin Marshall **Stroma Number:** STRO004020
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: (F-35.01-rev 4 - SAP Design)

Address : Deck House, 27, Central Drive, Elmer, BOGNOR REGIS, PO22 7TT

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.1 (1a) ×	2.4 (2a) =	185.04 (3a)
First floor	169.7 (1b) ×	3.39 (2b) =	575.28 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	246.8 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	760.32 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 × 40 =	0 (6a)
Number of open flues	0	0	0	0 × 20 =	0 (6b)
Number of intermittent fans				4 × 10 =	40 (7a)
Number of passive vents				0 × 10 =	0 (7b)
Number of flueless gas fires				0 × 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	+ (5) =	0.05 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 × (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			6 (17)
If based on air permeability value, then (18) = [(17) + 20]÷(8), otherwise (18) = (16)			0.35 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 × (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.35 (21)
Infiltration rate modified for monthly wind speed			

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

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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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
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(23c)

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(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 × 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59
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(24d)

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

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59
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(25)

3. Heat losses and heat input 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 Type 1			1.97	×	1.6	=	3.152
Doors Type 2			1.93	×	1.6	=	3.088
Doors Type 3			1.83	×	1.6	=	2.928
Doors Type 4			1.83	×	1.6	=	2.928
Doors Type 5			1.83	×	1.6	=	2.928
Windows Type 1			6.78	×	1/(1/(1.4) + 0.04)	=	8.99
Windows Type 2			22.9	×	1/(1/(1.5) + 0.04)	=	32.41
Windows Type 3			23.6	×	1/(1/(1.5) + 0.04)	=	33.4
Windows Type 4			2.17	×	1/(1/(1.4) + 0.04)	=	2.88
Windows Type 5			2.31	×	1/(1/(1.5) + 0.04)	=	3.27
Windows Type 6			1.41	×	1/(1/(1.5) + 0.04)	=	2
Windows Type 7			1.89	×	1/(1/(1.4) + 0.04)	=	2.51
Windows Type 8			13.92	×	1/(1/(1.5) + 0.04)	=	19.7
Windows Type 9			15.6	×	1/(1/(1.5) + 0.04)	=	22.08
Windows Type 10			15.6	×	1/(1/(1.5) + 0.04)	=	22.08
Rooflights Type 1			2.25	×	1/(1/(1.5) + 0.04)	=	3.375
Rooflights Type 2			2.6	×	1/(1/(1.5) + 0.04)	=	3.9

(26)

(26)

(26)

(26)

(26)

(27)

(27)

(27)

(27)

(27)

(27)

(27)

(27)

(27)

(27)

(27b)

(27b)

DER WorkSheet: New dwelling design stage

Rooflights Type 3			2.25	$\times 1/[1/(1.5) + 0.04]$	=	3.375			(27b)
Rooflights Type 4			2.6	$\times 1/[1/(1.5) + 0.04]$	=	3.9			(27b)
Rooflights Type 5			3.6	$\times 1/[1/(1.5) + 0.04]$	=	5.4			(27b)
Floor Type 1			77.1	$\times$	0.14	=	10.794		(28)
Floor Type 2			80.1	$\times$	0.14	=	11.214		(28)
Walls Type1	188.8	113.74	75.06	$\times$	0.18	=	13.51		(29)
Walls Type2	39.3	0	39.3	$\times$	0.24	=	9.43		(29)
Walls Type3	39.2	0	39.2	$\times$	0.18	=	7.06		(29)
Walls Type4	7.1	1.83	5.27	$\times$	0.26	=	1.37		(29)
Walls Type5	55.3	0	55.3	$\times$	0.31	=	17.14		(29)
Walls Type6	38.4	0	38.4	$\times$	0.31	=	11.9		(29)
Roof Type1	57.8	8.8	49	$\times$	0.14	=	6.86		(30)
Roof Type2	122.2	4.5	117.7	$\times$	0.11	=	12.95		(30)
Roof Type3	11.1	0	11.1	$\times$	0.18	=	2		(30)
Total area of elements, m ²			716.4						(31)
Party wall			15.9	$\times$	0.2	=	3.18		(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)...(30) + (32) =	290.54	(33)
Heat capacity Cm = S(A x k)	((28) ... (30) + (32) + (32a) ... (32e) =	40862.2	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		22.32	(36)
if details of thermal bridging are not known (36) = 0.05 x (31)			
Total fabric heat loss	(33) + (36) =	312.86	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	150.81	149.83	148.86	144.33	143.48	139.53	139.53	138.8	141.05	143.48	145.19	146.99	(38)

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

(39)m=	463.67	462.69	461.72	457.19	456.34	452.4	452.4	451.66	453.92	456.34	458.06	459.85	
	Average = Sum(39) _{1...12} / 12 =											457.19	(39)

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

(40)m=	1.88	1.87	1.87	1.85	1.85	1.83	1.83	1.83	1.84	1.85	1.86	1.86	
	Average = Sum(40) _{1...12} / 12 =											1.85	(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

N/A/m²/year

Assumed occupancy, N	3.06	(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	106.94	(43)
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Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 125 litres per person per day (all water use, hot and cold)

DER WorkSheet: New dwelling design stage

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	174.45	152.57	157.44	137.26	131.71	113.65	105.32	120.85	122.3	142.52	155.58	168.94	
Total = Sum(45) _{1..12} =													1682.59 (45)

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

(46)m=	26.17	22.89	23.62	20.59	19.76	17.05	15.8	18.13	18.34	21.38	23.34	25.34	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	200	(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):	2.1	(48)
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Temperature factor from Table 2b	0.54	(49)
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Energy lost from water storage, kWh/year	(48) × (49) =	1.13	(50)
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b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
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If community heating see section 4.3

Volume factor from Table 2a	0	(52)
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Temperature factor from Table 2b	0	(53)
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Energy lost from water storage, kWh/year	(47) × (51) × (52) × (53) =	0	(54)
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Enter (50) or (54) in (55)	1.13	(55)
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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	35.15	31.75	35.15	34.02	35.15	34.02	35.15	35.15	34.02	35.15	34.02	35.15	(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] + (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	35.15	31.75	35.15	34.02	35.15	34.02	35.15	35.15	34.02	35.15	34.02	35.15	(57)
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Primary circuit loss (annual) from Table 3	0	(58)
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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)
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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)
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Total heat required for water heating calculated for each month (62)m = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	232.87	205.34	215.86	193.79	190.12	170.18	163.73	179.27	178.83	200.94	212.11	227.36	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

(64)m=	232.87	205.34	215.86	193.79	190.12	170.18	163.73	179.27	178.83	200.94	212.11	227.36	
Output from water heater (annual) =													2370.4 (64)

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

(65)m=	104.74	92.94	99.08	90.87	90.53	83.02	81.75	86.92	85.89	94.12	96.95	102.91	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5 Internal gains (see Table 5 and Sap)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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DER WorkSheet: New dwelling design stage

(66)m=	153.14	153.14	153.14	153.14	153.14	153.14	153.14	153.14	153.14	153.14	153.14	153.14	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	36.87	32.75	26.63	20.16	15.07	12.72	13.75	17.87	23.99	30.46	35.55	37.9	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	413.6	417.89	407.08	384.05	354.99	327.67	309.42	305.13	315.95	338.97	368.03	395.35	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.31	38.31	38.31	38.31	38.31	38.31	38.31	38.31	38.31	38.31	38.31	38.31	(69)
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Pumps and fans gains (Table 5a)

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

(71)m=	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	(71)
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Water heating gains (Table 5)

(72)m=	140.78	138.31	133.18	126.2	121.67	115.3	109.88	116.82	119.29	126.51	134.66	138.32	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	663.19	660.89	638.83	602.36	563.68	527.64	504.99	511.77	531.17	567.88	610.19	643.51	(73)
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6 Solar gains

