Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
Printed on Thursday, December 20, 2018 at 5:11:23 PM

Project Information:

Assessed By: Chloe Hewitt (STRO029693) **Building Type:** Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 450.85m²

Site Reference : Weston Hills Road, Low Fulney **Plot Reference:** Weston Hills, Low Fulney

Address : Weston Hills Road, Low Fulney, Spalding

Client Details:

Name:

Address :

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

1a TER and DER

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

Target Carbon Dioxide Emission Rate (TER)	19.75 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	-0.91 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.8 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	45.4 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.14 (max. 0.30)	0.14 (max. 0.70)	**OK**
Floor	0.10 (max. 0.25)	0.20 (max. 0.70)	**OK**
Roof	0.17 (max. 0.20)	0.19 (max. 0.35)	**OK**
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	3.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
Vaillant geoTHERM 10 kW

Secondary heating system: Room heaters - wood chips
Data from manufacturer -
Closed room heater
Efficiency 76.5 %
Minimum 65.0 % **OK**

5 Cylinder insulation

Hot water Storage:

Regulations Compliance Report

	Measured cylinder loss: 2.64 kWh/day	
	Permitted by DBSCG: 2.86 kWh/day	OK
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	OK
MVHR efficiency:	93%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (East Pennines):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: South	4.18m²
Windows facing: West	7.73m²
Windows facing: West	1.87m²
Windows facing: North	8.51m²
Windows facing: North West	6.35m²
Windows facing: North West	6.35m²
Windows facing: East	1.62m²
Windows facing: East	1.62m²
Windows facing: East	0.3m²
Windows facing: East	2.84m²
Windows facing: South	14.83m²
Windows facing: West	1.87m²
Windows facing: North	1.61m²
Windows facing: North	1.61m²
Windows facing: North West	4.12m²
Windows facing: North West	4.12m²
Windows facing: North	1.44m²
Windows facing: East	5.52m²
Windows facing: East	5.52m²
Windows facing: East	5.52m²
Roof windows facing: West	8.5m²
Roof windows facing: North	0.68m²
Roof windows facing: Horizontal	1.2m²
Roof windows facing: Horizontal	1.2m²
Roof windows facing: East	1.36m²
Roof windows facing: East	1.36m²

Regulations Compliance Report

Roof windows facing: East	1.36m²
Ventilation rate:	2.50
Blinds/curtains:	
	Closed 100% of daylight hours

10 Key features

Air permeablility	3.0 m³/m²h
Floors U-value	0.1 W/m²K
Photovoltaic array	
Secondary heating (wood chips)	
Secondary heating fuel wood chips	

Thermal Bridge Report

Property Details: Weston Hills, Low Fulney

Address:	Weston Hills Road, Low Fulney, Spalding
Located in:	England
Region:	East Pennines

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0559

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.3	50.02	E2	[A]
Sill	0.04	44.06	E3	[A]
Jamb	0.05	65.32	E4	[A]
Ground floor (normal)	0.16	82.42	E5	[A]
Exposed floor (normal)	0.32	10.8	E20	[D]
Intermediate floor within a dwelling	0.07	78.89	E6	[A]
Eaves (insulation at rafter level)	0.04	19.48	E11	[A]
Gable (insulation at rafter level)	0.04	58.09	E13	[A]
Flat roof	0.08	15.52	E14	[D]
Corner (normal)	0.09	24.3	E16	[A]
Corner (inverted internal area greater than external area)	-0.09	13.5	E17	[A]

Roof Junctions Details:

Head	0.08	0	R1	[D]

SAP Input

Property Details: Weston Hills, Low Fulney

Address:	Weston Hills Road, Low Fulney, Spalding
Located in:	England
Region:	East Pennines
UPRN:	
Date of assessment:	Thursday, December 20, 2018
Date of certificate:	Thursday, December 20, 2018
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Low
Water use <= 125 litres/person/day:	True
PCDF Version:	436

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2018

Floor Location:	Floor area:	Storey height:
Floor 0	227.64 m²	2.7 m
Floor 1	223.21 m²	2.76 m

Living area:	138.19 m² (fraction 0.329)
Front of dwelling faces:	West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Snug/Kitchen	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
Entrance Door	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Family/Playroom	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Family/Playroom Sliding Door	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Lounge Sliding Doors	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Lounge Sliding Doors	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Lounge	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Study	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
WC	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Utility Door & Side Light	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Master Bedroom	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Bedroom 3	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Bedroom 3	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Bedroom 4	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Void	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Void	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Bedroom 5	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Bedroom 5	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Bedroom 2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Bedroom 2	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Void - Stairs	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
En-suite	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Bedroom 5	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Bedroom 2	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Bathroom	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Dressing	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
En-suite	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Snug/Kitchen	16mm or more	0.7	0.63	1.2	4.18	1

SAP Input

Entrance Door	16mm or more	0.7	0.63	1.2	7.73	1
Family/Playroom	16mm or more	0.7	0.63	1.2	1.87	1
Family/Playroom Sliding Door	16mm or more	0.7	0.63	1.2	8.51	1
Lounge Sliding Doors	16mm or more	0.7	0.63	1.2	6.35	1
Lounge Sliding Doors	16mm or more	0.7	0.63	1.2	6.35	1
Lounge	16mm or more	0.7	0.63	1.2	1.62	1
Study	16mm or more	0.7	0.63	1.2	1.62	1
WC	16mm or more	0.7	0.63	1.2	0.3	1
Utility Door & Side Light	16mm or more	0.7	0.63	1.2	2.84	1
Master Bedroom	16mm or more	0.7	0.63	1.2	14.83	1
Bedroom 3	16mm or more	0.7	0.63	1.2	1.87	1
Bedroom 3	16mm or more	0.7	0.63	1.2	1.61	1
Bedroom 4	16mm or more	0.7	0.63	1.2	1.61	1
Void	16mm or more	0.7	0.63	1.2	4.12	1
Void	16mm or more	0.7	0.63	1.2	4.12	1
Bedroom 5	16mm or more	0.7	0.63	1.2	1.44	1
Bedroom 5	16mm or more	0.7	0.63	1.2	5.52	1
Bedroom 2	16mm or more	0.7	0.63	1.2	5.52	1
Bedroom 2	16mm or more	0.7	0.63	1.2	5.52	1
Void - Stairs	16mm or more	0.7	0.63	1.2	8.5	1
En-suite	16mm or more	0.7	0.63	1.2	0.68	1
Bedroom 5	16mm or more	0.7	0.63	1.2	1.2	1
Bedroom 2	16mm or more	0.7	0.63	1.2	1.2	1
Bathroom	16mm or more	0.7	0.63	1.2	1.36	1
Dressing	16mm or more	0.7	0.63	1.2	1.36	1
En-suite	16mm or more	0.7	0.63	1.2	1.36	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Snug/Kitchen		External Wall	South	5.682	0.735
Entrance Door		External Wall	West	0	0
Family/Playroom		External Wall	West	3.11	0.6
Family/Playroom Sliding Door		External Wall	North	4.05	2.1
Lounge Sliding Doors		External Wall	North West	2.35	2.7
Lounge Sliding Doors		External Wall	North West	2.35	2.7
Lounge		External Wall	East	1.2	1.35
Study		External Wall	East	1.2	1.35
WC		External Wall	East	0.6	0.5
Utility Door & Side Light		External Wall	East	1.35	2.1
Master Bedroom		External Wall	South	0	0
Bedroom 3		External Wall	West	3.11	0.6
Bedroom 3		External Wall	North	0.78	2.07
Bedroom 4		External Wall	North	0.78	2.07
Void		External Wall	North West	0	0
Void		External Wall	North West	0	0
Bedroom 5		External Wall	North	0.6	2.4
Bedroom 5		External Wall	East	2.3	2.4
Bedroom 2		External Wall	East	2.3	2.4
Bedroom 2		External Wall	East	2.3	2.4
Void - Stairs		Sloping Ceiling	West	3.4	2.5
En-suite		Sloping Ceiling	North	0.8	0.85
Bedroom 5		Flat Roof to Dormer	Horizontal	0.6	2
Bedroom 2		Flat Roof to Dormer	Horizontal	0.6	2
Bathroom		Sloping Ceiling	East	1.6	0.85
Dressing		Sloping Ceiling	East	1.6	0.85
En-suite		Sloping Ceiling	East	1.6	0.85

Overshading: Average or unknown

Opaque Elements:

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

SAP Input

External Elements

External Wall	313.93	87.53	226.4	0.14	0	False	N/A
Sloping Ceiling	290.48	13.26	277.22	0.17	0		N/A
Flat Roof to Dormer	10.86	2.4	8.46	0.19	0		N/A
Ground Floor	227.64			0.1			N/A
Exposed Floor to Dormer	7.28			0.2			N/A

Internal Elements

Party Elements

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0559

	Length	Psi-value		
[Approved]	50.02	0.3	E2	Other lintels (including other steel lintels)
[Approved]	44.06	0.04	E3	Sill
[Approved]	65.32	0.05	E4	Jamb
[Approved]	82.42	0.16	E5	Ground floor (normal)
	10.8	0.32	E20	Exposed floor (normal)
[Approved]	78.89	0.07	E6	Intermediate floor within a dwelling
[Approved]	19.48	0.04	E11	Eaves (insulation at rafter level)
[Approved]	58.09	0.04	E13	Gable (insulation at rafter level)
	15.52	0.08	E14	Flat roof
[Approved]	24.3	0.09	E16	Corner (normal)
[Approved]	13.5	-0.09	E17	Corner (inverted internal area greater than external area)
	0	0.08	R1	Head

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 5
Ductwork: Insulation, rigid
Approved Installation Scheme: True

Number of chimneys: 1 (main: 0, secondary: 0, other: 1)

Number of open flues: 0

Number of fans: 0

Number of passive stacks: 0

Number of sides sheltered: 0

Pressure test: 3

Main heating system:

Main heating system: Heat pumps with radiators or underfloor heating
Electric heat pumps
Fuel: Electricity
Info Source: Boiler Database
Database: (rev 436, product index 100071, SEDBUK 383%):
Brand name: Vaillant
Model: geoTHERM 10 kW
Model qualifier: VWS 101/2 - Radiators
(provides DHW all year)
Underfloor heating, pipes in screed above insulation
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
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

SAP Input

Secondary heating system:

Secondary heating system:	Room heaters Solid fuel room heaters Fuel :wood chips Info Source: Manufacturer Declaration Closed room heater HETAS Approved

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :Electricity Hot water cylinder Cylinder volume: 300 litres Cylinder insulation: Factory 75 mm Primary pipework insulation: True Cylinderstat: True Cylinder in heated space: True Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 12 Tilt of collector: 30° Overshading: None or very little Collector Orientation: South East
Assess Zero Carbon Home:	Yes

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Chloe Hewitt	**Stroma Number:**	STRO029693
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Weston Hills, Low Fulney

Address : Weston Hills Road, Low Fulney, Spalding

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	227.64 (1a)	x	2.7 (2a)	=	614.63	(3a)
First floor	223.21 (1b)	x	2.76 (2b)	=	616.06	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	450.85 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	1230.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	1	=	1	x 40 =	40	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.03 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.18 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.18 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.23	0.23	0.22	0.2	0.2	0.17	0.17	0.17	0.18	0.2	0.21	0.21

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.05 (23c)

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

(24a)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.27	0.29	0.3	0.31	0.32	(24a)

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

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

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

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

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

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

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

(25)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.27	0.29	0.3	0.31	0.32	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			4.18	x1/[1/(1.2)+ 0.04] =	4.79			(27)
Windows Type 2			7.73	x1/[1/(1.2)+ 0.04] =	8.85			(27)
Windows Type 3			1.87	x1/[1/(1.2)+ 0.04] =	2.14			(27)
Windows Type 4			8.51	x1/[1/(1.2)+ 0.04] =	9.74			(27)
Windows Type 5			6.35	x1/[1/(1.2)+ 0.04] =	7.27			(27)
Windows Type 6			6.35	x1/[1/(1.2)+ 0.04] =	7.27			(27)
Windows Type 7			1.62	x1/[1/(1.2)+ 0.04] =	1.85			(27)
Windows Type 8			1.62	x1/[1/(1.2)+ 0.04] =	1.85			(27)
Windows Type 9			0.3	x1/[1/(1.2)+ 0.04] =	0.34			(27)
Windows Type 10			2.84	x1/[1/(1.2)+ 0.04] =	3.25			(27)
Windows Type 11			14.83	x1/[1/(1.2)+ 0.04] =	16.98			(27)
Windows Type 12			1.87	x1/[1/(1.2)+ 0.04] =	2.14			(27)
Windows Type 13			1.61	x1/[1/(1.2)+ 0.04] =	1.84			(27)
Windows Type 14			1.61	x1/[1/(1.2)+ 0.04] =	1.84			(27)
Windows Type 15			4.12	x1/[1/(1.2)+ 0.04] =	4.72			(27)
Windows Type 16			4.12	x1/[1/(1.2)+ 0.04] =	4.72			(27)
Windows Type 17			1.44	x1/[1/(1.2)+ 0.04] =	1.65			(27)

SAP WorkSheet: New dwelling design stage

Windows Type 18			5.52	x1/[1/(1.2)+ 0.04] =	6.32				(27)
Windows Type 19			5.52	x1/[1/(1.2)+ 0.04] =	6.32				(27)
Windows Type 20			5.52	x1/[1/(1.2)+ 0.04] =	6.32				(27)
Rooflights Type 1			8.5	x1/[1/(1.2) + 0.04] =	10.2				(27b)
Rooflights Type 2			0.68	x1/[1/(1.2) + 0.04] =	0.816				(27b)
Rooflights Type 3			1.2	x1/[1/(1.2) + 0.04] =	1.44				(27b)
Rooflights Type 4			1.2	x1/[1/(1.2) + 0.04] =	1.44				(27b)
Rooflights Type 5			1.36	x1/[1/(1.2) + 0.04] =	1.632				(27b)
Rooflights Type 6			1.36	x1/[1/(1.2) + 0.04] =	1.632				(27b)
Rooflights Type 7			1.36	x1/[1/(1.2) + 0.04] =	1.632				(27b)
Floor Type 1			227.64	x 0.1 =	22.764				(28)
Floor Type 2			7.28	x 0.2 =	1.456				(28)
Walls	313.93	87.53	226.4	x 0.14 =	31.7				(29)
Roof Type1	290.48	13.26	277.22	x 0.17 =	47.13				(30)
Roof Type2	10.86	2.4	8.46	x 0.19 =	1.61				(30)
Total area of elements, m²			850.19						(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 222.81 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21827.32 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 47.52 (36)

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

Total fabric heat loss (33) + (36) = 270.32 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	137.04	135.19	133.34	124.07	122.22	112.95	112.95	111.1	116.66	122.22	125.93	129.63	(38)