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	6.78	x	10.63	x	0.63	x	0.8	=	25.18	(74)
North	0.9x	0.77	x	22.9	x	10.63	x	0.63	x	0.8	=	85.05	(74)
North	0.9x	0.77	x	15.6	x	10.63	x	0.63	x	0.8	=	57.94	(74)
North	0.9x	0.77	x	6.78	x	20.32	x	0.63	x	0.8	=	48.12	(74)
North	0.9x	0.77	x	22.9	x	20.32	x	0.63	x	0.8	=	162.53	(74)
North	0.9x	0.77	x	15.6	x	20.32	x	0.63	x	0.8	=	110.72	(74)
North	0.9x	0.77	x	6.78	x	34.53	x	0.63	x	0.8	=	81.77	(74)
North	0.9x	0.77	x	22.9	x	34.53	x	0.63	x	0.8	=	276.18	(74)
North	0.9x	0.77	x	15.6	x	34.53	x	0.63	x	0.8	=	188.14	(74)
North	0.9x	0.77	x	6.78	x	55.46	x	0.63	x	0.8	=	131.34	(74)
North	0.9x	0.77	x	22.9	x	55.46	x	0.63	x	0.8	=	443.62	(74)
North	0.9x	0.77	x	15.6	x	55.46	x	0.63	x	0.8	=	302.21	(74)
North	0.9x	0.77	x	6.78	x	74.72	x	0.63	x	0.8	=	176.93	(74)
North	0.9x	0.77	x	22.9	x	74.72	x	0.63	x	0.8	=	597.6	(74)
North	0.9x	0.77	x	15.6	x	74.72	x	0.63	x	0.8	=	407.1	(74)
North	0.9x	0.77	x	6.78	x	79.99	x	0.63	x	0.8	=	189.41	(74)
North	0.9x	0.77	x	22.9	x	79.99	x	0.63	x	0.8	=	639.75	(74)
North	0.9x	0.77	x	15.6	x	79.99	x	0.63	x	0.8	=	435.81	(74)
North	0.9x	0.77	x	6.78	x	74.68	x	0.63	x	0.8	=	176.84	(74)
North	0.9x	0.77	x	22.9	x	74.68	x	0.63	x	0.8	=	597.29	(74)
North	0.9x	0.77	x	15.6	x	74.68	x	0.63	x	0.8	=	406.89	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	6.78	x	59.25	x	0.63	x	0.8	=	140.3	(74)
North	0.9x	0.77	x	22.9	x	59.25	x	0.63	x	0.8	=	473.87	(74)
North	0.9x	0.77	x	15.6	x	59.25	x	0.63	x	0.8	=	322.81	(74)
North	0.9x	0.77	x	6.78	x	41.52	x	0.63	x	0.8	=	98.31	(74)
North	0.9x	0.77	x	22.9	x	41.52	x	0.63	x	0.8	=	332.06	(74)
North	0.9x	0.77	x	15.6	x	41.52	x	0.63	x	0.8	=	226.21	(74)
North	0.9x	0.77	x	6.78	x	24.19	x	0.63	x	0.8	=	57.28	(74)
North	0.9x	0.77	x	22.9	x	24.19	x	0.63	x	0.8	=	193.48	(74)
North	0.9x	0.77	x	15.6	x	24.19	x	0.63	x	0.8	=	131.8	(74)
North	0.9x	0.77	x	6.78	x	13.12	x	0.63	x	0.8	=	31.06	(74)
North	0.9x	0.77	x	22.9	x	13.12	x	0.63	x	0.8	=	104.92	(74)
North	0.9x	0.77	x	15.6	x	13.12	x	0.63	x	0.8	=	71.47	(74)
North	0.9x	0.77	x	6.78	x	8.86	x	0.63	x	0.8	=	20.99	(74)
North	0.9x	0.77	x	22.9	x	8.86	x	0.63	x	0.8	=	70.9	(74)
North	0.9x	0.77	x	15.6	x	8.86	x	0.63	x	0.8	=	48.3	(74)
East	0.9x	0.77	x	2.17	x	19.64	x	0.63	x	0.8	=	14.89	(76)
East	0.9x	0.77	x	2.31	x	19.64	x	0.63	x	0.8	=	15.85	(76)
East	0.9x	0.77	x	2.17	x	38.42	x	0.63	x	0.8	=	29.12	(76)
East	0.9x	0.77	x	2.31	x	38.42	x	0.63	x	0.8	=	31	(76)
East	0.9x	0.77	x	2.17	x	63.27	x	0.63	x	0.8	=	47.96	(76)
East	0.9x	0.77	x	2.31	x	63.27	x	0.63	x	0.8	=	51.05	(76)
East	0.9x	0.77	x	2.17	x	92.28	x	0.63	x	0.8	=	69.94	(76)
East	0.9x	0.77	x	2.31	x	92.28	x	0.63	x	0.8	=	74.45	(76)
East	0.9x	0.77	x	2.17	x	113.09	x	0.63	x	0.8	=	85.72	(76)
East	0.9x	0.77	x	2.31	x	113.09	x	0.63	x	0.8	=	91.25	(76)
East	0.9x	0.77	x	2.17	x	115.77	x	0.63	x	0.8	=	87.74	(76)
East	0.9x	0.77	x	2.31	x	115.77	x	0.63	x	0.8	=	93.41	(76)
East	0.9x	0.77	x	2.17	x	110.22	x	0.63	x	0.8	=	83.54	(76)
East	0.9x	0.77	x	2.31	x	110.22	x	0.63	x	0.8	=	88.93	(76)
East	0.9x	0.77	x	2.17	x	94.68	x	0.63	x	0.8	=	71.76	(76)
East	0.9x	0.77	x	2.31	x	94.68	x	0.63	x	0.8	=	76.39	(76)
East	0.9x	0.77	x	2.17	x	73.59	x	0.63	x	0.8	=	55.77	(76)
East	0.9x	0.77	x	2.31	x	73.59	x	0.63	x	0.8	=	59.37	(76)
East	0.9x	0.77	x	2.17	x	45.59	x	0.63	x	0.8	=	34.55	(76)
East	0.9x	0.77	x	2.31	x	45.59	x	0.63	x	0.8	=	36.78	(76)
East	0.9x	0.77	x	2.17	x	24.49	x	0.63	x	0.8	=	18.56	(76)
East	0.9x	0.77	x	2.31	x	24.49	x	0.63	x	0.8	=	19.76	(76)
East	0.9x	0.77	x	2.17	x	16.15	x	0.63	x	0.8	=	12.24	(76)
East	0.9x	0.77	x	2.31	x	16.15	x	0.63	x	0.8	=	13.03	(76)
South	0.9x	0.77	x	23.6	x	46.75	x	0.63	x	0.8	=	385.37	(78)
South	0.9x	0.77	x	15.6	x	46.75	x	0.63	x	0.8	=	254.74	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	23.6	x	76.57	x	0.63	x	0.8	=	631.13	(78)
South	0.9x	0.77	x	15.6	x	76.57	x	0.63	x	0.8	=	417.19	(78)
South	0.9x	0.77	x	23.6	x	97.53	x	0.63	x	0.8	=	803.95	(78)
South	0.9x	0.77	x	15.6	x	97.53	x	0.63	x	0.8	=	531.43	(78)
South	0.9x	0.77	x	23.6	x	110.23	x	0.63	x	0.8	=	908.64	(78)
South	0.9x	0.77	x	15.6	x	110.23	x	0.63	x	0.8	=	600.63	(78)
South	0.9x	0.77	x	23.6	x	114.87	x	0.63	x	0.8	=	946.86	(78)
South	0.9x	0.77	x	15.6	x	114.87	x	0.63	x	0.8	=	625.89	(78)
South	0.9x	0.77	x	23.6	x	110.55	x	0.63	x	0.8	=	911.23	(78)
South	0.9x	0.77	x	15.6	x	110.55	x	0.63	x	0.8	=	602.34	(78)
South	0.9x	0.77	x	23.6	x	108.01	x	0.63	x	0.8	=	890.32	(78)
South	0.9x	0.77	x	15.6	x	108.01	x	0.63	x	0.8	=	588.52	(78)
South	0.9x	0.77	x	23.6	x	104.89	x	0.63	x	0.8	=	864.63	(78)
South	0.9x	0.77	x	15.6	x	104.89	x	0.63	x	0.8	=	571.53	(78)
South	0.9x	0.77	x	23.6	x	101.89	x	0.63	x	0.8	=	839.82	(78)
South	0.9x	0.77	x	15.6	x	101.89	x	0.63	x	0.8	=	555.14	(78)
South	0.9x	0.77	x	23.6	x	82.59	x	0.63	x	0.8	=	680.74	(78)
South	0.9x	0.77	x	15.6	x	82.59	x	0.63	x	0.8	=	449.98	(78)
South	0.9x	0.77	x	23.6	x	55.42	x	0.63	x	0.8	=	456.79	(78)
South	0.9x	0.77	x	15.6	x	55.42	x	0.63	x	0.8	=	301.95	(78)
South	0.9x	0.77	x	23.6	x	40.4	x	0.63	x	0.8	=	332.99	(78)
South	0.9x	0.77	x	15.6	x	40.4	x	0.63	x	0.8	=	220.11	(78)
West	0.9x	0.77	x	1.41	x	19.64	x	0.63	x	0.8	=	9.67	(80)
West	0.9x	0.77	x	1.89	x	19.64	x	0.63	x	0.8	=	12.97	(80)
West	0.9x	0.77	x	13.92	x	19.64	x	0.63	x	0.8	=	95.49	(80)
West	0.9x	0.77	x	1.41	x	38.42	x	0.63	x	0.8	=	18.92	(80)
West	0.9x	0.77	x	1.89	x	38.42	x	0.63	x	0.8	=	25.36	(80)
West	0.9x	0.77	x	13.92	x	38.42	x	0.63	x	0.8	=	186.8	(80)
West	0.9x	0.77	x	1.41	x	63.27	x	0.63	x	0.8	=	31.16	(80)
West	0.9x	0.77	x	1.89	x	63.27	x	0.63	x	0.8	=	41.77	(80)
West	0.9x	0.77	x	13.92	x	63.27	x	0.63	x	0.8	=	307.63	(80)
West	0.9x	0.77	x	1.41	x	92.28	x	0.63	x	0.8	=	45.45	(80)
West	0.9x	0.77	x	1.89	x	92.28	x	0.63	x	0.8	=	60.92	(80)
West	0.9x	0.77	x	13.92	x	92.28	x	0.63	x	0.8	=	448.65	(80)
West	0.9x	0.77	x	1.41	x	113.09	x	0.63	x	0.8	=	55.7	(80)
West	0.9x	0.77	x	1.89	x	113.09	x	0.63	x	0.8	=	74.66	(80)
West	0.9x	0.77	x	13.92	x	113.09	x	0.63	x	0.8	=	549.84	(80)
West	0.9x	0.77	x	1.41	x	115.77	x	0.63	x	0.8	=	57.01	(80)
West	0.9x	0.77	x	1.89	x	115.77	x	0.63	x	0.8	=	76.42	(80)
West	0.9x	0.77	x	13.92	x	115.77	x	0.63	x	0.8	=	562.86	(80)
West	0.9x	0.77	x	1.41	x	110.22	x	0.63	x	0.8	=	54.28	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.89	x	110.22	x	0.63	x	0.8	=	72.76	(80)
West	0.9x	0.77	x	13.92	x	110.22	x	0.63	x	0.8	=	535.87	(80)
West	0.9x	0.77	x	1.41	x	94.68	x	0.63	x	0.8	=	46.63	(80)
West	0.9x	0.77	x	1.89	x	94.68	x	0.63	x	0.8	=	62.5	(80)
West	0.9x	0.77	x	13.92	x	94.68	x	0.63	x	0.8	=	460.3	(80)
West	0.9x	0.77	x	1.41	x	73.59	x	0.63	x	0.8	=	36.24	(80)
West	0.9x	0.77	x	1.89	x	73.59	x	0.63	x	0.8	=	48.58	(80)
West	0.9x	0.77	x	13.92	x	73.59	x	0.63	x	0.8	=	357.78	(80)
West	0.9x	0.77	x	1.41	x	45.59	x	0.63	x	0.8	=	22.45	(80)
West	0.9x	0.77	x	1.89	x	45.59	x	0.63	x	0.8	=	30.09	(80)
West	0.9x	0.77	x	13.92	x	45.59	x	0.63	x	0.8	=	221.65	(80)
West	0.9x	0.77	x	1.41	x	24.49	x	0.63	x	0.8	=	12.06	(80)
West	0.9x	0.77	x	1.89	x	24.49	x	0.63	x	0.8	=	16.17	(80)
West	0.9x	0.77	x	13.92	x	24.49	x	0.63	x	0.8	=	119.06	(80)
West	0.9x	0.77	x	1.41	x	16.15	x	0.63	x	0.8	=	7.95	(80)
West	0.9x	0.77	x	1.89	x	16.15	x	0.63	x	0.8	=	10.66	(80)
West	0.9x	0.77	x	13.92	x	16.15	x	0.63	x	0.8	=	78.52	(80)
Rooflights	0.9x	1	x	2.25	x	15.52	x	0.63	x	0.7	=	13.86	(82)
Rooflights	0.9x	1	x	2.6	x	15.52	x	0.63	x	0.8	=	18.31	(82)
Rooflights	0.9x	1	x	2.25	x	46.22	x	0.63	x	0.7	=	41.28	(82)
Rooflights	0.9x	1	x	2.6	x	15.52	x	0.63	x	0.8	=	18.31	(82)
Rooflights	0.9x	1	x	3.6	x	46.22	x	0.63	x	0.8	=	75.48	(82)
Rooflights	0.9x	1	x	2.25	x	29.02	x	0.63	x	0.7	=	25.92	(82)
Rooflights	0.9x	1	x	2.6	x	29.02	x	0.63	x	0.8	=	34.23	(82)
Rooflights	0.9x	1	x	2.25	x	83.02	x	0.63	x	0.7	=	74.14	(82)
Rooflights	0.9x	1	x	2.6	x	29.02	x	0.63	x	0.8	=	34.23	(82)
Rooflights	0.9x	1	x	3.6	x	83.02	x	0.63	x	0.8	=	135.56	(82)
Rooflights	0.9x	1	x	2.25	x	51.71	x	0.63	x	0.7	=	46.17	(82)
Rooflights	0.9x	1	x	2.6	x	51.71	x	0.63	x	0.8	=	60.98	(82)
Rooflights	0.9x	1	x	2.25	x	122.59	x	0.63	x	0.7	=	109.48	(82)
Rooflights	0.9x	1	x	2.6	x	51.71	x	0.63	x	0.8	=	60.98	(82)
Rooflights	0.9x	1	x	3.6	x	122.59	x	0.63	x	0.8	=	200.19	(82)
Rooflights	0.9x	1	x	2.25	x	92.56	x	0.63	x	0.7	=	82.66	(82)
Rooflights	0.9x	1	x	2.6	x	92.56	x	0.63	x	0.8	=	109.16	(82)
Rooflights	0.9x	1	x	2.25	x	163.13	x	0.63	x	0.7	=	145.68	(82)
Rooflights	0.9x	1	x	2.6	x	92.56	x	0.63	x	0.8	=	109.16	(82)
Rooflights	0.9x	1	x	3.6	x	163.13	x	0.63	x	0.8	=	266.39	(82)
Rooflights	0.9x	1	x	2.25	x	135.76	x	0.63	x	0.7	=	121.24	(82)
Rooflights	0.9x	1	x	2.6	x	135.76	x	0.63	x	0.8	=	160.11	(82)
Rooflights	0.9x	1	x	2.25	x	190.18	x	0.63	x	0.7	=	169.83	(82)
Rooflights	0.9x	1	x	2.6	x	135.76	x	0.63	x	0.8	=	160.11	(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	3.6	x	190.18	x	0.63	x	0.8	=	310.55	(82)
Rooflights 0.9x	1	x	2.25	x	150.52	x	0.63	x	0.7	=	134.42	(82)
Rooflights 0.9x	1	x	2.6	x	150.52	x	0.63	x	0.8	=	177.51	(82)
Rooflights 0.9x	1	x	2.25	x	191.34	x	0.63	x	0.7	=	170.87	(82)
Rooflights 0.9x	1	x	2.6	x	150.52	x	0.63	x	0.8	=	177.51	(82)
Rooflights 0.9x	1	x	3.6	x	191.34	x	0.63	x	0.8	=	312.44	(82)
Rooflights 0.9x	1	x	2.25	x	138.45	x	0.63	x	0.7	=	123.64	(82)
Rooflights 0.9x	1	x	2.6	x	138.45	x	0.63	x	0.8	=	163.28	(82)
Rooflights 0.9x	1	x	2.25	x	183.47	x	0.63	x	0.7	=	163.84	(82)
Rooflights 0.9x	1	x	2.6	x	138.45	x	0.63	x	0.8	=	163.28	(82)
Rooflights 0.9x	1	x	3.6	x	183.47	x	0.63	x	0.8	=	299.6	(82)
Rooflights 0.9x	1	x	2.25	x	102.74	x	0.63	x	0.7	=	91.75	(82)
Rooflights 0.9x	1	x	2.6	x	102.74	x	0.63	x	0.8	=	121.17	(82)
Rooflights 0.9x	1	x	2.25	x	163.4	x	0.63	x	0.7	=	145.92	(82)
Rooflights 0.9x	1	x	2.6	x	102.74	x	0.63	x	0.8	=	121.17	(82)
Rooflights 0.9x	1	x	3.6	x	163.4	x	0.63	x	0.8	=	266.82	(82)
Rooflights 0.9x	1	x	2.25	x	64.74	x	0.63	x	0.7	=	57.81	(82)
Rooflights 0.9x	1	x	2.6	x	64.74	x	0.63	x	0.8	=	76.35	(82)
Rooflights 0.9x	1	x	2.25	x	136.91	x	0.63	x	0.7	=	122.26	(82)
Rooflights 0.9x	1	x	2.6	x	64.74	x	0.63	x	0.8	=	76.35	(82)
Rooflights 0.9x	1	x	3.6	x	136.91	x	0.63	x	0.8	=	223.57	(82)
Rooflights 0.9x	1	x	2.25	x	34.81	x	0.63	x	0.7	=	31.09	(82)
Rooflights 0.9x	1	x	2.6	x	34.81	x	0.63	x	0.8	=	41.06	(82)
Rooflights 0.9x	1	x	2.25	x	94.41	x	0.63	x	0.7	=	84.31	(82)
Rooflights 0.9x	1	x	2.6	x	34.81	x	0.63	x	0.8	=	41.06	(82)
Rooflights 0.9x	1	x	3.6	x	94.41	x	0.63	x	0.8	=	154.17	(82)
Rooflights 0.9x	1	x	2.25	x	18.94	x	0.63	x	0.7	=	16.91	(82)
Rooflights 0.9x	1	x	2.6	x	18.94	x	0.63	x	0.8	=	22.34	(82)
Rooflights 0.9x	1	x	2.25	x	56.2	x	0.63	x	0.7	=	50.19	(82)
Rooflights 0.9x	1	x	2.6	x	18.94	x	0.63	x	0.8	=	22.34	(82)
Rooflights 0.9x	1	x	3.6	x	56.2	x	0.63	x	0.8	=	91.78	(82)
Rooflights 0.9x	1	x	2.25	x	13.13	x	0.63	x	0.7	=	11.72	(82)
Rooflights 0.9x	1	x	2.6	x	13.13	x	0.63	x	0.8	=	15.48	(82)
Rooflights 0.9x	1	x	2.25	x	38.99	x	0.63	x	0.7	=	34.81	(82)
Rooflights 0.9x	1	x	2.6	x	13.13	x	0.63	x	0.8	=	15.48	(82)
Rooflights 0.9x	1	x	3.6	x	38.99	x	0.63	x	0.8	=	63.66	(82)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m= 1124.37 1964.98 2838.84 3798.91 4533.39 4628.74 4408.85 3837.53 3165.65 2210.49 1355.36 956.88 (83)