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

(39)m=	407.37	405.51	403.66	394.4	392.54	383.28	383.28	381.43	386.98	392.54	396.25	399.96	

Average = Sum(39)$_{1...12}$ /12= 393.93 (39)

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

(40)m=	0.9	0.9	0.9	0.87	0.87	0.85	0.85	0.85	0.86	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.33 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 113.24 (43)

SAP WorkSheet: New dwelling design stage

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

(45)m=	184.73	161.56	166.72	145.35	139.47	120.35	111.52	127.97	129.5	150.92	164.74	178.9	
										Total = Sum(45)$_{1...12}$ =			1781.72 (45)

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

(46)m=	27.71	24.23	25.01	21.8	20.92	18.05	16.73	19.2	19.42	22.64	24.71	26.83	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b: 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 300 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day): 0.01 (51)

If community heating see section 4.3

Volume factor from Table 2a: 0.74 (52)

Temperature factor from Table 2b: 0.54 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.43 (54)

Enter (50) or (54) in (55): 1.43 (55)

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

(56)m=	44.26	39.98	44.26	42.83	44.26	42.83	44.26	44.26	42.83	44.26	42.83	44.26	(56)

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

(57)m=	44.26	39.98	44.26	42.83	44.26	42.83	44.26	44.26	42.83	44.26	42.83	44.26	(57)

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

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

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

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

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

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

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

(62)m=	252.25	222.55	234.24	210.7	206.99	185.69	179.05	195.5	194.85	218.44	230.09	246.42	(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=	252.25	222.55	234.24	210.7	206.99	185.69	179.05	195.5	194.85	218.44	230.09	246.42	
											Output from water heater (annual)$_{1...12}$		2576.77 (64)

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

(65)m=	115.44	102.51	109.45	100.61	100.39	92.29	91.1	96.57	95.34	104.2	107.05	113.5	(65)

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

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

Metabolic gains (Table 5), Watts

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

SAP WorkSheet: New dwelling design stage

(66)m=	199.68	199.68	199.68	199.68	199.68	199.68	199.68	199.68	199.68	199.68	199.68	199.68	(66)

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

(67)m=	127.35	113.11	91.99	69.64	52.06	43.95	47.49	61.73	82.85	105.2	122.78	130.89	(67)

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

(68)m=	852.85	861.7	839.39	791.92	731.99	675.66	638.03	629.18	651.48	698.96	758.89	815.22	(68)

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

(69)m=	58.3	58.3	58.3	58.3	58.3	58.3	58.3	58.3	58.3	58.3	58.3	58.3	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	(71)

Water heating gains (Table 5)

(72)m=	155.16	152.55	147.12	139.73	134.94	128.18	122.45	129.8	132.41	140.05	148.69	152.56	(72)

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

(73)m=	1260.22	1252.21	1203.36	1126.15	1043.84	972.65	932.82	945.56	991.6	1069.07	1155.22	1223.52	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	8.51		10.63		0.63		0.7	=	27.65	(74)
North	0.9x	0.77	1.61		10.63		0.63		0.7	=	5.23	(74)
North	0.9x	0.77	1.61		10.63		0.63		0.7	=	5.23	(74)
North	0.9x	0.77	1.44		10.63		0.63		0.7	=	4.68	(74)
North	0.9x	0.77	8.51		20.32		0.63		0.7	=	52.85	(74)
North	0.9x	0.77	1.61		20.32		0.63		0.7	=	10	(74)
North	0.9x	0.77	1.61		20.32		0.63		0.7	=	10	(74)
North	0.9x	0.77	1.44		20.32		0.63		0.7	=	8.94	(74)
North	0.9x	0.77	8.51		34.53		0.63		0.7	=	89.81	(74)
North	0.9x	0.77	1.61		34.53		0.63		0.7	=	16.99	(74)
North	0.9x	0.77	1.61		34.53		0.63		0.7	=	16.99	(74)
North	0.9x	0.77	1.44		34.53		0.63		0.7	=	15.2	(74)
North	0.9x	0.77	8.51		55.46		0.63		0.7	=	144.25	(74)
North	0.9x	0.77	1.61		55.46		0.63		0.7	=	27.29	(74)
North	0.9x	0.77	1.61		55.46		0.63		0.7	=	27.29	(74)
North	0.9x	0.77	1.44		55.46		0.63		0.7	=	24.41	(74)
North	0.9x	0.77	8.51		74.72		0.63		0.7	=	194.32	(74)
North	0.9x	0.77	1.61		74.72		0.63		0.7	=	36.76	(74)
North	0.9x	0.77	1.61		74.72		0.63		0.7	=	36.76	(74)
North	0.9x	0.77	1.44		74.72		0.63		0.7	=	32.88	(74)
North	0.9x	0.77	8.51		79.99		0.63		0.7	=	208.02	(74)

SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.61	x	79.99	x	0.63	x	0.7	=	39.36	(74)
North	0.9x	0.77	x	1.61	x	79.99	x	0.63	x	0.7	=	39.36	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.63	x	0.7	=	35.2	(74)
North	0.9x	0.77	x	8.51	x	74.68	x	0.63	x	0.7	=	194.22	(74)
North	0.9x	0.77	x	1.61	x	74.68	x	0.63	x	0.7	=	36.74	(74)
North	0.9x	0.77	x	1.61	x	74.68	x	0.63	x	0.7	=	36.74	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.63	x	0.7	=	32.86	(74)
North	0.9x	0.77	x	8.51	x	59.25	x	0.63	x	0.7	=	154.09	(74)
North	0.9x	0.77	x	1.61	x	59.25	x	0.63	x	0.7	=	29.15	(74)
North	0.9x	0.77	x	1.61	x	59.25	x	0.63	x	0.7	=	29.15	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.63	x	0.7	=	26.07	(74)
North	0.9x	0.77	x	8.51	x	41.52	x	0.63	x	0.7	=	107.97	(74)
North	0.9x	0.77	x	1.61	x	41.52	x	0.63	x	0.7	=	20.43	(74)
North	0.9x	0.77	x	1.61	x	41.52	x	0.63	x	0.7	=	20.43	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.63	x	0.7	=	18.27	(74)
North	0.9x	0.77	x	8.51	x	24.19	x	0.63	x	0.7	=	62.91	(74)
North	0.9x	0.77	x	1.61	x	24.19	x	0.63	x	0.7	=	11.9	(74)
North	0.9x	0.77	x	1.61	x	24.19	x	0.63	x	0.7	=	11.9	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.63	x	0.7	=	10.65	(74)
North	0.9x	0.77	x	8.51	x	13.12	x	0.63	x	0.7	=	34.12	(74)
North	0.9x	0.77	x	1.61	x	13.12	x	0.63	x	0.7	=	6.45	(74)
North	0.9x	0.77	x	1.61	x	13.12	x	0.63	x	0.7	=	6.45	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.63	x	0.7	=	5.77	(74)
North	0.9x	0.77	x	8.51	x	8.86	x	0.63	x	0.7	=	23.05	(74)
North	0.9x	0.77	x	1.61	x	8.86	x	0.63	x	0.7	=	4.36	(74)
North	0.9x	0.77	x	1.61	x	8.86	x	0.63	x	0.7	=	4.36	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.63	x	0.7	=	3.9	(74)
East	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.7	=	9.72	(76)
East	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.7	=	9.72	(76)
East	0.9x	1	x	0.3	x	19.64	x	0.63	x	0.7	=	1.8	(76)
East	0.9x	1	x	2.84	x	19.64	x	0.63	x	0.7	=	17.05	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.7	=	19.02	(76)
East	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.7	=	19.02	(76)
East	0.9x	1	x	0.3	x	38.42	x	0.63	x	0.7	=	3.52	(76)
East	0.9x	1	x	2.84	x	38.42	x	0.63	x	0.7	=	33.35	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)

SAP WorkSheet: New dwelling design stage

East	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.7	=	31.33	(76)
East	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.7	=	31.33	(76)
East	0.9x	1	x	0.3	x	63.27	x	0.63	x	0.7	=	5.8	(76)
East	0.9x	1	x	2.84	x	63.27	x	0.63	x	0.7	=	54.92	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.7	=	45.69	(76)
East	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.7	=	45.69	(76)
East	0.9x	1	x	0.3	x	92.28	x	0.63	x	0.7	=	8.46	(76)
East	0.9x	1	x	2.84	x	92.28	x	0.63	x	0.7	=	80.09	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.7	=	55.99	(76)
East	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.7	=	55.99	(76)
East	0.9x	1	x	0.3	x	113.09	x	0.63	x	0.7	=	10.37	(76)
East	0.9x	1	x	2.84	x	113.09	x	0.63	x	0.7	=	98.16	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.7	=	57.32	(76)
East	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.7	=	57.32	(76)
East	0.9x	1	x	0.3	x	115.77	x	0.63	x	0.7	=	10.61	(76)
East	0.9x	1	x	2.84	x	115.77	x	0.63	x	0.7	=	100.48	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.7	=	54.57	(76)
East	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.7	=	54.57	(76)
East	0.9x	1	x	0.3	x	110.22	x	0.63	x	0.7	=	10.11	(76)
East	0.9x	1	x	2.84	x	110.22	x	0.63	x	0.7	=	95.66	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.7	=	46.87	(76)
East	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.7	=	46.87	(76)
East	0.9x	1	x	0.3	x	94.68	x	0.63	x	0.7	=	8.68	(76)
East	0.9x	1	x	2.84	x	94.68	x	0.63	x	0.7	=	82.17	(76)
East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)
East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)

SAP WorkSheet: New dwelling design stage

East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)
East	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.7	=	36.43	(76)
East	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.7	=	36.43	(76)
East	0.9x	1	x	0.3	x	73.59	x	0.63	x	0.7	=	6.75	(76)
East	0.9x	1	x	2.84	x	73.59	x	0.63	x	0.7	=	63.87	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.7	=	22.57	(76)
East	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.7	=	22.57	(76)
East	0.9x	1	x	0.3	x	45.59	x	0.63	x	0.7	=	4.18	(76)
East	0.9x	1	x	2.84	x	45.59	x	0.63	x	0.7	=	39.57	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.7	=	12.12	(76)
East	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.7	=	12.12	(76)
East	0.9x	1	x	0.3	x	24.49	x	0.63	x	0.7	=	2.25	(76)
East	0.9x	1	x	2.84	x	24.49	x	0.63	x	0.7	=	21.26	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.7	=	8	(76)
East	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.7	=	8	(76)
East	0.9x	1	x	0.3	x	16.15	x	0.63	x	0.7	=	1.48	(76)
East	0.9x	1	x	2.84	x	16.15	x	0.63	x	0.7	=	14.02	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
South	0.9x	0.77	x	4.18	x	46.75	x	0.63	x	0.7	=	59.72	(78)
South	0.9x	0.77	x	14.83	x	46.75	x	0.63	x	0.7	=	211.89	(78)
South	0.9x	0.77	x	4.18	x	76.57	x	0.63	x	0.7	=	97.81	(78)
South	0.9x	0.77	x	14.83	x	76.57	x	0.63	x	0.7	=	347.02	(78)
South	0.9x	0.77	x	4.18	x	97.53	x	0.63	x	0.7	=	124.6	(78)
South	0.9x	0.77	x	14.83	x	97.53	x	0.63	x	0.7	=	442.05	(78)
South	0.9x	0.77	x	4.18	x	110.23	x	0.63	x	0.7	=	140.82	(78)
South	0.9x	0.77	x	14.83	x	110.23	x	0.63	x	0.7	=	499.61	(78)
South	0.9x	0.77	x	4.18	x	114.87	x	0.63	x	0.7	=	146.74	(78)
South	0.9x	0.77	x	14.83	x	114.87	x	0.63	x	0.7	=	520.62	(78)
South	0.9x	0.77	x	4.18	x	110.55	x	0.63	x	0.7	=	141.22	(78)
South	0.9x	0.77	x	14.83	x	110.55	x	0.63	x	0.7	=	501.03	(78)

SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	4.18	x	108.01	x	0.63	x	0.7	=	137.98	(78)
South	0.9x	0.77	x	14.83	x	108.01	x	0.63	x	0.7	=	489.54	(78)
South	0.9x	0.77	x	4.18	x	104.89	x	0.63	x	0.7	=	134	(78)
South	0.9x	0.77	x	14.83	x	104.89	x	0.63	x	0.7	=	475.41	(78)
South	0.9x	0.77	x	4.18	x	101.89	x	0.63	x	0.7	=	130.16	(78)
South	0.9x	0.77	x	14.83	x	101.89	x	0.63	x	0.7	=	461.77	(78)
South	0.9x	0.77	x	4.18	x	82.59	x	0.63	x	0.7	=	105.5	(78)
South	0.9x	0.77	x	14.83	x	82.59	x	0.63	x	0.7	=	374.3	(78)
South	0.9x	0.77	x	4.18	x	55.42	x	0.63	x	0.7	=	70.79	(78)
South	0.9x	0.77	x	14.83	x	55.42	x	0.63	x	0.7	=	251.16	(78)
South	0.9x	0.77	x	4.18	x	40.4	x	0.63	x	0.7	=	51.61	(78)
South	0.9x	0.77	x	14.83	x	40.4	x	0.63	x	0.7	=	183.09	(78)
West	0.9x	0.77	x	7.73	x	19.64	x	0.63	x	0.7	=	46.4	(80)
West	0.9x	0.77	x	1.87	x	19.64	x	0.63	x	0.7	=	11.22	(80)
West	0.9x	0.77	x	1.87	x	19.64	x	0.63	x	0.7	=	11.22	(80)
West	0.9x	0.77	x	7.73	x	38.42	x	0.63	x	0.7	=	90.76	(80)
West	0.9x	0.77	x	1.87	x	38.42	x	0.63	x	0.7	=	21.96	(80)
West	0.9x	0.77	x	1.87	x	38.42	x	0.63	x	0.7	=	21.96	(80)
West	0.9x	0.77	x	7.73	x	63.27	x	0.63	x	0.7	=	149.48	(80)
West	0.9x	0.77	x	1.87	x	63.27	x	0.63	x	0.7	=	36.16	(80)
West	0.9x	0.77	x	1.87	x	63.27	x	0.63	x	0.7	=	36.16	(80)
West	0.9x	0.77	x	7.73	x	92.28	x	0.63	x	0.7	=	218	(80)
West	0.9x	0.77	x	1.87	x	92.28	x	0.63	x	0.7	=	52.74	(80)
West	0.9x	0.77	x	1.87	x	92.28	x	0.63	x	0.7	=	52.74	(80)
West	0.9x	0.77	x	7.73	x	113.09	x	0.63	x	0.7	=	267.17	(80)
West	0.9x	0.77	x	1.87	x	113.09	x	0.63	x	0.7	=	64.63	(80)
West	0.9x	0.77	x	1.87	x	113.09	x	0.63	x	0.7	=	64.63	(80)
West	0.9x	0.77	x	7.73	x	115.77	x	0.63	x	0.7	=	273.49	(80)
West	0.9x	0.77	x	1.87	x	115.77	x	0.63	x	0.7	=	66.16	(80)
West	0.9x	0.77	x	1.87	x	115.77	x	0.63	x	0.7	=	66.16	(80)
West	0.9x	0.77	x	7.73	x	110.22	x	0.63	x	0.7	=	260.38	(80)
West	0.9x	0.77	x	1.87	x	110.22	x	0.63	x	0.7	=	62.99	(80)
West	0.9x	0.77	x	1.87	x	110.22	x	0.63	x	0.7	=	62.99	(80)
West	0.9x	0.77	x	7.73	x	94.68	x	0.63	x	0.7	=	223.66	(80)
West	0.9x	0.77	x	1.87	x	94.68	x	0.63	x	0.7	=	54.11	(80)
West	0.9x	0.77	x	1.87	x	94.68	x	0.63	x	0.7	=	54.11	(80)
West	0.9x	0.77	x	7.73	x	73.59	x	0.63	x	0.7	=	173.85	(80)
West	0.9x	0.77	x	1.87	x	73.59	x	0.63	x	0.7	=	42.06	(80)
West	0.9x	0.77	x	1.87	x	73.59	x	0.63	x	0.7	=	42.06	(80)
West	0.9x	0.77	x	7.73	x	45.59	x	0.63	x	0.7	=	107.7	(80)
West	0.9x	0.77	x	1.87	x	45.59	x	0.63	x	0.7	=	26.05	(80)

SAP WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.87	x	45.59	x	0.63	x	0.7	=	26.05	(80)
West	0.9x	0.77	x	7.73	x	24.49	x	0.63	x	0.7	=	57.85	(80)
West	0.9x	0.77	x	1.87	x	24.49	x	0.63	x	0.7	=	14	(80)
West	0.9x	0.77	x	1.87	x	24.49	x	0.63	x	0.7	=	14	(80)
West	0.9x	0.77	x	7.73	x	16.15	x	0.63	x	0.7	=	38.16	(80)
West	0.9x	0.77	x	1.87	x	16.15	x	0.63	x	0.7	=	9.23	(80)
West	0.9x	0.77	x	1.87	x	16.15	x	0.63	x	0.7	=	9.23	(80)
Northwest	0.9x	0.77	x	6.35	x	11.28	x	0.63	x	0.7	=	21.9	(81)
Northwest	0.9x	0.77	x	6.35	x	11.28	x	0.63	x	0.7	=	21.9	(81)
Northwest	0.9x	0.77	x	4.12	x	11.28	x	0.63	x	0.7	=	14.21	(81)
Northwest	0.9x	0.77	x	4.12	x	11.28	x	0.63	x	0.7	=	14.21	(81)
Northwest	0.9x	0.77	x	6.35	x	22.97	x	0.63	x	0.7	=	44.57	(81)
Northwest	0.9x	0.77	x	6.35	x	22.97	x	0.63	x	0.7	=	44.57	(81)
Northwest	0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest	0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest	0.9x	0.77	x	6.35	x	41.38	x	0.63	x	0.7	=	80.3	(81)
Northwest	0.9x	0.77	x	6.35	x	41.38	x	0.63	x	0.7	=	80.3	(81)
Northwest	0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest	0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest	0.9x	0.77	x	6.35	x	67.96	x	0.63	x	0.7	=	131.88	(81)
Northwest	0.9x	0.77	x	6.35	x	67.96	x	0.63	x	0.7	=	131.88	(81)
Northwest	0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest	0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest	0.9x	0.77	x	6.35	x	91.35	x	0.63	x	0.7	=	177.27	(81)
Northwest	0.9x	0.77	x	6.35	x	91.35	x	0.63	x	0.7	=	177.27	(81)
Northwest	0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest	0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest	0.9x	0.77	x	6.35	x	97.38	x	0.63	x	0.7	=	188.99	(81)
Northwest	0.9x	0.77	x	6.35	x	97.38	x	0.63	x	0.7	=	188.99	(81)
Northwest	0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest	0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest	0.9x	0.77	x	6.35	x	91.1	x	0.63	x	0.7	=	176.79	(81)
Northwest	0.9x	0.77	x	6.35	x	91.1	x	0.63	x	0.7	=	176.79	(81)
Northwest	0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest	0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest	0.9x	0.77	x	6.35	x	72.63	x	0.63	x	0.7	=	140.94	(81)
Northwest	0.9x	0.77	x	6.35	x	72.63	x	0.63	x	0.7	=	140.94	(81)
Northwest	0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest	0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest	0.9x	0.77	x	6.35	x	50.42	x	0.63	x	0.7	=	97.85	(81)
Northwest	0.9x	0.77	x	6.35	x	50.42	x	0.63	x	0.7	=	97.85	(81)

SAP WorkSheet: New dwelling design stage

Northwest	0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest	0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest	0.9x	0.77	x	6.35	x	28.07	x	0.63	x	0.7	=	54.47	(81)
Northwest	0.9x	0.77	x	6.35	x	28.07	x	0.63	x	0.7	=	54.47	(81)
Northwest	0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest	0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest	0.9x	0.77	x	6.35	x	14.2	x	0.63	x	0.7	=	27.55	(81)
Northwest	0.9x	0.77	x	6.35	x	14.2	x	0.63	x	0.7	=	27.55	(81)
Northwest	0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	6.35	x	9.21	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	6.35	x	9.21	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Northwest	0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Rooflights	0.9x	1	x	8.5	x	26.46	x	0.63	x	0.7	=	89.28	(82)
Rooflights	0.9x	1	x	0.68	x	16.18	x	0.63	x	0.7	=	4.37	(82)
Rooflights	0.9x	1	x	1.2	x	26	x	0.63	x	0.7	=	12.38	(82)
Rooflights	0.9x	1	x	1.2	x	26	x	0.63	x	0.7	=	12.38	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	8.5	x	53.3	x	0.63	x	0.7	=	179.83	(82)
Rooflights	0.9x	1	x	0.68	x	30.63	x	0.63	x	0.7	=	8.27	(82)
Rooflights	0.9x	1	x	1.2	x	54	x	0.63	x	0.7	=	25.72	(82)
Rooflights	0.9x	1	x	1.2	x	54	x	0.63	x	0.7	=	25.72	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	8.5	x	91.66	x	0.63	x	0.7	=	309.24	(82)
Rooflights	0.9x	1	x	0.68	x	55.7	x	0.63	x	0.7	=	15.03	(82)
Rooflights	0.9x	1	x	1.2	x	96	x	0.63	x	0.7	=	45.72	(82)
Rooflights	0.9x	1	x	1.2	x	96	x	0.63	x	0.7	=	45.72	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	8.5	x	139.87	x	0.63	x	0.7	=	471.87	(82)
Rooflights	0.9x	1	x	0.68	x	101.28	x	0.63	x	0.7	=	27.34	(82)
Rooflights	0.9x	1	x	1.2	x	150	x	0.63	x	0.7	=	71.44	(82)
Rooflights	0.9x	1	x	1.2	x	150	x	0.63	x	0.7	=	71.44	(82)
Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)
Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)

SAP WorkSheet: New dwelling design stage

Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)
Rooflights	0.9x	1	x	8.5	x	176.97	x	0.63	x	0.7	=	597.03	(82)
Rooflights	0.9x	1	x	0.68	x	149.52	x	0.63	x	0.7	=	40.35	(82)
Rooflights	0.9x	1	x	1.2	x	192	x	0.63	x	0.7	=	91.45	(82)
Rooflights	0.9x	1	x	1.2	x	192	x	0.63	x	0.7	=	91.45	(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52	(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52	(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52	(82)
Rooflights	0.9x	1	x	8.5	x	183.63	x	0.63	x	0.7	=	619.52	(82)
Rooflights	0.9x	1	x	0.68	x	166.08	x	0.63	x	0.7	=	44.82	(82)
Rooflights	0.9x	1	x	1.2	x	200	x	0.63	x	0.7	=	95.26	(82)
Rooflights	0.9x	1	x	1.2	x	200	x	0.63	x	0.7	=	95.26	(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12	(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12	(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12	(82)
Rooflights	0.9x	1	x	8.5	x	173.81	x	0.63	x	0.7	=	586.37	(82)
Rooflights	0.9x	1	x	0.68	x	152.65	x	0.63	x	0.7	=	41.2	(82)
Rooflights	0.9x	1	x	1.2	x	189	x	0.63	x	0.7	=	90.02	(82)
Rooflights	0.9x	1	x	1.2	x	189	x	0.63	x	0.7	=	90.02	(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82	(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82	(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82	(82)
Rooflights	0.9x	1	x	8.5	x	145.57	x	0.63	x	0.7	=	491.1	(82)
Rooflights	0.9x	1	x	0.68	x	112.79	x	0.63	x	0.7	=	30.44	(82)
Rooflights	0.9x	1	x	1.2	x	157	x	0.63	x	0.7	=	74.78	(82)
Rooflights	0.9x	1	x	1.2	x	157	x	0.63	x	0.7	=	74.78	(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58	(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58	(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58	(82)
Rooflights	0.9x	1	x	8.5	x	108.61	x	0.63	x	0.7	=	366.42	(82)
Rooflights	0.9x	1	x	0.68	x	70.26	x	0.63	x	0.7	=	18.96	(82)
Rooflights	0.9x	1	x	1.2	x	115	x	0.63	x	0.7	=	54.77	(82)
Rooflights	0.9x	1	x	1.2	x	115	x	0.63	x	0.7	=	54.77	(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63	(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63	(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63	(82)
Rooflights	0.9x	1	x	8.5	x	64.26	x	0.63	x	0.7	=	216.81	(82)
Rooflights	0.9x	1	x	0.68	x	37.03	x	0.63	x	0.7	=	10	(82)
Rooflights	0.9x	1	x	1.2	x	66	x	0.63	x	0.7	=	31.43	(82)
Rooflights	0.9x	1	x	1.2	x	66	x	0.63	x	0.7	=	31.43	(82)
Rooflights	0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)

SAP WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)
Rooflights 0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)
Rooflights 0.9x	1	x	8.5	x	33.27	x	0.63	x	0.7	=	112.25	(82)
Rooflights 0.9x	1	x	0.68	x	19.8	x	0.63	x	0.7	=	5.34	(82)
Rooflights 0.9x	1	x	1.2	x	33	x	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	x	1.2	x	33	x	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	8.5	x	21.59	x	0.63	x	0.7	=	72.83	(82)
Rooflights 0.9x	1	x	0.68	x	13.64	x	0.63	x	0.7	=	3.68	(82)
Rooflights 0.9x	1	x	1.2	x	21	x	0.63	x	0.7	=	10	(82)
Rooflights 0.9x	1	x	1.2	x	21	x	0.63	x	0.7	=	10	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)

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

(83)m=	754.42	1403.5	2199.98	3137.57	3848.81	3957.08	3759.22	3215.09	2526.38	1629.94	926.04	630.67	(83)

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

(84)m=	2014.64	2655.71	3403.33	4263.71	4892.65	4929.73	4692.04	4160.65	3517.98	2699.01	2081.26	1854.19	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.91	0.8	0.64	0.47	0.35	0.41	0.65	0.89	0.97	0.99	(86)

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

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

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

(88)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.21	20.2	20.19	20.19	20.18	(88)

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

(89)m=	0.98	0.96	0.9	0.77	0.6	0.42	0.29	0.34	0.59	0.87	0.96	0.98	(89)

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

(90)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.21	20.2	20.19	20.19	20.18	(90)

fLA = Living area ÷ (4) = 0.31 (91)

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

(92)m=	20.42	20.42	20.43	20.44	20.44	20.45	20.45	20.45	20.45	20.44	20.44	20.43	(92)

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

(93)m=	20.42	20.42	20.43	20.44	20.44	20.45	20.45	20.45	20.45	20.44	20.44	20.43	(93)

8. Space heating requirement

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

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

SAP WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.9	0.78	0.61	0.43	0.31	0.36	0.61	0.87	0.97	0.98	(94)

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

(95)m=	1976.29	2542.73	3072.39	3330.56	2991.39	2139.09	1450.61	1504.49	2148.81	2355.77	2009.93	1826.36	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	6566.99	6294.8	5621.15	4550.38	3430.83	2243.03	1476.47	1546.55	2456.32	3862.63	5284.04	6491.38	(97)

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

(98)m=	3415.48	2521.39	1896.28	878.27	326.94	0	0	0	0	1121.11	2357.36	3470.78	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 15987.59 (98)

Space heating requirement in kWh/m²/year 35.46 (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 1 383.46 (206)

Efficiency of secondary/supplementary heating system, % 76.5 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	3415.48	2521.39	1896.28	878.27	326.94	0	0	0	0	1121.11	2357.36	3470.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	890.71	657.54	494.52	229.04	85.26	0	0	0	0	292.37	614.76	905.13	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4169.32 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	252.25	222.55	234.24	210.7	206.99	185.69	179.05	195.5	194.85	218.44	230.09	246.42	

Efficiency of water heater 121.26 (216)

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

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

(219)m=	208.02	183.53	193.17	173.76	170.7	153.14	147.65	161.22	160.68	180.15	189.75	203.22	

Total = Sum(219a)$_{1...12}$ = 2125 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4169.32
Water heating fuel used		2125
Electricity for pumps, fans and electric keep-hot		

SAP WorkSheet: New dwelling design stage

mechanical ventilation - balanced, extract or positive input from outside	1482.67		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	1482.67	(231)
Electricity for lighting		899.64	(232)
Electricity generated by PVs		-9880.19	(233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	13.19	x 0.01 =	549.93		(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0		(241)
Space heating - secondary	(215) x	3.07	x 0.01 =	0		(242)
Water heating cost (other fuel)	(219)	13.19	x 0.01 =	280.29		(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	195.56		(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a						
Energy for lighting	(232)	13.19	x 0.01 =	118.66		(250)
Additional standing charges (Table 12)				0		(251)
	one of (233) to (235) x)	13.19	x 0.01 =	-1303.2		(252)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)…(254) =			-158.75		(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	-0.13	(257)
SAP rating (Section 12)		101.88	(258)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	2163.88		(261)
Space heating (secondary)	(215) x	0.016	=	0		(263)
Water heating	(219) x	0.519	=	1102.87		(264)
Space and water heating	(261) + (262) + (263) + (264) =			3266.75		(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	769.51		(267)
Electricity for lighting	(232) x	0.519	=	466.91		(268)
Energy saving/generation technologies						
Item 1		0.519	=	-5127.82		(269)
Total CO2, kg/year	sum of (265)…(271) =			-624.65		(272)
CO2 emissions per m²	(272) ÷ (4) =			-1.39		(273)
EI rating (section 14)				102		(274)