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

(84)m= 1787.56 2625.87 3477.67 4401.27 5097.07 5156.37 4913.85 4349.3 3696.81 2778.37 1965.54 1600.39 (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)

DER WorkSheet: New dwelling design stage

(86)m=	1	0.98	0.95	0.86	0.7	0.53	0.39	0.46	0.71	0.93	0.99	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.42	19.69	20.06	20.48	20.75	20.88	20.91	20.9	20.79	20.38	19.8	19.37	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.42	19.42	19.42	19.43	19.44	19.45	19.45	19.44	19.44	19.43	19.43	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.81	0.62	0.41	0.26	0.31	0.6	0.9	0.98	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.37	17.77	18.3	18.86	19.19	19.31	19.33	19.33	19.25	18.75	17.94	17.31	(90)
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$$fLA = \text{Living area} \div (4) = 0.57 \quad (91)$$

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

(92)m=	18.53	18.86	19.3	19.78	20.08	20.2	20.23	20.22	20.13	19.67	19	18.48	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.53	18.86	19.3	19.78	20.08	20.2	20.23	20.22	20.13	19.67	19	18.48	(93)
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8. Space heating requirement

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.82	0.66	0.47	0.33	0.39	0.65	0.9	0.98	0.99	(94)
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Useful gains, hmGm, W = (94)m x (84)m

(95)m=	1773.39	2556.02	3227.64	3620.6	3342.18	2423.84	1618.01	1685.92	2403.43	2507.56	1929.57	1591.54	(95)
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Monthly average external temperature from Table 8

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

(97)m=	6599.3	6460.01	5910.11	4972.99	3822.15	2533.43	1641.05	1726.45	2734.97	4140.31	5450.09	6567.45	(97)
--------	--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

Space heating requirement for each month, kWh/month = $0.024 \times [(97)m - (95)m] \times (41)m$

(98)m=	3590.48	2623.48	1995.76	973.72	357.1	0	0	0	0	1214.77	2534.77	3702.08	(98)
--------	---------	---------	---------	--------	-------	---	---	---	---	---------	---------	---------	------

$$\text{Total per year (kWh/year)} = \text{Sum}(98)_{1..12} = 16992.17 \quad (99)$$

Space heating requirement in kWh/m²/year

$$68.85 \quad (99)$$

9a. Energy requirements - individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system

$$0 \quad (201)$$

Fraction of space heat from main system(s)

$$(202) = 1 - (201) = 1 \quad (202)$$

Fraction of total heating from main system 1

$$(204) = (202) \times [1 - (203)] = 1 \quad (204)$$

Efficiency of main space heating system 1

$$249.9 \quad (206)$$

Efficiency of secondary/supplementary heating system, %

$$0 \quad (208)$$

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

Space heating requirement (calculated above)

3590.48	2623.48	1995.76	973.72	357.1	0	0	0	0	1214.77	2534.77	3702.08
---------	---------	---------	--------	-------	---	---	---	---	---------	---------	---------

$$(211)m = [(98)m \times (204)] \div 100 + (206) \quad (211)$$

1436.77	1049.81	798.62	389.65	142.9	0	0	0	0	486.1	1014.32	1481.42
---------	---------	--------	--------	-------	---	---	---	---	-------	---------	---------

$$\text{Total (kWh/year)} = \text{Sum}(211)_{1..12} = 6799.59 \quad (211)$$

DER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215) _{1, 3,12, 12} =													0 (215)

Water heating

Output from water heater (calculated above)

	232.87	205.34	215.86	193.79	190.12	170.18	163.73	179.27	178.83	200.94	212.11	227.36	
Efficiency of water heater													175.1 (216)
(217)m=	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	175.1	(217)

Fuel for water heating, kWh/month

$$(219)m = (64)m \times 100 \div (217)m$$

(219)m=	132.99	117.27	123.28	110.68	108.58	97.19	93.51	102.38	102.13	114.76	121.13	129.85	
Total = Sum(219a) _{1,12} =													1353.74 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

Water heating fuel used

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230c)

Total electricity for the above, kWh/year

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

30 (231)

Electricity for lighting

651.19 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

8834.51 (338)

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	=	3528.99	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	702.59	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4231.58	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	15.57	(267)
Electricity for lighting	(232) x	0.519	=	337.97	(268)
Total CO2, kg/year		sum of (265)...(271) =		4585.11	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		18.58	(273)
El rating (section 14)				79	(274)