SAP WorkSheet: New dwelling design stage

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	3.07	=	12799.82	(261)
Space heating (secondary)	(215)	x	1.12	=	0	(263)
Energy for water heating	(219)	x	3.07	=	6523.73	(264)
Space and water heating	(261) + (262) + (263) + (264) =				19323.55	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	4551.8	(267)
Electricity for lighting	(232)	x	0	=	2761.9	(268)
Energy saving/generation technologies Item 1			3.07	=	-30332.19	(269)
'Total Primary Energy		sum of (265)…(271) =			-3694.94	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =			-8.2	(273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Chloe Hewitt	**Stroma Number:**	STRO029693
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Weston Hills, Low Fulney

Address : Weston Hills Road, Low Fulney, Spalding

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	227.64 (1a)	x	2.7 (2a)	=	614.63	(3a)
First floor	223.21 (1b)	x	2.76 (2b)	=	616.06	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	450.85 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		1230.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	1	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.03 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.28 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.28 (21)

Infiltration rate modified for monthly wind speed

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

TFEE WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56

(24d)

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

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

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			4.18	x1/[1/(1.4)+ 0.04] =	5.54			(27)
Windows Type 2			7.73	x1/[1/(1.4)+ 0.04] =	10.25			(27)
Windows Type 3			1.87	x1/[1/(1.4)+ 0.04] =	2.48			(27)
Windows Type 4			8.51	x1/[1/(1.4)+ 0.04] =	11.28			(27)
Windows Type 5			6.35	x1/[1/(1.4)+ 0.04] =	8.42			(27)
Windows Type 6			6.35	x1/[1/(1.4)+ 0.04] =	8.42			(27)
Windows Type 7			1.62	x1/[1/(1.4)+ 0.04] =	2.15			(27)
Windows Type 8			1.62	x1/[1/(1.4)+ 0.04] =	2.15			(27)
Windows Type 9			0.3	x1/[1/(1.4)+ 0.04] =	0.4			(27)
Windows Type 10			2.84	x1/[1/(1.4)+ 0.04] =	3.77			(27)
Windows Type 11			14.83	x1/[1/(1.4)+ 0.04] =	19.66			(27)
Windows Type 12			1.87	x1/[1/(1.4)+ 0.04] =	2.48			(27)
Windows Type 13			1.61	x1/[1/(1.4)+ 0.04] =	2.13			(27)
Windows Type 14			1.61	x1/[1/(1.4)+ 0.04] =	2.13			(27)
Windows Type 15			4.12	x1/[1/(1.4)+ 0.04] =	5.46			(27)
Windows Type 16			4.12	x1/[1/(1.4)+ 0.04] =	5.46			(27)
Windows Type 17			1.44	x1/[1/(1.4)+ 0.04] =	1.91			(27)

TFEE WorkSheet: New dwelling design stage

Windows Type 18			5.52	x1/[1/(1.4)+ 0.04] =	7.32				(27)
Windows Type 19			5.52	x1/[1/(1.4)+ 0.04] =	7.32				(27)
Windows Type 20			5.52	x1/[1/(1.4)+ 0.04] =	7.32				(27)
Rooflights Type 1			8.5	x1/[1/(1.7) + 0.04] =	14.45				(27b)
Rooflights Type 2			0.68	x1/[1/(1.7) + 0.04] =	1.156				(27b)
Rooflights Type 3			1.2	x1/[1/(1.7) + 0.04] =	2.04				(27b)
Rooflights Type 4			1.2	x1/[1/(1.7) + 0.04] =	2.04				(27b)
Rooflights Type 5			1.36	x1/[1/(1.7) + 0.04] =	2.312				(27b)
Rooflights Type 6			1.36	x1/[1/(1.7) + 0.04] =	2.312				(27b)
Rooflights Type 7			1.36	x1/[1/(1.7) + 0.04] =	2.312				(27b)
Floor Type 1			227.64	x 0.13 =	29.5932				(28)
Floor Type 2			7.28	x 0.13 =	0.9464				(28)
Walls	313.93	87.53	226.4	x 0.18 =	40.75				(29)
Roof Type1	290.48	13.26	277.22	x 0.13 =	36.04				(30)
Roof Type2	10.86	2.4	8.46	x 0.13 =	1.1				(30)
Total area of elements, m²			850.19						(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 249.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21827.32 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 32.25 (36)

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

Total fabric heat loss (33) + (36) = 281.65 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	229.41	228.39	227.38	222.67	221.79	217.69	217.69	216.93	219.27	221.79	223.57	225.44	(38)

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

(39)m=	511.06	510.04	509.04	504.33	503.45	499.34	499.34	498.58	500.92	503.45	505.23	507.09	

Average = Sum(39)$_{1...12}$ /12= 504.32 (39)

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

(40)m=	1.13	1.13	1.13	1.12	1.12	1.11	1.11	1.11	1.11	1.12	1.12	1.12	

Average = Sum(40)$_{1...12}$ /12= 1.12 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.33 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 113.24 (43)

TFEE WorkSheet: New dwelling design stage

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

(45)m=	184.73	161.56	166.72	145.35	139.47	120.35	111.52	127.97	129.5	150.92	164.74	178.9	
										Total = Sum(45)$_{1...12}$ =		1781.72	(45)

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

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

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

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

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

(62)m=	157.02	137.33	141.71	123.55	118.55	102.3	94.79	108.78	110.07	128.28	140.03	152.06	(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=	157.02	137.33	141.71	123.55	118.55	102.3	94.79	108.78	110.07	128.28	140.03	152.06	
										Output from water heater (annual)$_{1...12}$		1514.46	(64)

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

(65)m=	39.25	34.33	35.43	30.89	29.64	25.57	23.7	27.19	27.52	32.07	35.01	38.02	(65)

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

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

Metabolic gains (Table 5), Watts

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

TFEE WorkSheet: New dwelling design stage

(66)m=	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	(66)

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

(67)m=	50.94	45.25	36.8	27.86	20.82	17.58	19	24.69	33.14	42.08	49.11	52.36	(67)

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

(68)m=	571.41	577.34	562.39	530.58	490.43	452.69	427.48	421.55	436.49	468.3	508.46	546.2	(68)

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

(69)m=	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	(71)

Water heating gains (Table 5)

(72)m=	52.76	51.09	47.62	42.9	39.83	35.52	31.85	36.55	38.22	43.11	48.62	51.1	(72)

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

(73)m=	748.03	746.59	719.73	674.26	624.01	578.71	551.25	555.71	580.77	626.41	679.11	722.57	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	8.51		10.63		0.63		0.7	=	27.65	(74)
North	0.9x	0.77	1.61		10.63		0.63		0.7	=	5.23	(74)
North	0.9x	0.77	1.61		10.63		0.63		0.7	=	5.23	(74)
North	0.9x	0.77	1.44		10.63		0.63		0.7	=	4.68	(74)
North	0.9x	0.77	8.51		20.32		0.63		0.7	=	52.85	(74)
North	0.9x	0.77	1.61		20.32		0.63		0.7	=	10	(74)
North	0.9x	0.77	1.61		20.32		0.63		0.7	=	10	(74)
North	0.9x	0.77	1.44		20.32		0.63		0.7	=	8.94	(74)
North	0.9x	0.77	8.51		34.53		0.63		0.7	=	89.81	(74)
North	0.9x	0.77	1.61		34.53		0.63		0.7	=	16.99	(74)
North	0.9x	0.77	1.61		34.53		0.63		0.7	=	16.99	(74)
North	0.9x	0.77	1.44		34.53		0.63		0.7	=	15.2	(74)
North	0.9x	0.77	8.51		55.46		0.63		0.7	=	144.25	(74)
North	0.9x	0.77	1.61		55.46		0.63		0.7	=	27.29	(74)
North	0.9x	0.77	1.61		55.46		0.63		0.7	=	27.29	(74)
North	0.9x	0.77	1.44		55.46		0.63		0.7	=	24.41	(74)
North	0.9x	0.77	8.51		74.72		0.63		0.7	=	194.32	(74)
North	0.9x	0.77	1.61		74.72		0.63		0.7	=	36.76	(74)
North	0.9x	0.77	1.61		74.72		0.63		0.7	=	36.76	(74)
North	0.9x	0.77	1.44		74.72		0.63		0.7	=	32.88	(74)
North	0.9x	0.77	8.51		79.99		0.63		0.7	=	208.02	(74)

TFEE WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.61	x	79.99	x	0.63	x	0.7	=	39.36	(74)
North	0.9x	0.77	x	1.61	x	79.99	x	0.63	x	0.7	=	39.36	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.63	x	0.7	=	35.2	(74)
North	0.9x	0.77	x	8.51	x	74.68	x	0.63	x	0.7	=	194.22	(74)
North	0.9x	0.77	x	1.61	x	74.68	x	0.63	x	0.7	=	36.74	(74)
North	0.9x	0.77	x	1.61	x	74.68	x	0.63	x	0.7	=	36.74	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.63	x	0.7	=	32.86	(74)
North	0.9x	0.77	x	8.51	x	59.25	x	0.63	x	0.7	=	154.09	(74)
North	0.9x	0.77	x	1.61	x	59.25	x	0.63	x	0.7	=	29.15	(74)
North	0.9x	0.77	x	1.61	x	59.25	x	0.63	x	0.7	=	29.15	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.63	x	0.7	=	26.07	(74)
North	0.9x	0.77	x	8.51	x	41.52	x	0.63	x	0.7	=	107.97	(74)
North	0.9x	0.77	x	1.61	x	41.52	x	0.63	x	0.7	=	20.43	(74)
North	0.9x	0.77	x	1.61	x	41.52	x	0.63	x	0.7	=	20.43	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.63	x	0.7	=	18.27	(74)
North	0.9x	0.77	x	8.51	x	24.19	x	0.63	x	0.7	=	62.91	(74)
North	0.9x	0.77	x	1.61	x	24.19	x	0.63	x	0.7	=	11.9	(74)
North	0.9x	0.77	x	1.61	x	24.19	x	0.63	x	0.7	=	11.9	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.63	x	0.7	=	10.65	(74)
North	0.9x	0.77	x	8.51	x	13.12	x	0.63	x	0.7	=	34.12	(74)
North	0.9x	0.77	x	1.61	x	13.12	x	0.63	x	0.7	=	6.45	(74)
North	0.9x	0.77	x	1.61	x	13.12	x	0.63	x	0.7	=	6.45	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.63	x	0.7	=	5.77	(74)
North	0.9x	0.77	x	8.51	x	8.86	x	0.63	x	0.7	=	23.05	(74)
North	0.9x	0.77	x	1.61	x	8.86	x	0.63	x	0.7	=	4.36	(74)
North	0.9x	0.77	x	1.61	x	8.86	x	0.63	x	0.7	=	4.36	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.63	x	0.7	=	3.9	(74)
East	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.7	=	9.72	(76)
East	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.7	=	9.72	(76)
East	0.9x	1	x	0.3	x	19.64	x	0.63	x	0.7	=	1.8	(76)
East	0.9x	1	x	2.84	x	19.64	x	0.63	x	0.7	=	17.05	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.7	=	19.02	(76)
East	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.7	=	19.02	(76)
East	0.9x	1	x	0.3	x	38.42	x	0.63	x	0.7	=	3.52	(76)
East	0.9x	1	x	2.84	x	38.42	x	0.63	x	0.7	=	33.35	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)

TFEE WorkSheet: New dwelling design stage

East	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.7	=	31.33	(76)
East	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.7	=	31.33	(76)
East	0.9x	1	x	0.3	x	63.27	x	0.63	x	0.7	=	5.8	(76)
East	0.9x	1	x	2.84	x	63.27	x	0.63	x	0.7	=	54.92	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.7	=	45.69	(76)
East	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.7	=	45.69	(76)
East	0.9x	1	x	0.3	x	92.28	x	0.63	x	0.7	=	8.46	(76)
East	0.9x	1	x	2.84	x	92.28	x	0.63	x	0.7	=	80.09	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.7	=	55.99	(76)
East	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.7	=	55.99	(76)
East	0.9x	1	x	0.3	x	113.09	x	0.63	x	0.7	=	10.37	(76)
East	0.9x	1	x	2.84	x	113.09	x	0.63	x	0.7	=	98.16	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.7	=	57.32	(76)
East	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.7	=	57.32	(76)
East	0.9x	1	x	0.3	x	115.77	x	0.63	x	0.7	=	10.61	(76)
East	0.9x	1	x	2.84	x	115.77	x	0.63	x	0.7	=	100.48	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.7	=	54.57	(76)
East	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.7	=	54.57	(76)
East	0.9x	1	x	0.3	x	110.22	x	0.63	x	0.7	=	10.11	(76)
East	0.9x	1	x	2.84	x	110.22	x	0.63	x	0.7	=	95.66	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.7	=	46.87	(76)
East	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.7	=	46.87	(76)
East	0.9x	1	x	0.3	x	94.68	x	0.63	x	0.7	=	8.68	(76)
East	0.9x	1	x	2.84	x	94.68	x	0.63	x	0.7	=	82.17	(76)
East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)
East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)

TFEE WorkSheet: New dwelling design stage

East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)
East	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.7	=	36.43	(76)
East	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.7	=	36.43	(76)
East	0.9x	1	x	0.3	x	73.59	x	0.63	x	0.7	=	6.75	(76)
East	0.9x	1	x	2.84	x	73.59	x	0.63	x	0.7	=	63.87	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.7	=	22.57	(76)
East	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.7	=	22.57	(76)
East	0.9x	1	x	0.3	x	45.59	x	0.63	x	0.7	=	4.18	(76)
East	0.9x	1	x	2.84	x	45.59	x	0.63	x	0.7	=	39.57	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.7	=	12.12	(76)
East	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.7	=	12.12	(76)
East	0.9x	1	x	0.3	x	24.49	x	0.63	x	0.7	=	2.25	(76)
East	0.9x	1	x	2.84	x	24.49	x	0.63	x	0.7	=	21.26	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.7	=	8	(76)
East	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.7	=	8	(76)
East	0.9x	1	x	0.3	x	16.15	x	0.63	x	0.7	=	1.48	(76)
East	0.9x	1	x	2.84	x	16.15	x	0.63	x	0.7	=	14.02	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
South	0.9x	0.77	x	4.18	x	46.75	x	0.63	x	0.7	=	59.72	(78)
South	0.9x	0.77	x	14.83	x	46.75	x	0.63	x	0.7	=	211.89	(78)
South	0.9x	0.77	x	4.18	x	76.57	x	0.63	x	0.7	=	97.81	(78)
South	0.9x	0.77	x	14.83	x	76.57	x	0.63	x	0.7	=	347.02	(78)
South	0.9x	0.77	x	4.18	x	97.53	x	0.63	x	0.7	=	124.6	(78)
South	0.9x	0.77	x	14.83	x	97.53	x	0.63	x	0.7	=	442.05	(78)
South	0.9x	0.77	x	4.18	x	110.23	x	0.63	x	0.7	=	140.82	(78)
South	0.9x	0.77	x	14.83	x	110.23	x	0.63	x	0.7	=	499.61	(78)
South	0.9x	0.77	x	4.18	x	114.87	x	0.63	x	0.7	=	146.74	(78)
South	0.9x	0.77	x	14.83	x	114.87	x	0.63	x	0.7	=	520.62	(78)
South	0.9x	0.77	x	4.18	x	110.55	x	0.63	x	0.7	=	141.22	(78)
South	0.9x	0.77	x	14.83	x	110.55	x	0.63	x	0.7	=	501.03	(78)

TFEE WorkSheet: New dwelling design stage

South	0.9x	0.77	x	4.18	x	108.01	x	0.63	x	0.7	=	137.98	(78)
South	0.9x	0.77	x	14.83	x	108.01	x	0.63	x	0.7	=	489.54	(78)
South	0.9x	0.77	x	4.18	x	104.89	x	0.63	x	0.7	=	134	(78)
South	0.9x	0.77	x	14.83	x	104.89	x	0.63	x	0.7	=	475.41	(78)
South	0.9x	0.77	x	4.18	x	101.89	x	0.63	x	0.7	=	130.16	(78)
South	0.9x	0.77	x	14.83	x	101.89	x	0.63	x	0.7	=	461.77	(78)
South	0.9x	0.77	x	4.18	x	82.59	x	0.63	x	0.7	=	105.5	(78)
South	0.9x	0.77	x	14.83	x	82.59	x	0.63	x	0.7	=	374.3	(78)
South	0.9x	0.77	x	4.18	x	55.42	x	0.63	x	0.7	=	70.79	(78)
South	0.9x	0.77	x	14.83	x	55.42	x	0.63	x	0.7	=	251.16	(78)
South	0.9x	0.77	x	4.18	x	40.4	x	0.63	x	0.7	=	51.61	(78)
South	0.9x	0.77	x	14.83	x	40.4	x	0.63	x	0.7	=	183.09	(78)
West	0.9x	0.77	x	7.73	x	19.64	x	0.63	x	0.7	=	46.4	(80)
West	0.9x	0.77	x	1.87	x	19.64	x	0.63	x	0.7	=	11.22	(80)
West	0.9x	0.77	x	1.87	x	19.64	x	0.63	x	0.7	=	11.22	(80)
West	0.9x	0.77	x	7.73	x	38.42	x	0.63	x	0.7	=	90.76	(80)
West	0.9x	0.77	x	1.87	x	38.42	x	0.63	x	0.7	=	21.96	(80)
West	0.9x	0.77	x	1.87	x	38.42	x	0.63	x	0.7	=	21.96	(80)
West	0.9x	0.77	x	7.73	x	63.27	x	0.63	x	0.7	=	149.48	(80)
West	0.9x	0.77	x	1.87	x	63.27	x	0.63	x	0.7	=	36.16	(80)
West	0.9x	0.77	x	1.87	x	63.27	x	0.63	x	0.7	=	36.16	(80)
West	0.9x	0.77	x	7.73	x	92.28	x	0.63	x	0.7	=	218	(80)
West	0.9x	0.77	x	1.87	x	92.28	x	0.63	x	0.7	=	52.74	(80)
West	0.9x	0.77	x	1.87	x	92.28	x	0.63	x	0.7	=	52.74	(80)
West	0.9x	0.77	x	7.73	x	113.09	x	0.63	x	0.7	=	267.17	(80)
West	0.9x	0.77	x	1.87	x	113.09	x	0.63	x	0.7	=	64.63	(80)
West	0.9x	0.77	x	1.87	x	113.09	x	0.63	x	0.7	=	64.63	(80)
West	0.9x	0.77	x	7.73	x	115.77	x	0.63	x	0.7	=	273.49	(80)
West	0.9x	0.77	x	1.87	x	115.77	x	0.63	x	0.7	=	66.16	(80)
West	0.9x	0.77	x	1.87	x	115.77	x	0.63	x	0.7	=	66.16	(80)
West	0.9x	0.77	x	7.73	x	110.22	x	0.63	x	0.7	=	260.38	(80)
West	0.9x	0.77	x	1.87	x	110.22	x	0.63	x	0.7	=	62.99	(80)
West	0.9x	0.77	x	1.87	x	110.22	x	0.63	x	0.7	=	62.99	(80)
West	0.9x	0.77	x	7.73	x	94.68	x	0.63	x	0.7	=	223.66	(80)
West	0.9x	0.77	x	1.87	x	94.68	x	0.63	x	0.7	=	54.11	(80)
West	0.9x	0.77	x	1.87	x	94.68	x	0.63	x	0.7	=	54.11	(80)
West	0.9x	0.77	x	7.73	x	73.59	x	0.63	x	0.7	=	173.85	(80)
West	0.9x	0.77	x	1.87	x	73.59	x	0.63	x	0.7	=	42.06	(80)
West	0.9x	0.77	x	1.87	x	73.59	x	0.63	x	0.7	=	42.06	(80)
West	0.9x	0.77	x	7.73	x	45.59	x	0.63	x	0.7	=	107.7	(80)
West	0.9x	0.77	x	1.87	x	45.59	x	0.63	x	0.7	=	26.05	(80)

TFEE WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.87	x	45.59	x	0.63	x	0.7	=	26.05	(80)
West	0.9x	0.77	x	7.73	x	24.49	x	0.63	x	0.7	=	57.85	(80)
West	0.9x	0.77	x	1.87	x	24.49	x	0.63	x	0.7	=	14	(80)
West	0.9x	0.77	x	1.87	x	24.49	x	0.63	x	0.7	=	14	(80)
West	0.9x	0.77	x	7.73	x	16.15	x	0.63	x	0.7	=	38.16	(80)
West	0.9x	0.77	x	1.87	x	16.15	x	0.63	x	0.7	=	9.23	(80)
West	0.9x	0.77	x	1.87	x	16.15	x	0.63	x	0.7	=	9.23	(80)
Northwest	0.9x	0.77	x	6.35	x	11.28	x	0.63	x	0.7	=	21.9	(81)
Northwest	0.9x	0.77	x	6.35	x	11.28	x	0.63	x	0.7	=	21.9	(81)
Northwest	0.9x	0.77	x	4.12	x	11.28	x	0.63	x	0.7	=	14.21	(81)
Northwest	0.9x	0.77	x	4.12	x	11.28	x	0.63	x	0.7	=	14.21	(81)
Northwest	0.9x	0.77	x	6.35	x	22.97	x	0.63	x	0.7	=	44.57	(81)
Northwest	0.9x	0.77	x	6.35	x	22.97	x	0.63	x	0.7	=	44.57	(81)
Northwest	0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest	0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest	0.9x	0.77	x	6.35	x	41.38	x	0.63	x	0.7	=	80.3	(81)
Northwest	0.9x	0.77	x	6.35	x	41.38	x	0.63	x	0.7	=	80.3	(81)
Northwest	0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest	0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest	0.9x	0.77	x	6.35	x	67.96	x	0.63	x	0.7	=	131.88	(81)
Northwest	0.9x	0.77	x	6.35	x	67.96	x	0.63	x	0.7	=	131.88	(81)
Northwest	0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest	0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest	0.9x	0.77	x	6.35	x	91.35	x	0.63	x	0.7	=	177.27	(81)
Northwest	0.9x	0.77	x	6.35	x	91.35	x	0.63	x	0.7	=	177.27	(81)
Northwest	0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest	0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest	0.9x	0.77	x	6.35	x	97.38	x	0.63	x	0.7	=	188.99	(81)
Northwest	0.9x	0.77	x	6.35	x	97.38	x	0.63	x	0.7	=	188.99	(81)
Northwest	0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest	0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest	0.9x	0.77	x	6.35	x	91.1	x	0.63	x	0.7	=	176.79	(81)
Northwest	0.9x	0.77	x	6.35	x	91.1	x	0.63	x	0.7	=	176.79	(81)
Northwest	0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest	0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest	0.9x	0.77	x	6.35	x	72.63	x	0.63	x	0.7	=	140.94	(81)
Northwest	0.9x	0.77	x	6.35	x	72.63	x	0.63	x	0.7	=	140.94	(81)
Northwest	0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest	0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest	0.9x	0.77	x	6.35	x	50.42	x	0.63	x	0.7	=	97.85	(81)
Northwest	0.9x	0.77	x	6.35	x	50.42	x	0.63	x	0.7	=	97.85	(81)

TFEE WorkSheet: New dwelling design stage

Northwest	0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest	0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest	0.9x	0.77	x	6.35	x	28.07	x	0.63	x	0.7	=	54.47	(81)
Northwest	0.9x	0.77	x	6.35	x	28.07	x	0.63	x	0.7	=	54.47	(81)
Northwest	0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest	0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest	0.9x	0.77	x	6.35	x	14.2	x	0.63	x	0.7	=	27.55	(81)
Northwest	0.9x	0.77	x	6.35	x	14.2	x	0.63	x	0.7	=	27.55	(81)
Northwest	0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	6.35	x	9.21	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	6.35	x	9.21	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Northwest	0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Rooflights	0.9x	1	x	8.5	x	26.46	x	0.63	x	0.7	=	89.28	(82)
Rooflights	0.9x	1	x	0.68	x	16.18	x	0.63	x	0.7	=	4.37	(82)
Rooflights	0.9x	1	x	1.2	x	26	x	0.63	x	0.7	=	12.38	(82)
Rooflights	0.9x	1	x	1.2	x	26	x	0.63	x	0.7	=	12.38	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	8.5	x	53.3	x	0.63	x	0.7	=	179.83	(82)
Rooflights	0.9x	1	x	0.68	x	30.63	x	0.63	x	0.7	=	8.27	(82)
Rooflights	0.9x	1	x	1.2	x	54	x	0.63	x	0.7	=	25.72	(82)
Rooflights	0.9x	1	x	1.2	x	54	x	0.63	x	0.7	=	25.72	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	8.5	x	91.66	x	0.63	x	0.7	=	309.24	(82)
Rooflights	0.9x	1	x	0.68	x	55.7	x	0.63	x	0.7	=	15.03	(82)
Rooflights	0.9x	1	x	1.2	x	96	x	0.63	x	0.7	=	45.72	(82)
Rooflights	0.9x	1	x	1.2	x	96	x	0.63	x	0.7	=	45.72	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	8.5	x	139.87	x	0.63	x	0.7	=	471.87	(82)
Rooflights	0.9x	1	x	0.68	x	101.28	x	0.63	x	0.7	=	27.34	(82)
Rooflights	0.9x	1	x	1.2	x	150	x	0.63	x	0.7	=	71.44	(82)
Rooflights	0.9x	1	x	1.2	x	150	x	0.63	x	0.7	=	71.44	(82)
Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)
Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)

TFEE WorkSheet: New dwelling design stage

Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5		(82)
Rooflights	0.9x	1	x	8.5	x	176.97	x	0.63	x	0.7	=	597.03		(82)
Rooflights	0.9x	1	x	0.68	x	149.52	x	0.63	x	0.7	=	40.35		(82)
Rooflights	0.9x	1	x	1.2	x	192	x	0.63	x	0.7	=	91.45		(82)
Rooflights	0.9x	1	x	1.2	x	192	x	0.63	x	0.7	=	91.45		(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52		(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52		(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52		(82)
Rooflights	0.9x	1	x	8.5	x	183.63	x	0.63	x	0.7	=	619.52		(82)
Rooflights	0.9x	1	x	0.68	x	166.08	x	0.63	x	0.7	=	44.82		(82)
Rooflights	0.9x	1	x	1.2	x	200	x	0.63	x	0.7	=	95.26		(82)
Rooflights	0.9x	1	x	1.2	x	200	x	0.63	x	0.7	=	95.26		(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12		(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12		(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12		(82)
Rooflights	0.9x	1	x	8.5	x	173.81	x	0.63	x	0.7	=	586.37		(82)
Rooflights	0.9x	1	x	0.68	x	152.65	x	0.63	x	0.7	=	41.2		(82)
Rooflights	0.9x	1	x	1.2	x	189	x	0.63	x	0.7	=	90.02		(82)
Rooflights	0.9x	1	x	1.2	x	189	x	0.63	x	0.7	=	90.02		(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82		(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82		(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82		(82)
Rooflights	0.9x	1	x	8.5	x	145.57	x	0.63	x	0.7	=	491.1		(82)
Rooflights	0.9x	1	x	0.68	x	112.79	x	0.63	x	0.7	=	30.44		(82)
Rooflights	0.9x	1	x	1.2	x	157	x	0.63	x	0.7	=	74.78		(82)
Rooflights	0.9x	1	x	1.2	x	157	x	0.63	x	0.7	=	74.78		(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58		(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58		(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58		(82)
Rooflights	0.9x	1	x	8.5	x	108.61	x	0.63	x	0.7	=	366.42		(82)
Rooflights	0.9x	1	x	0.68	x	70.26	x	0.63	x	0.7	=	18.96		(82)
Rooflights	0.9x	1	x	1.2	x	115	x	0.63	x	0.7	=	54.77		(82)
Rooflights	0.9x	1	x	1.2	x	115	x	0.63	x	0.7	=	54.77		(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63		(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63		(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63		(82)
Rooflights	0.9x	1	x	8.5	x	64.26	x	0.63	x	0.7	=	216.81		(82)
Rooflights	0.9x	1	x	0.68	x	37.03	x	0.63	x	0.7	=	10		(82)
Rooflights	0.9x	1	x	1.2	x	66	x	0.63	x	0.7	=	31.43		(82)
Rooflights	0.9x	1	x	1.2	x	66	x	0.63	x	0.7	=	31.43		(82)
Rooflights	0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69		(82)

TFEE WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)
Rooflights 0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)
Rooflights 0.9x	1	x	8.5	x	33.27	x	0.63	x	0.7	=	112.25	(82)
Rooflights 0.9x	1	x	0.68	x	19.8	x	0.63	x	0.7	=	5.34	(82)
Rooflights 0.9x	1	x	1.2	x	33	x	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	x	1.2	x	33	x	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	8.5	x	21.59	x	0.63	x	0.7	=	72.83	(82)
Rooflights 0.9x	1	x	0.68	x	13.64	x	0.63	x	0.7	=	3.68	(82)
Rooflights 0.9x	1	x	1.2	x	21	x	0.63	x	0.7	=	10	(82)
Rooflights 0.9x	1	x	1.2	x	21	x	0.63	x	0.7	=	10	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)