TER WorkSheet: New dwelling design stage

User Details

Assessor Name: Colin Marshall **Stroma Number:** STRO004020
Software Name: Stroma FSAP 2012 **Software Version:** 1.0.2.0

Property Address: (F-35.01-rev 4 - SAP Design)

Address : Deck House, 27, Central Drive, Elmer, BOGNOR REGIS, PO22 7TT

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	77.1 (1a) ×	2.4 (2a) =	185.04 (3a)
First floor	169.7 (1b) ×	3.39 (2b) =	575.28 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	246.8 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	760.32 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0 × 40 =	0 (6a)
Number of open flues	0	0	0	0 × 20 =	0 (6b)
Number of intermittent fans				4 × 10 =	40 (7a)
Number of passive vents				0 × 10 =	0 (7b)
Number of flueless gas fires				0 × 40 =	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	× (5) =	0.05 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 × (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)			0.3 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 × (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.3 (21)
Infiltration rate modified for monthly wind speed			

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

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

	0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36
--	------	------	------	------	------	------	------	------	-----	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(23c)

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

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

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

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

c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0
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(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 × 0.5]

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

(24d)

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

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

3. Heat losses and heat gains 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 Type 1			1.97	x	1	=	1.97				(26)
Doors Type 2			1.93	x	1.2	=	2.316				(26)
Doors Type 3			1.83	x	1.2	=	2.196				(26)
Doors Type 4			1.83	x	1.2	=	2.196				(26)
Doors Type 5			1.83	x	1	=	1.83				(26)
Windows Type 1			2.97	x	$1/[1/(1.4) + 0.04]$	=	3.94				(27)
Windows Type 2			10.03	x	$1/[1/(1.4) + 0.04]$	=	13.3				(27)
Windows Type 3			10.33	x	$1/[1/(1.4) + 0.04]$	=	13.7				(27)
Windows Type 4			0.95	x	$1/[1/(1.4) + 0.04]$	=	1.26				(27)
Windows Type 5			1.01	x	$1/[1/(1.4) + 0.04]$	=	1.34				(27)
Windows Type 6			0.62	x	$1/[1/(1.4) + 0.04]$	=	0.82				(27)
Windows Type 7			0.83	x	$1/[1/(1.4) + 0.04]$	=	1.1				(27)
Windows Type 8			6.09	x	$1/[1/(1.4) + 0.04]$	=	8.07				(27)
Windows Type 9			6.83	x	$1/[1/(1.4) + 0.04]$	=	9.05				(27)
Windows Type 10			6.83	x	$1/[1/(1.4) + 0.04]$	=	9.05				(27)
Rooflights Type 1			0.9850812	x	$1/[1/(1.7) + 0.04]$	=	1.674638				(27b)
Rooflights Type 2			1.138316	x	$1/[1/(1.7) + 0.04]$	=	1.935137				(27b)

TER WorkSheet: New dwelling design stage

Rooflights Type 3			0.9850812	$\times 1/[1/(1.7) + 0.04]$	=	1.674638		(27b)
Rooflights Type 4			1.138316	$\times 1/[1/(1.7) + 0.04]$	=	1.935137		(27b)
Rooflights Type 5			1.57613	$\times 1/[1/(1.7) + 0.04]$	=	2.679421		(27b)
Floor Type 1			77.1	$\times$	0.13	=	10.023	(28)
Floor Type 2			80.1	$\times$	0.13	=	10.413	(28)
Walls Type1	188.8	54.05	134.75	$\times$	0.18	=	24.26	(29)
Walls Type2	39.3	0	39.3	$\times$	0.18	=	7.07	(29)
Walls Type3	39.2	0	39.2	$\times$	0.18	=	7.06	(29)
Walls Type4	7.1	1.83	5.27	$\times$	0.18	=	0.95	(29)
Walls Type5	55.3	0	55.3	$\times$	0.18	=	9.95	(29)
Walls Type6	38.4	0	38.4	$\times$	0.18	=	6.91	(29)
Roof Type1	57.8	3.85	53.95	$\times$	0.13	=	7.01	(30)
Roof Type2	122.2	1.97	120.23	$\times$	0.13	=	15.63	(30)
Roof Type3	11.1	0	11.1	$\times$	0.13	=	1.44	(30)
Total area of elements, m ²			716.4					(31)
Party wall			15.9	$\times$	0	=	0	(32)

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

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

Fabric heat loss, W/K = S (A x U)	(26)...(30) + (32) =	182.13	(33)
Heat capacity Cm = S(A x k)	((28) ... (30) + (32) + (32a) ... (32e) =	52270.59	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m ² K	Indicative Value: Medium	250	(35)

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

Thermal bridges : S (L x Y) calculated using Appendix K		17.87	(36)
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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	200	(37)
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Ventilation heat loss calculated monthly	(38)m = 0.33 x (25)m x (5)		
--	----------------------------	--	--

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	144.13	143.4	142.69	139.35	138.73	135.82	135.82	135.28	136.94	138.73	139.99	141.31	(38)

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

(39)m=	344.13	343.4	342.69	339.36	338.73	335.82	335.82	335.28	336.94	338.73	339.99	341.32		
Average = Sum(39) _{1...12} / 12=													339.35	(39)

Heat loss parameter (HLP), W/m ² K	(40)m = (39)m ÷ (4)		
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(40)m=	1.39	1.39	1.39	1.38	1.37	1.36	1.36	1.36	1.37	1.37	1.38	1.38		
Average = Sum(40) _{1...12} / 12=													1.38	(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 litres/year

Assumed occupancy, N	3.06	(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	106.94	(43)
---	--------	------

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

TER WorkSheet: New dwelling design stage

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	174.45	152.57	157.44	137.26	131.71	113.65	105.32	120.85	122.3	142.52	155.58	168.94	
Total = Sum(45) _{1..12} =													1682.59 (45)

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

(46)m=	26.17	22.89	23.62	20.59	19.76	17.05	15.8	18.13	18.34	21.38	23.34	25.34	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	150	(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):	1.65	(48)
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Temperature factor from Table 2b

0.54	(49)
------	------

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

0.89	(50)
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b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
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If community heating see section 4.3

Volume factor from Table 2a

0	(52)
---	------

Temperature factor from Table 2b

0	(53)
---	------

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

0	(54)
---	------

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

0.89	(55)
------	------

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

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(56)
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If cylinder contains dedicated solar storage, (57)m = (56)m × [(50) – (H11)] + (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)
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Primary circuit loss (annual) from Table 3

0	(58)
---	------

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (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 = $0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$

(62)m=	225.38	198.57	208.37	186.55	182.63	162.94	156.24	171.78	171.58	193.45	204.86	219.87	(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=	225.38	198.57	208.37	186.55	182.63	162.94	156.24	171.78	171.58	193.45	204.86	219.87	
Output from water heater (annual) =													2282.21 (64)

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

(65)m=	98.75	87.53	93.09	85.07	84.53	77.22	75.76	80.92	80.09	88.13	91.16	96.91	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and Sap)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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TER WorkSheet: New dwelling design stage

(66)m=	153.14	153.14	153.14	153.14	153.14	153.14	153.14	153.14	153.14	153.14	153.14	153.14	(66)
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Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	36.87	32.75	26.63	20.16	15.07	12.72	13.75	17.87	23.99	30.46	35.55	37.9	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	413.6	417.89	407.08	384.05	354.99	327.67	309.42	305.13	315.95	338.97	368.03	395.35	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	38.31	38.31	38.31	38.31	38.31	38.31	38.31	38.31	38.31	38.31	38.31	38.31	(69)
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Pumps and fans gains (Table 5a)

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

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

(71)m=	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	-122.51	(71)
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

Water heating gains (Table 5)

(72)m=	132.72	130.25	125.12	118.15	113.62	107.24	101.83	108.77	111.24	118.45	126.6	130.26	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	655.14	652.84	630.77	594.31	555.62	519.58	496.94	503.71	523.11	559.82	602.13	635.45	(73)
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6 Solar gains