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

(83)m=	754.42	1403.5	2199.98	3137.57	3848.81	3957.08	3759.22	3215.09	2526.38	1629.94	926.04	630.67	(83)

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

(84)m=	1502.45	2150.09	2919.71	3811.83	4472.82	4535.79	4310.47	3770.8	3107.15	2256.34	1605.15	1353.24	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.86	0.67	0.5	0.59	0.88	0.99	1	1	(86)

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

(87)m=	19.53	19.73	20.06	20.49	20.82	20.96	20.99	20.98	20.85	20.37	19.87	19.5	(87)

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

(88)m=	19.97	19.98	19.98	19.99	19.99	19.99	19.99	20	19.99	19.99	19.98	19.98	(88)

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

(89)m=	1	1	0.99	0.95	0.81	0.58	0.39	0.47	0.82	0.99	1	1	(89)

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

(90)m=	18.61	18.82	19.15	19.57	19.87	19.98	19.99	19.99	19.9	19.46	18.96	18.59	(90)

fLA = Living area ÷ (4) = 0.31 (91)

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

(92)m=	18.89	19.1	19.43	19.86	20.16	20.28	20.3	20.3	20.19	19.74	19.24	18.87	(92)

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

(93)m=	18.89	19.1	19.43	19.86	20.16	20.28	20.3	20.3	20.19	19.74	19.24	18.87	(93)

8. Space heating requirement

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

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

TFEE WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.95	0.82	0.6	0.43	0.51	0.83	0.99	1	1	(94)

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

(95)m=	1502.11	2146.97	2893.8	3616.31	3650.61	2737.67	1834.13	1911.89	2579.86	2226.63	1603.93	1353.06	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	7458.86	7241.4	6581.41	5524.96	4259.61	2836.5	1847.3	1942.6	3052.36	4602.69	6131.05	7438.26	(97)

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

(98)m=	4431.83	3423.46	2743.58	1374.23	453.09	0	0	0	0	1767.79	3259.53	4527.39	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 21980.91 (98)

Space heating requirement in kWh/m²/year 48.75 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	4693.82	3695.14	3789.23	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.89	0.94	0.9	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	4154.99	3465.57	3403.17	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	5310.61	5052.26	4457.11	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	832.05	1180.49	784.14	0	0	0	0	

Total = Sum(104)$_{5,6,7,8}$ = 2796.68 (104)

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

Intermittency factor (Table 10b)

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

Total = Sum(104)$_{5,6,7,8}$ = 0 (106)

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

(107)m=	0	0	0	0	0	208.01	295.12	196.03	0	0	0	0	

Total = Sum(107)$_{5,6,7,8}$ = 699.17 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 1.55 (108)

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

Fabric Energy Efficiency (99) + (108) = 50.31 (109)

Target Fabric Energy Efficiency (TFEE) 57.85 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Chloe Hewitt	**Stroma Number:**	STRO029693
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Weston Hills, Low Fulney

Address : Weston Hills Road, Low Fulney, Spalding

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	227.64 (1a)	x	2.7 (2a)	=	614.63	(3a)
First floor	223.21 (1b)	x	2.76 (2b)	=	616.06	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	450.85 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		1230.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	1	=	1	x 40 =	40	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	80	÷ (5) =	0.07 (8)

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

Number of storeys in the dwelling (ns)		0 (9)
Additional infiltration	[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35		
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.22 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used		
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.22 (21)

Infiltration rate modified for monthly wind speed

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

DFEE WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.27	0.27	0.26	0.24	0.23	0.2	0.2	0.2	0.22	0.23	0.24	0.25

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0.54	0.54	0.53	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53

(24d)

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

(25)m=	0.54	0.54	0.53	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			4.18	x1/[1/(1.2)+ 0.04] =	4.79			(27)
Windows Type 2			7.73	x1/[1/(1.2)+ 0.04] =	8.85			(27)
Windows Type 3			1.87	x1/[1/(1.2)+ 0.04] =	2.14			(27)
Windows Type 4			8.51	x1/[1/(1.2)+ 0.04] =	9.74			(27)
Windows Type 5			6.35	x1/[1/(1.2)+ 0.04] =	7.27			(27)
Windows Type 6			6.35	x1/[1/(1.2)+ 0.04] =	7.27			(27)
Windows Type 7			1.62	x1/[1/(1.2)+ 0.04] =	1.85			(27)
Windows Type 8			1.62	x1/[1/(1.2)+ 0.04] =	1.85			(27)
Windows Type 9			0.3	x1/[1/(1.2)+ 0.04] =	0.34			(27)
Windows Type 10			2.84	x1/[1/(1.2)+ 0.04] =	3.25			(27)
Windows Type 11			14.83	x1/[1/(1.2)+ 0.04] =	16.98			(27)
Windows Type 12			1.87	x1/[1/(1.2)+ 0.04] =	2.14			(27)
Windows Type 13			1.61	x1/[1/(1.2)+ 0.04] =	1.84			(27)
Windows Type 14			1.61	x1/[1/(1.2)+ 0.04] =	1.84			(27)
Windows Type 15			4.12	x1/[1/(1.2)+ 0.04] =	4.72			(27)
Windows Type 16			4.12	x1/[1/(1.2)+ 0.04] =	4.72			(27)
Windows Type 17			1.44	x1/[1/(1.2)+ 0.04] =	1.65			(27)

DFEE WorkSheet: New dwelling design stage

Windows Type 18			5.52	x1/[1/(1.2)+ 0.04] =	6.32				(27)
Windows Type 19			5.52	x1/[1/(1.2)+ 0.04] =	6.32				(27)
Windows Type 20			5.52	x1/[1/(1.2)+ 0.04] =	6.32				(27)
Rooflights Type 1			8.5	x1/[1/(1.2) + 0.04] =	10.2				(27b)
Rooflights Type 2			0.68	x1/[1/(1.2) + 0.04] =	0.816				(27b)
Rooflights Type 3			1.2	x1/[1/(1.2) + 0.04] =	1.44				(27b)
Rooflights Type 4			1.2	x1/[1/(1.2) + 0.04] =	1.44				(27b)
Rooflights Type 5			1.36	x1/[1/(1.2) + 0.04] =	1.632				(27b)
Rooflights Type 6			1.36	x1/[1/(1.2) + 0.04] =	1.632				(27b)
Rooflights Type 7			1.36	x1/[1/(1.2) + 0.04] =	1.632				(27b)
Floor Type 1			227.64	x 0.1 =	22.764				(28)
Floor Type 2			7.28	x 0.2 =	1.456				(28)
Walls	313.93	87.53	226.4	x 0.14 =	31.7				(29)
Roof Type1	290.48	13.26	277.22	x 0.17 =	47.13				(30)
Roof Type2	10.86	2.4	8.46	x 0.19 =	1.61				(30)
Total area of elements, m²			850.19						(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 222.81 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21827.32 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 47.52 (36)

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

Total fabric heat loss (33) + (36) = 270.32 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	218.32	217.73	217.15	214.42	213.91	211.54	211.54	211.1	212.45	213.91	214.94	216.02	(38)

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

(39)m=	488.65	488.05	487.47	484.75	484.23	481.86	481.86	481.42	482.77	484.23	485.27	486.35	

Average = Sum(39)$_{1...12}$ /12= 484.74 (39)

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

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

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

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.33 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 113.24 (43)

DFEE WorkSheet: New dwelling design stage

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

(45)m=	184.73	161.56	166.72	145.35	139.47	120.35	111.52	127.97	129.5	150.92	164.74	178.9	
										Total = Sum(45)$_{1...12}$ =		1781.72	(45)

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

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

Water storage loss:

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

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

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

Water storage loss:

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

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

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

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

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

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

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

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

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

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

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

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

(62)m=	157.02	137.33	141.71	123.55	118.55	102.3	94.79	108.78	110.07	128.28	140.03	152.06	(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=	157.02	137.33	141.71	123.55	118.55	102.3	94.79	108.78	110.07	128.28	140.03	152.06	
										Output from water heater (annual)$_{1...12}$		1514.46	(64)

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

(65)m=	39.25	34.33	35.43	30.89	29.64	25.57	23.7	27.19	27.52	32.07	35.01	38.02	(65)

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

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

Metabolic gains (Table 5), Watts

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

DFEE WorkSheet: New dwelling design stage

(66)m=	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	(66)

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

(67)m=	50.94	45.25	36.8	27.86	20.82	17.58	19	24.69	33.14	42.08	49.11	52.36	(67)

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

(68)m=	571.41	577.34	562.39	530.58	490.43	452.69	427.48	421.55	436.49	468.3	508.46	546.2	(68)

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

(69)m=	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	(71)

Water heating gains (Table 5)

(72)m=	52.76	51.09	47.62	42.9	39.83	35.52	31.85	36.55	38.22	43.11	48.62	51.1	(72)

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

(73)m=	748.03	746.59	719.73	674.26	624.01	578.71	551.25	555.71	580.77	626.41	679.11	722.57	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	8.51		10.63		0.63		0.7	=	27.65	(74)
North	0.9x	0.77	1.61		10.63		0.63		0.7	=	5.23	(74)
North	0.9x	0.77	1.61		10.63		0.63		0.7	=	5.23	(74)
North	0.9x	0.77	1.44		10.63		0.63		0.7	=	4.68	(74)
North	0.9x	0.77	8.51		20.32		0.63		0.7	=	52.85	(74)
North	0.9x	0.77	1.61		20.32		0.63		0.7	=	10	(74)
North	0.9x	0.77	1.61		20.32		0.63		0.7	=	10	(74)
North	0.9x	0.77	1.44		20.32		0.63		0.7	=	8.94	(74)
North	0.9x	0.77	8.51		34.53		0.63		0.7	=	89.81	(74)
North	0.9x	0.77	1.61		34.53		0.63		0.7	=	16.99	(74)
North	0.9x	0.77	1.61		34.53		0.63		0.7	=	16.99	(74)
North	0.9x	0.77	1.44		34.53		0.63		0.7	=	15.2	(74)
North	0.9x	0.77	8.51		55.46		0.63		0.7	=	144.25	(74)
North	0.9x	0.77	1.61		55.46		0.63		0.7	=	27.29	(74)
North	0.9x	0.77	1.61		55.46		0.63		0.7	=	27.29	(74)
North	0.9x	0.77	1.44		55.46		0.63		0.7	=	24.41	(74)
North	0.9x	0.77	8.51		74.72		0.63		0.7	=	194.32	(74)
North	0.9x	0.77	1.61		74.72		0.63		0.7	=	36.76	(74)
North	0.9x	0.77	1.61		74.72		0.63		0.7	=	36.76	(74)
North	0.9x	0.77	1.44		74.72		0.63		0.7	=	32.88	(74)
North	0.9x	0.77	8.51		79.99		0.63		0.7	=	208.02	(74)

DFEE WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.61	x	79.99	x	0.63	x	0.7	=	39.36	(74)
North	0.9x	0.77	x	1.61	x	79.99	x	0.63	x	0.7	=	39.36	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.63	x	0.7	=	35.2	(74)
North	0.9x	0.77	x	8.51	x	74.68	x	0.63	x	0.7	=	194.22	(74)
North	0.9x	0.77	x	1.61	x	74.68	x	0.63	x	0.7	=	36.74	(74)
North	0.9x	0.77	x	1.61	x	74.68	x	0.63	x	0.7	=	36.74	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.63	x	0.7	=	32.86	(74)
North	0.9x	0.77	x	8.51	x	59.25	x	0.63	x	0.7	=	154.09	(74)
North	0.9x	0.77	x	1.61	x	59.25	x	0.63	x	0.7	=	29.15	(74)
North	0.9x	0.77	x	1.61	x	59.25	x	0.63	x	0.7	=	29.15	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.63	x	0.7	=	26.07	(74)
North	0.9x	0.77	x	8.51	x	41.52	x	0.63	x	0.7	=	107.97	(74)
North	0.9x	0.77	x	1.61	x	41.52	x	0.63	x	0.7	=	20.43	(74)
North	0.9x	0.77	x	1.61	x	41.52	x	0.63	x	0.7	=	20.43	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.63	x	0.7	=	18.27	(74)
North	0.9x	0.77	x	8.51	x	24.19	x	0.63	x	0.7	=	62.91	(74)
North	0.9x	0.77	x	1.61	x	24.19	x	0.63	x	0.7	=	11.9	(74)
North	0.9x	0.77	x	1.61	x	24.19	x	0.63	x	0.7	=	11.9	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.63	x	0.7	=	10.65	(74)
North	0.9x	0.77	x	8.51	x	13.12	x	0.63	x	0.7	=	34.12	(74)
North	0.9x	0.77	x	1.61	x	13.12	x	0.63	x	0.7	=	6.45	(74)
North	0.9x	0.77	x	1.61	x	13.12	x	0.63	x	0.7	=	6.45	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.63	x	0.7	=	5.77	(74)
North	0.9x	0.77	x	8.51	x	8.86	x	0.63	x	0.7	=	23.05	(74)
North	0.9x	0.77	x	1.61	x	8.86	x	0.63	x	0.7	=	4.36	(74)
North	0.9x	0.77	x	1.61	x	8.86	x	0.63	x	0.7	=	4.36	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.63	x	0.7	=	3.9	(74)
East	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.7	=	9.72	(76)
East	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.7	=	9.72	(76)
East	0.9x	1	x	0.3	x	19.64	x	0.63	x	0.7	=	1.8	(76)
East	0.9x	1	x	2.84	x	19.64	x	0.63	x	0.7	=	17.05	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.7	=	19.02	(76)
East	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.7	=	19.02	(76)
East	0.9x	1	x	0.3	x	38.42	x	0.63	x	0.7	=	3.52	(76)
East	0.9x	1	x	2.84	x	38.42	x	0.63	x	0.7	=	33.35	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)

DFEE WorkSheet: New dwelling design stage

East	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.7	=	31.33	(76)
East	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.7	=	31.33	(76)
East	0.9x	1	x	0.3	x	63.27	x	0.63	x	0.7	=	5.8	(76)
East	0.9x	1	x	2.84	x	63.27	x	0.63	x	0.7	=	54.92	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.7	=	45.69	(76)
East	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.7	=	45.69	(76)
East	0.9x	1	x	0.3	x	92.28	x	0.63	x	0.7	=	8.46	(76)
East	0.9x	1	x	2.84	x	92.28	x	0.63	x	0.7	=	80.09	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.7	=	55.99	(76)
East	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.7	=	55.99	(76)
East	0.9x	1	x	0.3	x	113.09	x	0.63	x	0.7	=	10.37	(76)
East	0.9x	1	x	2.84	x	113.09	x	0.63	x	0.7	=	98.16	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.7	=	57.32	(76)
East	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.7	=	57.32	(76)
East	0.9x	1	x	0.3	x	115.77	x	0.63	x	0.7	=	10.61	(76)
East	0.9x	1	x	2.84	x	115.77	x	0.63	x	0.7	=	100.48	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.7	=	54.57	(76)
East	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.7	=	54.57	(76)
East	0.9x	1	x	0.3	x	110.22	x	0.63	x	0.7	=	10.11	(76)
East	0.9x	1	x	2.84	x	110.22	x	0.63	x	0.7	=	95.66	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.7	=	46.87	(76)
East	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.7	=	46.87	(76)
East	0.9x	1	x	0.3	x	94.68	x	0.63	x	0.7	=	8.68	(76)
East	0.9x	1	x	2.84	x	94.68	x	0.63	x	0.7	=	82.17	(76)
East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)
East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)

DFEE WorkSheet: New dwelling design stage

East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)
East	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.7	=	36.43	(76)
East	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.7	=	36.43	(76)
East	0.9x	1	x	0.3	x	73.59	x	0.63	x	0.7	=	6.75	(76)
East	0.9x	1	x	2.84	x	73.59	x	0.63	x	0.7	=	63.87	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.7	=	22.57	(76)
East	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.7	=	22.57	(76)
East	0.9x	1	x	0.3	x	45.59	x	0.63	x	0.7	=	4.18	(76)
East	0.9x	1	x	2.84	x	45.59	x	0.63	x	0.7	=	39.57	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.7	=	12.12	(76)
East	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.7	=	12.12	(76)
East	0.9x	1	x	0.3	x	24.49	x	0.63	x	0.7	=	2.25	(76)
East	0.9x	1	x	2.84	x	24.49	x	0.63	x	0.7	=	21.26	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.7	=	8	(76)
East	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.7	=	8	(76)
East	0.9x	1	x	0.3	x	16.15	x	0.63	x	0.7	=	1.48	(76)
East	0.9x	1	x	2.84	x	16.15	x	0.63	x	0.7	=	14.02	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
South	0.9x	0.77	x	4.18	x	46.75	x	0.63	x	0.7	=	59.72	(78)
South	0.9x	0.77	x	14.83	x	46.75	x	0.63	x	0.7	=	211.89	(78)
South	0.9x	0.77	x	4.18	x	76.57	x	0.63	x	0.7	=	97.81	(78)
South	0.9x	0.77	x	14.83	x	76.57	x	0.63	x	0.7	=	347.02	(78)
South	0.9x	0.77	x	4.18	x	97.53	x	0.63	x	0.7	=	124.6	(78)
South	0.9x	0.77	x	14.83	x	97.53	x	0.63	x	0.7	=	442.05	(78)
South	0.9x	0.77	x	4.18	x	110.23	x	0.63	x	0.7	=	140.82	(78)
South	0.9x	0.77	x	14.83	x	110.23	x	0.63	x	0.7	=	499.61	(78)
South	0.9x	0.77	x	4.18	x	114.87	x	0.63	x	0.7	=	146.74	(78)
South	0.9x	0.77	x	14.83	x	114.87	x	0.63	x	0.7	=	520.62	(78)
South	0.9x	0.77	x	4.18	x	110.55	x	0.63	x	0.7	=	141.22	(78)
South	0.9x	0.77	x	14.83	x	110.55	x	0.63	x	0.7	=	501.03	(78)

DFEE WorkSheet: New dwelling design stage

South	0.9x	0.77	x	4.18	x	108.01	x	0.63	x	0.7	=	137.98	(78)
South	0.9x	0.77	x	14.83	x	108.01	x	0.63	x	0.7	=	489.54	(78)
South	0.9x	0.77	x	4.18	x	104.89	x	0.63	x	0.7	=	134	(78)
South	0.9x	0.77	x	14.83	x	104.89	x	0.63	x	0.7	=	475.41	(78)
South	0.9x	0.77	x	4.18	x	101.89	x	0.63	x	0.7	=	130.16	(78)
South	0.9x	0.77	x	14.83	x	101.89	x	0.63	x	0.7	=	461.77	(78)
South	0.9x	0.77	x	4.18	x	82.59	x	0.63	x	0.7	=	105.5	(78)
South	0.9x	0.77	x	14.83	x	82.59	x	0.63	x	0.7	=	374.3	(78)
South	0.9x	0.77	x	4.18	x	55.42	x	0.63	x	0.7	=	70.79	(78)
South	0.9x	0.77	x	14.83	x	55.42	x	0.63	x	0.7	=	251.16	(78)
South	0.9x	0.77	x	4.18	x	40.4	x	0.63	x	0.7	=	51.61	(78)
South	0.9x	0.77	x	14.83	x	40.4	x	0.63	x	0.7	=	183.09	(78)
West	0.9x	0.77	x	7.73	x	19.64	x	0.63	x	0.7	=	46.4	(80)
West	0.9x	0.77	x	1.87	x	19.64	x	0.63	x	0.7	=	11.22	(80)
West	0.9x	0.77	x	1.87	x	19.64	x	0.63	x	0.7	=	11.22	(80)
West	0.9x	0.77	x	7.73	x	38.42	x	0.63	x	0.7	=	90.76	(80)
West	0.9x	0.77	x	1.87	x	38.42	x	0.63	x	0.7	=	21.96	(80)
West	0.9x	0.77	x	1.87	x	38.42	x	0.63	x	0.7	=	21.96	(80)
West	0.9x	0.77	x	7.73	x	63.27	x	0.63	x	0.7	=	149.48	(80)
West	0.9x	0.77	x	1.87	x	63.27	x	0.63	x	0.7	=	36.16	(80)
West	0.9x	0.77	x	1.87	x	63.27	x	0.63	x	0.7	=	36.16	(80)
West	0.9x	0.77	x	7.73	x	92.28	x	0.63	x	0.7	=	218	(80)
West	0.9x	0.77	x	1.87	x	92.28	x	0.63	x	0.7	=	52.74	(80)
West	0.9x	0.77	x	1.87	x	92.28	x	0.63	x	0.7	=	52.74	(80)
West	0.9x	0.77	x	7.73	x	113.09	x	0.63	x	0.7	=	267.17	(80)
West	0.9x	0.77	x	1.87	x	113.09	x	0.63	x	0.7	=	64.63	(80)
West	0.9x	0.77	x	1.87	x	113.09	x	0.63	x	0.7	=	64.63	(80)
West	0.9x	0.77	x	7.73	x	115.77	x	0.63	x	0.7	=	273.49	(80)
West	0.9x	0.77	x	1.87	x	115.77	x	0.63	x	0.7	=	66.16	(80)
West	0.9x	0.77	x	1.87	x	115.77	x	0.63	x	0.7	=	66.16	(80)
West	0.9x	0.77	x	7.73	x	110.22	x	0.63	x	0.7	=	260.38	(80)
West	0.9x	0.77	x	1.87	x	110.22	x	0.63	x	0.7	=	62.99	(80)
West	0.9x	0.77	x	1.87	x	110.22	x	0.63	x	0.7	=	62.99	(80)
West	0.9x	0.77	x	7.73	x	94.68	x	0.63	x	0.7	=	223.66	(80)
West	0.9x	0.77	x	1.87	x	94.68	x	0.63	x	0.7	=	54.11	(80)
West	0.9x	0.77	x	1.87	x	94.68	x	0.63	x	0.7	=	54.11	(80)
West	0.9x	0.77	x	7.73	x	73.59	x	0.63	x	0.7	=	173.85	(80)
West	0.9x	0.77	x	1.87	x	73.59	x	0.63	x	0.7	=	42.06	(80)
West	0.9x	0.77	x	1.87	x	73.59	x	0.63	x	0.7	=	42.06	(80)
West	0.9x	0.77	x	7.73	x	45.59	x	0.63	x	0.7	=	107.7	(80)
West	0.9x	0.77	x	1.87	x	45.59	x	0.63	x	0.7	=	26.05	(80)

DFEE WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.87	x	45.59	x	0.63	x	0.7	=	26.05	(80)
West	0.9x	0.77	x	7.73	x	24.49	x	0.63	x	0.7	=	57.85	(80)
West	0.9x	0.77	x	1.87	x	24.49	x	0.63	x	0.7	=	14	(80)
West	0.9x	0.77	x	1.87	x	24.49	x	0.63	x	0.7	=	14	(80)
West	0.9x	0.77	x	7.73	x	16.15	x	0.63	x	0.7	=	38.16	(80)
West	0.9x	0.77	x	1.87	x	16.15	x	0.63	x	0.7	=	9.23	(80)
West	0.9x	0.77	x	1.87	x	16.15	x	0.63	x	0.7	=	9.23	(80)
Northwest	0.9x	0.77	x	6.35	x	11.28	x	0.63	x	0.7	=	21.9	(81)
Northwest	0.9x	0.77	x	6.35	x	11.28	x	0.63	x	0.7	=	21.9	(81)
Northwest	0.9x	0.77	x	4.12	x	11.28	x	0.63	x	0.7	=	14.21	(81)
Northwest	0.9x	0.77	x	4.12	x	11.28	x	0.63	x	0.7	=	14.21	(81)
Northwest	0.9x	0.77	x	6.35	x	22.97	x	0.63	x	0.7	=	44.57	(81)
Northwest	0.9x	0.77	x	6.35	x	22.97	x	0.63	x	0.7	=	44.57	(81)
Northwest	0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest	0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest	0.9x	0.77	x	6.35	x	41.38	x	0.63	x	0.7	=	80.3	(81)
Northwest	0.9x	0.77	x	6.35	x	41.38	x	0.63	x	0.7	=	80.3	(81)
Northwest	0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest	0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest	0.9x	0.77	x	6.35	x	67.96	x	0.63	x	0.7	=	131.88	(81)
Northwest	0.9x	0.77	x	6.35	x	67.96	x	0.63	x	0.7	=	131.88	(81)
Northwest	0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest	0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest	0.9x	0.77	x	6.35	x	91.35	x	0.63	x	0.7	=	177.27	(81)
Northwest	0.9x	0.77	x	6.35	x	91.35	x	0.63	x	0.7	=	177.27	(81)
Northwest	0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest	0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest	0.9x	0.77	x	6.35	x	97.38	x	0.63	x	0.7	=	188.99	(81)
Northwest	0.9x	0.77	x	6.35	x	97.38	x	0.63	x	0.7	=	188.99	(81)
Northwest	0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest	0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest	0.9x	0.77	x	6.35	x	91.1	x	0.63	x	0.7	=	176.79	(81)
Northwest	0.9x	0.77	x	6.35	x	91.1	x	0.63	x	0.7	=	176.79	(81)
Northwest	0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest	0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest	0.9x	0.77	x	6.35	x	72.63	x	0.63	x	0.7	=	140.94	(81)
Northwest	0.9x	0.77	x	6.35	x	72.63	x	0.63	x	0.7	=	140.94	(81)
Northwest	0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest	0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest	0.9x	0.77	x	6.35	x	50.42	x	0.63	x	0.7	=	97.85	(81)
Northwest	0.9x	0.77	x	6.35	x	50.42	x	0.63	x	0.7	=	97.85	(81)

DFEE WorkSheet: New dwelling design stage

Northwest	0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest	0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest	0.9x	0.77	x	6.35	x	28.07	x	0.63	x	0.7	=	54.47	(81)
Northwest	0.9x	0.77	x	6.35	x	28.07	x	0.63	x	0.7	=	54.47	(81)
Northwest	0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest	0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest	0.9x	0.77	x	6.35	x	14.2	x	0.63	x	0.7	=	27.55	(81)
Northwest	0.9x	0.77	x	6.35	x	14.2	x	0.63	x	0.7	=	27.55	(81)
Northwest	0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	6.35	x	9.21	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	6.35	x	9.21	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Northwest	0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Rooflights	0.9x	1	x	8.5	x	26.46	x	0.63	x	0.7	=	89.28	(82)
Rooflights	0.9x	1	x	0.68	x	16.18	x	0.63	x	0.7	=	4.37	(82)
Rooflights	0.9x	1	x	1.2	x	26	x	0.63	x	0.7	=	12.38	(82)
Rooflights	0.9x	1	x	1.2	x	26	x	0.63	x	0.7	=	12.38	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	8.5	x	53.3	x	0.63	x	0.7	=	179.83	(82)
Rooflights	0.9x	1	x	0.68	x	30.63	x	0.63	x	0.7	=	8.27	(82)
Rooflights	0.9x	1	x	1.2	x	54	x	0.63	x	0.7	=	25.72	(82)
Rooflights	0.9x	1	x	1.2	x	54	x	0.63	x	0.7	=	25.72	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	8.5	x	91.66	x	0.63	x	0.7	=	309.24	(82)
Rooflights	0.9x	1	x	0.68	x	55.7	x	0.63	x	0.7	=	15.03	(82)
Rooflights	0.9x	1	x	1.2	x	96	x	0.63	x	0.7	=	45.72	(82)
Rooflights	0.9x	1	x	1.2	x	96	x	0.63	x	0.7	=	45.72	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	8.5	x	139.87	x	0.63	x	0.7	=	471.87	(82)
Rooflights	0.9x	1	x	0.68	x	101.28	x	0.63	x	0.7	=	27.34	(82)
Rooflights	0.9x	1	x	1.2	x	150	x	0.63	x	0.7	=	71.44	(82)
Rooflights	0.9x	1	x	1.2	x	150	x	0.63	x	0.7	=	71.44	(82)
Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)
Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)

DFEE WorkSheet: New dwelling design stage

Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)
Rooflights	0.9x	1	x	8.5	x	176.97	x	0.63	x	0.7	=	597.03	(82)
Rooflights	0.9x	1	x	0.68	x	149.52	x	0.63	x	0.7	=	40.35	(82)
Rooflights	0.9x	1	x	1.2	x	192	x	0.63	x	0.7	=	91.45	(82)
Rooflights	0.9x	1	x	1.2	x	192	x	0.63	x	0.7	=	91.45	(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52	(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52	(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52	(82)
Rooflights	0.9x	1	x	8.5	x	183.63	x	0.63	x	0.7	=	619.52	(82)
Rooflights	0.9x	1	x	0.68	x	166.08	x	0.63	x	0.7	=	44.82	(82)
Rooflights	0.9x	1	x	1.2	x	200	x	0.63	x	0.7	=	95.26	(82)
Rooflights	0.9x	1	x	1.2	x	200	x	0.63	x	0.7	=	95.26	(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12	(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12	(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12	(82)
Rooflights	0.9x	1	x	8.5	x	173.81	x	0.63	x	0.7	=	586.37	(82)
Rooflights	0.9x	1	x	0.68	x	152.65	x	0.63	x	0.7	=	41.2	(82)
Rooflights	0.9x	1	x	1.2	x	189	x	0.63	x	0.7	=	90.02	(82)
Rooflights	0.9x	1	x	1.2	x	189	x	0.63	x	0.7	=	90.02	(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82	(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82	(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82	(82)
Rooflights	0.9x	1	x	8.5	x	145.57	x	0.63	x	0.7	=	491.1	(82)
Rooflights	0.9x	1	x	0.68	x	112.79	x	0.63	x	0.7	=	30.44	(82)
Rooflights	0.9x	1	x	1.2	x	157	x	0.63	x	0.7	=	74.78	(82)
Rooflights	0.9x	1	x	1.2	x	157	x	0.63	x	0.7	=	74.78	(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58	(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58	(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58	(82)
Rooflights	0.9x	1	x	8.5	x	108.61	x	0.63	x	0.7	=	366.42	(82)
Rooflights	0.9x	1	x	0.68	x	70.26	x	0.63	x	0.7	=	18.96	(82)
Rooflights	0.9x	1	x	1.2	x	115	x	0.63	x	0.7	=	54.77	(82)
Rooflights	0.9x	1	x	1.2	x	115	x	0.63	x	0.7	=	54.77	(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63	(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63	(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63	(82)
Rooflights	0.9x	1	x	8.5	x	64.26	x	0.63	x	0.7	=	216.81	(82)
Rooflights	0.9x	1	x	0.68	x	37.03	x	0.63	x	0.7	=	10	(82)
Rooflights	0.9x	1	x	1.2	x	66	x	0.63	x	0.7	=	31.43	(82)
Rooflights	0.9x	1	x	1.2	x	66	x	0.63	x	0.7	=	31.43	(82)
Rooflights	0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)