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.97	x	10.63	x	0.63	x	0.7	=	9.65	(74)
North	0.9x	0.77	x	10.03	x	10.63	x	0.63	x	0.7	=	32.59	(74)
North	0.9x	0.77	x	6.83	x	10.63	x	0.63	x	0.7	=	22.2	(74)
North	0.9x	0.77	x	2.97	x	20.32	x	0.63	x	0.7	=	18.44	(74)
North	0.9x	0.77	x	10.03	x	20.32	x	0.63	x	0.7	=	62.29	(74)
North	0.9x	0.77	x	6.83	x	20.32	x	0.63	x	0.7	=	42.42	(74)
North	0.9x	0.77	x	2.97	x	34.53	x	0.63	x	0.7	=	31.34	(74)
North	0.9x	0.77	x	10.03	x	34.53	x	0.63	x	0.7	=	105.85	(74)
North	0.9x	0.77	x	6.83	x	34.53	x	0.63	x	0.7	=	72.08	(74)
North	0.9x	0.77	x	2.97	x	55.46	x	0.63	x	0.7	=	50.34	(74)
North	0.9x	0.77	x	10.03	x	55.46	x	0.63	x	0.7	=	170.02	(74)
North	0.9x	0.77	x	6.83	x	55.46	x	0.63	x	0.7	=	115.77	(74)
North	0.9x	0.77	x	2.97	x	74.72	x	0.63	x	0.7	=	67.82	(74)
North	0.9x	0.77	x	10.03	x	74.72	x	0.63	x	0.7	=	229.03	(74)
North	0.9x	0.77	x	6.83	x	74.72	x	0.63	x	0.7	=	155.96	(74)
North	0.9x	0.77	x	2.97	x	79.99	x	0.63	x	0.7	=	72.6	(74)
North	0.9x	0.77	x	10.03	x	79.99	x	0.63	x	0.7	=	245.18	(74)
North	0.9x	0.77	x	6.83	x	79.99	x	0.63	x	0.7	=	166.96	(74)
North	0.9x	0.77	x	2.97	x	74.68	x	0.63	x	0.7	=	67.78	(74)
North	0.9x	0.77	x	10.03	x	74.68	x	0.63	x	0.7	=	228.91	(74)
North	0.9x	0.77	x	6.83	x	74.68	x	0.63	x	0.7	=	155.88	(74)

TER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	2.97	x	59.25	x	0.63	x	0.7	=	53.78	(74)
North	0.9x	0.77	x	10.03	x	59.25	x	0.63	x	0.7	=	181.61	(74)
North	0.9x	0.77	x	6.83	x	59.25	x	0.63	x	0.7	=	123.67	(74)
North	0.9x	0.77	x	2.97	x	41.52	x	0.63	x	0.7	=	37.68	(74)
North	0.9x	0.77	x	10.03	x	41.52	x	0.63	x	0.7	=	127.26	(74)
North	0.9x	0.77	x	6.83	x	41.52	x	0.63	x	0.7	=	86.66	(74)
North	0.9x	0.77	x	2.97	x	24.19	x	0.63	x	0.7	=	21.96	(74)
North	0.9x	0.77	x	10.03	x	24.19	x	0.63	x	0.7	=	74.15	(74)
North	0.9x	0.77	x	6.83	x	24.19	x	0.63	x	0.7	=	50.49	(74)
North	0.9x	0.77	x	2.97	x	13.12	x	0.63	x	0.7	=	11.91	(74)
North	0.9x	0.77	x	10.03	x	13.12	x	0.63	x	0.7	=	40.21	(74)
North	0.9x	0.77	x	6.83	x	13.12	x	0.63	x	0.7	=	27.38	(74)
North	0.9x	0.77	x	2.97	x	8.86	x	0.63	x	0.7	=	8.05	(74)
North	0.9x	0.77	x	10.03	x	8.86	x	0.63	x	0.7	=	27.17	(74)
North	0.9x	0.77	x	6.83	x	8.86	x	0.63	x	0.7	=	18.5	(74)
East	0.9x	0.77	x	0.95	x	19.64	x	0.63	x	0.7	=	5.7	(76)
East	0.9x	0.77	x	1.01	x	19.64	x	0.63	x	0.7	=	6.06	(76)
East	0.9x	0.77	x	0.95	x	38.42	x	0.63	x	0.7	=	11.15	(76)
East	0.9x	0.77	x	1.01	x	38.42	x	0.63	x	0.7	=	11.86	(76)
East	0.9x	0.77	x	0.95	x	63.27	x	0.63	x	0.7	=	18.37	(76)
East	0.9x	0.77	x	1.01	x	63.27	x	0.63	x	0.7	=	19.53	(76)
East	0.9x	0.77	x	0.95	x	92.28	x	0.63	x	0.7	=	26.79	(76)
East	0.9x	0.77	x	1.01	x	92.28	x	0.63	x	0.7	=	28.48	(76)
East	0.9x	0.77	x	0.95	x	113.09	x	0.63	x	0.7	=	32.83	(76)
East	0.9x	0.77	x	1.01	x	113.09	x	0.63	x	0.7	=	34.91	(76)
East	0.9x	0.77	x	0.95	x	115.77	x	0.63	x	0.7	=	33.61	(76)
East	0.9x	0.77	x	1.01	x	115.77	x	0.63	x	0.7	=	35.73	(76)
East	0.9x	0.77	x	0.95	x	110.22	x	0.63	x	0.7	=	32	(76)
East	0.9x	0.77	x	1.01	x	110.22	x	0.63	x	0.7	=	34.02	(76)
East	0.9x	0.77	x	0.95	x	94.68	x	0.63	x	0.7	=	27.49	(76)
East	0.9x	0.77	x	1.01	x	94.68	x	0.63	x	0.7	=	29.22	(76)
East	0.9x	0.77	x	0.95	x	73.59	x	0.63	x	0.7	=	21.37	(76)
East	0.9x	0.77	x	1.01	x	73.59	x	0.63	x	0.7	=	22.71	(76)
East	0.9x	0.77	x	0.95	x	45.59	x	0.63	x	0.7	=	13.24	(76)
East	0.9x	0.77	x	1.01	x	45.59	x	0.63	x	0.7	=	14.07	(76)
East	0.9x	0.77	x	0.95	x	24.49	x	0.63	x	0.7	=	7.11	(76)
East	0.9x	0.77	x	1.01	x	24.49	x	0.63	x	0.7	=	7.56	(76)
East	0.9x	0.77	x	0.95	x	16.15	x	0.63	x	0.7	=	4.69	(76)
East	0.9x	0.77	x	1.01	x	16.15	x	0.63	x	0.7	=	4.99	(76)
South	0.9x	0.77	x	10.33	x	46.75	x	0.63	x	0.7	=	147.6	(78)
South	0.9x	0.77	x	6.83	x	46.75	x	0.63	x	0.7	=	97.59	(78)

TER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	10.33	x	76.57	x	0.63	x	0.7	=	241.72	(78)
South	0.9x	0.77	x	6.83	x	76.57	x	0.63	x	0.7	=	159.82	(78)
South	0.9x	0.77	x	10.33	x	97.53	x	0.63	x	0.7	=	307.91	(78)
South	0.9x	0.77	x	6.83	x	97.53	x	0.63	x	0.7	=	203.59	(78)
South	0.9x	0.77	x	10.33	x	110.23	x	0.63	x	0.7	=	348.01	(78)
South	0.9x	0.77	x	6.83	x	110.23	x	0.63	x	0.7	=	230.1	(78)
South	0.9x	0.77	x	10.33	x	114.87	x	0.63	x	0.7	=	362.65	(78)
South	0.9x	0.77	x	6.83	x	114.87	x	0.63	x	0.7	=	239.77	(78)
South	0.9x	0.77	x	10.33	x	110.55	x	0.63	x	0.7	=	349	(78)
South	0.9x	0.77	x	6.83	x	110.55	x	0.63	x	0.7	=	230.75	(78)
South	0.9x	0.77	x	10.33	x	108.01	x	0.63	x	0.7	=	340.99	(78)
South	0.9x	0.77	x	6.83	x	108.01	x	0.63	x	0.7	=	225.46	(78)
South	0.9x	0.77	x	10.33	x	104.89	x	0.63	x	0.7	=	331.15	(78)
South	0.9x	0.77	x	6.83	x	104.89	x	0.63	x	0.7	=	218.95	(78)
South	0.9x	0.77	x	10.33	x	101.89	x	0.63	x	0.7	=	321.65	(78)
South	0.9x	0.77	x	6.83	x	101.89	x	0.63	x	0.7	=	212.67	(78)
South	0.9x	0.77	x	10.33	x	82.59	x	0.63	x	0.7	=	260.72	(78)
South	0.9x	0.77	x	6.83	x	82.59	x	0.63	x	0.7	=	172.38	(78)
South	0.9x	0.77	x	10.33	x	55.42	x	0.63	x	0.7	=	174.95	(78)
South	0.9x	0.77	x	6.83	x	55.42	x	0.63	x	0.7	=	115.67	(78)
South	0.9x	0.77	x	10.33	x	40.4	x	0.63	x	0.7	=	127.54	(78)
South	0.9x	0.77	x	6.83	x	40.4	x	0.63	x	0.7	=	84.32	(78)
West	0.9x	0.77	x	0.62	x	19.64	x	0.63	x	0.7	=	3.72	(80)
West	0.9x	0.77	x	0.83	x	19.64	x	0.63	x	0.7	=	4.98	(80)
West	0.9x	0.77	x	6.09	x	19.64	x	0.63	x	0.7	=	36.55	(80)
West	0.9x	0.77	x	0.62	x	38.42	x	0.63	x	0.7	=	7.28	(80)
West	0.9x	0.77	x	0.83	x	38.42	x	0.63	x	0.7	=	9.75	(80)
West	0.9x	0.77	x	6.09	x	38.42	x	0.63	x	0.7	=	71.51	(80)
West	0.9x	0.77	x	0.62	x	63.27	x	0.63	x	0.7	=	11.99	(80)
West	0.9x	0.77	x	0.83	x	63.27	x	0.63	x	0.7	=	16.05	(80)
West	0.9x	0.77	x	6.09	x	63.27	x	0.63	x	0.7	=	117.76	(80)
West	0.9x	0.77	x	0.62	x	92.28	x	0.63	x	0.7	=	17.49	(80)
West	0.9x	0.77	x	0.83	x	92.28	x	0.63	x	0.7	=	23.41	(80)
West	0.9x	0.77	x	6.09	x	92.28	x	0.63	x	0.7	=	171.75	(80)
West	0.9x	0.77	x	0.62	x	113.09	x	0.63	x	0.7	=	21.43	(80)
West	0.9x	0.77	x	0.83	x	113.09	x	0.63	x	0.7	=	28.69	(80)
West	0.9x	0.77	x	6.09	x	113.09	x	0.63	x	0.7	=	210.49	(80)
West	0.9x	0.77	x	0.62	x	115.77	x	0.63	x	0.7	=	21.94	(80)
West	0.9x	0.77	x	0.83	x	115.77	x	0.63	x	0.7	=	29.37	(80)
West	0.9x	0.77	x	6.09	x	115.77	x	0.63	x	0.7	=	215.47	(80)
West	0.9x	0.77	x	0.62	x	110.22	x	0.63	x	0.7	=	20.88	(80)

TER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	0.83	x	110.22	x	0.63	x	0.7	=	27.96	(80)
West	0.9x	0.77	x	6.09	x	110.22	x	0.63	x	0.7	=	205.14	(80)
West	0.9x	0.77	x	0.62	x	94.68	x	0.63	x	0.7	=	17.94	(80)
West	0.9x	0.77	x	0.83	x	94.68	x	0.63	x	0.7	=	24.02	(80)
West	0.9x	0.77	x	6.09	x	94.68	x	0.63	x	0.7	=	176.21	(80)
West	0.9x	0.77	x	0.62	x	73.59	x	0.63	x	0.7	=	13.94	(80)
West	0.9x	0.77	x	0.83	x	73.59	x	0.63	x	0.7	=	18.67	(80)
West	0.9x	0.77	x	6.09	x	73.59	x	0.63	x	0.7	=	136.96	(80)
West	0.9x	0.77	x	0.62	x	45.59	x	0.63	x	0.7	=	8.64	(80)
West	0.9x	0.77	x	0.83	x	45.59	x	0.63	x	0.7	=	11.56	(80)
West	0.9x	0.77	x	6.09	x	45.59	x	0.63	x	0.7	=	84.85	(80)
West	0.9x	0.77	x	0.62	x	24.49	x	0.63	x	0.7	=	4.64	(80)
West	0.9x	0.77	x	0.83	x	24.49	x	0.63	x	0.7	=	6.21	(80)
West	0.9x	0.77	x	6.09	x	24.49	x	0.63	x	0.7	=	45.58	(80)
West	0.9x	0.77	x	0.62	x	16.15	x	0.63	x	0.7	=	3.06	(80)
West	0.9x	0.77	x	0.83	x	16.15	x	0.63	x	0.7	=	4.1	(80)
West	0.9x	0.77	x	6.09	x	16.15	x	0.63	x	0.7	=	30.06	(80)
Rooflights	0.9x	1	x	0.99	x	15.52	x	0.63	x	0.7	=	6.07	(82)
Rooflights	0.9x	1	x	1.14	x	15.52	x	0.63	x	0.7	=	7.01	(82)
Rooflights	0.9x	1	x	0.99	x	46.22	x	0.63	x	0.7	=	18.07	(82)
Rooflights	0.9x	1	x	1.14	x	15.52	x	0.63	x	0.7	=	7.01	(82)
Rooflights	0.9x	1	x	1.58	x	46.22	x	0.63	x	0.7	=	28.92	(82)
Rooflights	0.9x	1	x	0.99	x	29.02	x	0.63	x	0.7	=	11.35	(82)
Rooflights	0.9x	1	x	1.14	x	29.02	x	0.63	x	0.7	=	13.11	(82)
Rooflights	0.9x	1	x	0.99	x	83.02	x	0.63	x	0.7	=	32.46	(82)
Rooflights	0.9x	1	x	1.14	x	29.02	x	0.63	x	0.7	=	13.11	(82)
Rooflights	0.9x	1	x	1.58	x	83.02	x	0.63	x	0.7	=	51.93	(82)
Rooflights	0.9x	1	x	0.99	x	51.71	x	0.63	x	0.7	=	20.22	(82)
Rooflights	0.9x	1	x	1.14	x	51.71	x	0.63	x	0.7	=	23.36	(82)
Rooflights	0.9x	1	x	0.99	x	122.59	x	0.63	x	0.7	=	47.93	(82)
Rooflights	0.9x	1	x	1.14	x	51.71	x	0.63	x	0.7	=	23.36	(82)
Rooflights	0.9x	1	x	1.58	x	122.59	x	0.63	x	0.7	=	76.69	(82)
Rooflights	0.9x	1	x	0.99	x	92.56	x	0.63	x	0.7	=	36.19	(82)
Rooflights	0.9x	1	x	1.14	x	92.56	x	0.63	x	0.7	=	41.82	(82)
Rooflights	0.9x	1	x	0.99	x	163.13	x	0.63	x	0.7	=	63.78	(82)
Rooflights	0.9x	1	x	1.14	x	92.56	x	0.63	x	0.7	=	41.82	(82)
Rooflights	0.9x	1	x	1.58	x	163.13	x	0.63	x	0.7	=	102.05	(82)
Rooflights	0.9x	1	x	0.99	x	135.76	x	0.63	x	0.7	=	53.08	(82)
Rooflights	0.9x	1	x	1.14	x	135.76	x	0.63	x	0.7	=	61.34	(82)
Rooflights	0.9x	1	x	0.99	x	190.18	x	0.63	x	0.7	=	74.36	(82)
Rooflights	0.9x	1	x	1.14	x	135.76	x	0.63	x	0.7	=	61.34	(82)

TER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	1.58	x	190.18	x	0.63	x	0.7	=	118.97	(82)
Rooflights 0.9x	1	x	0.99	x	150.52	x	0.63	x	0.7	=	58.85	(82)
Rooflights 0.9x	1	x	1.14	x	150.52	x	0.63	x	0.7	=	68	(82)
Rooflights 0.9x	1	x	0.99	x	191.34	x	0.63	x	0.7	=	74.81	(82)
Rooflights 0.9x	1	x	1.14	x	150.52	x	0.63	x	0.7	=	68	(82)
Rooflights 0.9x	1	x	1.58	x	191.34	x	0.63	x	0.7	=	119.69	(82)
Rooflights 0.9x	1	x	0.99	x	138.45	x	0.63	x	0.7	=	54.13	(82)
Rooflights 0.9x	1	x	1.14	x	138.45	x	0.63	x	0.7	=	62.55	(82)
Rooflights 0.9x	1	x	0.99	x	183.47	x	0.63	x	0.7	=	71.73	(82)
Rooflights 0.9x	1	x	1.14	x	138.45	x	0.63	x	0.7	=	62.55	(82)
Rooflights 0.9x	1	x	1.58	x	183.47	x	0.63	x	0.7	=	114.77	(82)
Rooflights 0.9x	1	x	0.99	x	102.74	x	0.63	x	0.7	=	40.17	(82)
Rooflights 0.9x	1	x	1.14	x	102.74	x	0.63	x	0.7	=	46.42	(82)
Rooflights 0.9x	1	x	0.99	x	163.4	x	0.63	x	0.7	=	63.89	(82)
Rooflights 0.9x	1	x	1.14	x	102.74	x	0.63	x	0.7	=	46.42	(82)
Rooflights 0.9x	1	x	1.58	x	163.4	x	0.63	x	0.7	=	102.22	(82)
Rooflights 0.9x	1	x	0.99	x	64.74	x	0.63	x	0.7	=	25.31	(82)
Rooflights 0.9x	1	x	1.14	x	64.74	x	0.63	x	0.7	=	29.25	(82)
Rooflights 0.9x	1	x	0.99	x	136.91	x	0.63	x	0.7	=	53.53	(82)
Rooflights 0.9x	1	x	1.14	x	64.74	x	0.63	x	0.7	=	29.25	(82)
Rooflights 0.9x	1	x	1.58	x	136.91	x	0.63	x	0.7	=	85.65	(82)
Rooflights 0.9x	1	x	0.99	x	34.81	x	0.63	x	0.7	=	13.61	(82)
Rooflights 0.9x	1	x	1.14	x	34.81	x	0.63	x	0.7	=	15.73	(82)
Rooflights 0.9x	1	x	0.99	x	94.41	x	0.63	x	0.7	=	36.91	(82)
Rooflights 0.9x	1	x	1.14	x	34.81	x	0.63	x	0.7	=	15.73	(82)
Rooflights 0.9x	1	x	1.58	x	94.41	x	0.63	x	0.7	=	59.06	(82)
Rooflights 0.9x	1	x	0.99	x	18.94	x	0.63	x	0.7	=	7.4	(82)
Rooflights 0.9x	1	x	1.14	x	18.94	x	0.63	x	0.7	=	8.56	(82)
Rooflights 0.9x	1	x	0.99	x	56.2	x	0.63	x	0.7	=	21.97	(82)
Rooflights 0.9x	1	x	1.14	x	18.94	x	0.63	x	0.7	=	8.56	(82)
Rooflights 0.9x	1	x	1.58	x	56.2	x	0.63	x	0.7	=	35.16	(82)
Rooflights 0.9x	1	x	0.99	x	13.13	x	0.63	x	0.7	=	5.13	(82)
Rooflights 0.9x	1	x	1.14	x	13.13	x	0.63	x	0.7	=	5.93	(82)
Rooflights 0.9x	1	x	0.99	x	38.99	x	0.63	x	0.7	=	15.24	(82)
Rooflights 0.9x	1	x	1.14	x	13.13	x	0.63	x	0.7	=	5.93	(82)
Rooflights 0.9x	1	x	1.58	x	38.99	x	0.63	x	0.7	=	24.39	(82)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	433.73	758.21	1096.02	1467.82	1752.65	1789.96	1704.74	1483.13	1222.56	853.1	522.87	369.1	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	1088.87	1411.04	1726.8	2062.12	2308.27	2309.54	2201.68	1986.84	1745.67	1412.93	1125	1004.55	(84)
--------	---------	---------	--------	---------	---------	---------	---------	---------	---------	---------	------	---------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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TER WorkSheet: New dwelling design stage

(86)m=	1	1	0.99	0.97	0.92	0.78	0.63	0.7	0.91	0.99	1	1	(86)
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Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.3	19.5	19.81	20.23	20.62	20.88	20.97	20.94	20.73	20.22	19.68	19.27	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.77	19.77	19.77	19.78	19.78	19.79	19.79	19.8	19.79	19.78	19.78	19.78	(88)
--------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	------

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

(89)m=	1	1	0.99	0.96	0.88	0.69	0.48	0.55	0.85	0.98	1	1	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.51	17.79	18.26	18.87	19.4	19.71	19.78	19.77	19.56	18.86	18.07	17.47	(90)
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fLA = Living area ÷ (4) =	0.57	(91)
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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.53	18.76	19.14	19.64	20.09	20.37	20.45	20.44	20.22	19.63	18.99	18.49	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.53	18.76	19.14	19.64	20.09	20.37	20.45	20.44	20.22	19.63	18.99	18.49	(93)
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8. Space heating requirement

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.96	0.89	0.74	0.56	0.64	0.88	0.98	1	1	(94)
--------	---	---	------	------	------	------	------	------	------	------	---	---	------

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

(95)m=	1087.59	1405.89	1707.37	1984.08	2049.12	1702.74	1239.37	1262.67	1528.46	1386.6	1121.93	1003.73	(95)
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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	4895.61	4759.95	4331.52	3645.8	2842.93	1937.99	1293.82	1353.53	2063.14	3059.98	4041.56	4878.51	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	2833.17	2253.93	1952.37	1196.44	590.6	0	0	0	0	1245	2102.14	2882.84	(98)
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Total per year (kWh/year) = Sum(98) _{1, 3, 5, ..., 12} =	15056.48	(98)
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Space heating requirement in kWh/m²/year

61.01	(99)
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9a. Energy requirements – individual heating systems including micro-CHP

Space heating:

Fraction of space heat from secondary/supplementary system

0	(201)
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Fraction of space heat from main system(s) (202) = 1 – (201) =

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

1	(204)
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Efficiency of main space heating system 1

93.5	(206)
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Efficiency of secondary/supplementary heating system, %

0	(208)
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Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
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Space heating requirement (calculated above)

2833.17	2253.93	1952.37	1196.44	590.6	0	0	0	0	1245	2102.14	2882.84
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(211)m = [(98)m x (204)] ÷ (206)

3030.12	2410.62	2088.1	1279.62	631.66	0	0	0	0	1331.55	2248.27	3083.25
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Total (kWh/year) = Sum(211) _{1, 3, 5, 10, ..., 12} =	16103.19	(211)
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TER WorkSheet: New dwelling design stage

Space heating fuel (secondary), kWh/month

$$= \{[(98)m \times (201)]\} \times 100 \div (208)$$

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215) _{1, 3,12, 12} =													0 (215)

Water heating

Output from water heater (calculated above)

225.38	198.57	208.37	186.55	182.63	162.94	156.24	171.78	171.58	193.45	204.86	219.87
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Efficiency of water heater

79.8 (216)

(217)m=	89.61	89.53	89.34	88.89	87.72	79.8	79.8	79.8	79.8	88.9	89.44	89.65	(217)
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Fuel for water heating, kWh/month

$$(219)m = (64)m \times 100 \div (217)m$$

(219)m=	251.49	221.8	233.22	209.86	208.2	204.18	195.79	215.26	215.01	217.61	229.06	245.26	
Total = Sum(219a) _{1,12} =													2646.74 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

16103.19

Water heating fuel used

2646.74

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

651.19 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

19476.11 (238)

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) ×	0.216	3478.29 (261)
Space heating (secondary)	(215) ×	0.519	0 (263)
Water heating	(219) ×	0.216	571.69 (264)
Space and water heating	(261) + (262) + (263) + (264) =		4049.98 (265)
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	38.93 (267)
Electricity for lighting	(232) ×	0.519	337.97 (268)
Total CO2, kg/year		sum of (265)...(271) =	4426.87 (272)

TER = 26.96 (273)