DFEE WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)
Rooflights 0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)
Rooflights 0.9x	1	x	8.5	x	33.27	x	0.63	x	0.7	=	112.25	(82)
Rooflights 0.9x	1	x	0.68	x	19.8	x	0.63	x	0.7	=	5.34	(82)
Rooflights 0.9x	1	x	1.2	x	33	x	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	x	1.2	x	33	x	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	8.5	x	21.59	x	0.63	x	0.7	=	72.83	(82)
Rooflights 0.9x	1	x	0.68	x	13.64	x	0.63	x	0.7	=	3.68	(82)
Rooflights 0.9x	1	x	1.2	x	21	x	0.63	x	0.7	=	10	(82)
Rooflights 0.9x	1	x	1.2	x	21	x	0.63	x	0.7	=	10	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)

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

(83)m=	754.42	1403.5	2199.98	3137.57	3848.81	3957.08	3759.22	3215.09	2526.38	1629.94	926.04	630.67	(83)

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

(84)m=	1502.45	2150.09	2919.71	3811.83	4472.82	4535.79	4310.47	3770.8	3107.15	2256.34	1605.15	1353.24	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.94	0.86	0.73	0.58	0.45	0.52	0.76	0.93	0.98	0.99	(86)

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

(87)m=	18.29	18.67	19.25	19.95	20.5	20.82	20.93	20.9	20.6	19.81	18.9	18.23	(87)

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

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

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

(89)m=	0.99	0.97	0.94	0.84	0.69	0.51	0.37	0.43	0.7	0.92	0.98	0.99	(89)

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

(90)m=	17.5	17.87	18.45	19.13	19.64	19.91	20	19.98	19.75	19.01	18.11	17.44	(90)

fLA = Living area ÷ (4) = 0.31 (91)

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

(92)m=	17.75	18.12	18.7	19.39	19.91	20.19	20.28	20.26	20.01	19.25	18.35	17.68	(92)

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

(93)m=	17.75	18.12	18.7	19.39	19.91	20.19	20.28	20.26	20.01	19.25	18.35	17.68	(93)

8. Space heating requirement

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

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

DFEE WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.92	0.83	0.69	0.53	0.39	0.45	0.7	0.91	0.97	0.99	(94)

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

(95)m=	1481.06	2075.86	2687.23	3149.45	3072.31	2385.91	1678.61	1711.79	2174.53	2042.19	1564.19	1338.43	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	6570.28	6449.74	5945.04	5083.05	3973.71	2693.01	1774.43	1858.39	2852.45	4190.98	5460.72	6555.92	(97)

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

(98)m=	3786.38	2939.25	2423.81	1392.19	670.64	0	0	0	0	1598.7	2805.5	3881.81	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 19498.28 (98)

Space heating requirement in kWh/m²/year 43.25 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	4529.47	3565.76	3658.78	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.79	0.84	0.8	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	3566.28	3009.39	2926.19	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	5310.61	5052.26	4457.11	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	1255.92	1519.89	1139.01	0	0	0	0	

Total = Sum(104)$_{5...8}$ = 3914.82 (104)

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

Intermittency factor (Table 10b)

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

Total = Sum(104)$_{5...8}$ = 0 (106)

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

(107)m=	0	0	0	0	0	313.98	379.97	284.75	0	0	0	0	

Total = Sum(107)$_{5...8}$ = 978.7 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 2.17 (108)

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

Fabric Energy Efficiency (99) + (108) = 45.42 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Chloe Hewitt	**Stroma Number:**	STRO029693
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Weston Hills, Low Fulney

Address : Weston Hills Road, Low Fulney, Spalding

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	227.64 (1a)	x	2.7 (2a)	=	614.63	(3a)
First floor	223.21 (1b)	x	2.76 (2b)	=	616.06	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	450.85 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		1230.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	1	=	1	x 40 =	40	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.03 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			3 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.18 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.18 (21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

0.23	0.23	0.22	0.2	0.2	0.17	0.17	0.17	0.18	0.2	0.21	0.21

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

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

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.05 (23c)

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

(24a)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.27	0.29	0.3	0.31	0.32	(24a)

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

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

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

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

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

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

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

(25)m=	0.34	0.33	0.33	0.31	0.3	0.28	0.28	0.27	0.29	0.3	0.31	0.32	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			4.18	x1/[1/(1.2)+ 0.04] =	4.79			(27)
Windows Type 2			7.73	x1/[1/(1.2)+ 0.04] =	8.85			(27)
Windows Type 3			1.87	x1/[1/(1.2)+ 0.04] =	2.14			(27)
Windows Type 4			8.51	x1/[1/(1.2)+ 0.04] =	9.74			(27)
Windows Type 5			6.35	x1/[1/(1.2)+ 0.04] =	7.27			(27)
Windows Type 6			6.35	x1/[1/(1.2)+ 0.04] =	7.27			(27)
Windows Type 7			1.62	x1/[1/(1.2)+ 0.04] =	1.85			(27)
Windows Type 8			1.62	x1/[1/(1.2)+ 0.04] =	1.85			(27)
Windows Type 9			0.3	x1/[1/(1.2)+ 0.04] =	0.34			(27)
Windows Type 10			2.84	x1/[1/(1.2)+ 0.04] =	3.25			(27)
Windows Type 11			14.83	x1/[1/(1.2)+ 0.04] =	16.98			(27)
Windows Type 12			1.87	x1/[1/(1.2)+ 0.04] =	2.14			(27)
Windows Type 13			1.61	x1/[1/(1.2)+ 0.04] =	1.84			(27)
Windows Type 14			1.61	x1/[1/(1.2)+ 0.04] =	1.84			(27)
Windows Type 15			4.12	x1/[1/(1.2)+ 0.04] =	4.72			(27)
Windows Type 16			4.12	x1/[1/(1.2)+ 0.04] =	4.72			(27)
Windows Type 17			1.44	x1/[1/(1.2)+ 0.04] =	1.65			(27)

DER WorkSheet: New dwelling design stage

Windows Type 18			5.52	x1/[1/(1.2)+ 0.04] =	6.32				(27)
Windows Type 19			5.52	x1/[1/(1.2)+ 0.04] =	6.32				(27)
Windows Type 20			5.52	x1/[1/(1.2)+ 0.04] =	6.32				(27)
Rooflights Type 1			8.5	x1/[1/(1.2) + 0.04] =	10.2				(27b)
Rooflights Type 2			0.68	x1/[1/(1.2) + 0.04] =	0.816				(27b)
Rooflights Type 3			1.2	x1/[1/(1.2) + 0.04] =	1.44				(27b)
Rooflights Type 4			1.2	x1/[1/(1.2) + 0.04] =	1.44				(27b)
Rooflights Type 5			1.36	x1/[1/(1.2) + 0.04] =	1.632				(27b)
Rooflights Type 6			1.36	x1/[1/(1.2) + 0.04] =	1.632				(27b)
Rooflights Type 7			1.36	x1/[1/(1.2) + 0.04] =	1.632				(27b)
Floor Type 1			227.64	x 0.1 =	22.764				(28)
Floor Type 2			7.28	x 0.2 =	1.456				(28)
Walls	313.93	87.53	226.4	x 0.14 =	31.7				(29)
Roof Type1	290.48	13.26	277.22	x 0.17 =	47.13				(30)
Roof Type2	10.86	2.4	8.46	x 0.19 =	1.61				(30)
Total area of elements, m²			850.19						(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 222.81 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21827.32 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 47.52 (36)

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

Total fabric heat loss (33) + (36) = 270.32 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	137.04	135.19	133.34	124.07	122.22	112.95	112.95	111.1	116.66	122.22	125.93	129.63	(38)

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

(39)m=	407.37	405.51	403.66	394.4	392.54	383.28	383.28	381.43	386.98	392.54	396.25	399.96	

Average = Sum(39)$_{1...12}$ /12= 393.93 (39)

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

(40)m=	0.9	0.9	0.9	0.87	0.87	0.85	0.85	0.85	0.86	0.87	0.88	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.33 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 113.24 (43)

DER WorkSheet: New dwelling design stage

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

(45)m=	184.73	161.56	166.72	145.35	139.47	120.35	111.52	127.97	129.5	150.92	164.74	178.9	
										Total = Sum(45)$_{1...12}$ =			1781.72 (45)

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

(46)m=	27.71	24.23	25.01	21.8	20.92	18.05	16.73	19.2	19.42	22.64	24.71	26.83	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b: 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 300 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day): 0.01 (51)

If community heating see section 4.3

Volume factor from Table 2a: 0.74 (52)

Temperature factor from Table 2b: 0.54 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.43 (54)

Enter (50) or (54) in (55): 1.43 (55)

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

(56)m=	44.26	39.98	44.26	42.83	44.26	42.83	44.26	44.26	42.83	44.26	42.83	44.26	(56)

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

(57)m=	44.26	39.98	44.26	42.83	44.26	42.83	44.26	44.26	42.83	44.26	42.83	44.26	(57)

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

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

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

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

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

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

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

(62)m=	252.25	222.55	234.24	210.7	206.99	185.69	179.05	195.5	194.85	218.44	230.09	246.42	(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=	252.25	222.55	234.24	210.7	206.99	185.69	179.05	195.5	194.85	218.44	230.09	246.42	
											Output from water heater (annual)$_{1...12}$		2576.77 (64)

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

(65)m=	115.44	102.51	109.45	100.61	100.39	92.29	91.1	96.57	95.34	104.2	107.05	113.5	(65)

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

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

Metabolic gains (Table 5), Watts

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

DER WorkSheet: New dwelling design stage

(66)m=	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	(66)

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

(67)m=	50.94	45.25	36.8	27.86	20.82	17.58	19	24.69	33.14	42.08	49.11	52.36	(67)

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

(68)m=	571.41	577.34	562.39	530.58	490.43	452.69	427.48	421.55	436.49	468.3	508.46	546.2	(68)

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

(69)m=	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	(71)

Water heating gains (Table 5)

(72)m=	155.16	152.55	147.12	139.73	134.94	128.18	122.45	129.8	132.41	140.05	148.69	152.56	(72)

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

(73)m=	850.43	848.05	819.23	771.09	719.11	671.38	641.84	648.96	674.96	723.36	779.18	824.03	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	8.51	10.63	0.63	0.7	27.65	(74)
North	0.9x	0.77	1.61	10.63	0.63	0.7	5.23	(74)
North	0.9x	0.77	1.61	10.63	0.63	0.7	5.23	(74)
North	0.9x	0.77	1.44	10.63	0.63	0.7	4.68	(74)
North	0.9x	0.77	8.51	20.32	0.63	0.7	52.85	(74)
North	0.9x	0.77	1.61	20.32	0.63	0.7	10	(74)
North	0.9x	0.77	1.61	20.32	0.63	0.7	10	(74)
North	0.9x	0.77	1.44	20.32	0.63	0.7	8.94	(74)
North	0.9x	0.77	8.51	34.53	0.63	0.7	89.81	(74)
North	0.9x	0.77	1.61	34.53	0.63	0.7	16.99	(74)
North	0.9x	0.77	1.61	34.53	0.63	0.7	16.99	(74)
North	0.9x	0.77	1.44	34.53	0.63	0.7	15.2	(74)
North	0.9x	0.77	8.51	55.46	0.63	0.7	144.25	(74)
North	0.9x	0.77	1.61	55.46	0.63	0.7	27.29	(74)
North	0.9x	0.77	1.61	55.46	0.63	0.7	27.29	(74)
North	0.9x	0.77	1.44	55.46	0.63	0.7	24.41	(74)
North	0.9x	0.77	8.51	74.72	0.63	0.7	194.32	(74)
North	0.9x	0.77	1.61	74.72	0.63	0.7	36.76	(74)
North	0.9x	0.77	1.61	74.72	0.63	0.7	36.76	(74)
North	0.9x	0.77	1.44	74.72	0.63	0.7	32.88	(74)
North	0.9x	0.77	8.51	79.99	0.63	0.7	208.02	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.61	x	79.99	x	0.63	x	0.7	=	39.36	(74)
North	0.9x	0.77	x	1.61	x	79.99	x	0.63	x	0.7	=	39.36	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.63	x	0.7	=	35.2	(74)
North	0.9x	0.77	x	8.51	x	74.68	x	0.63	x	0.7	=	194.22	(74)
North	0.9x	0.77	x	1.61	x	74.68	x	0.63	x	0.7	=	36.74	(74)
North	0.9x	0.77	x	1.61	x	74.68	x	0.63	x	0.7	=	36.74	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.63	x	0.7	=	32.86	(74)
North	0.9x	0.77	x	8.51	x	59.25	x	0.63	x	0.7	=	154.09	(74)
North	0.9x	0.77	x	1.61	x	59.25	x	0.63	x	0.7	=	29.15	(74)
North	0.9x	0.77	x	1.61	x	59.25	x	0.63	x	0.7	=	29.15	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.63	x	0.7	=	26.07	(74)
North	0.9x	0.77	x	8.51	x	41.52	x	0.63	x	0.7	=	107.97	(74)
North	0.9x	0.77	x	1.61	x	41.52	x	0.63	x	0.7	=	20.43	(74)
North	0.9x	0.77	x	1.61	x	41.52	x	0.63	x	0.7	=	20.43	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.63	x	0.7	=	18.27	(74)
North	0.9x	0.77	x	8.51	x	24.19	x	0.63	x	0.7	=	62.91	(74)
North	0.9x	0.77	x	1.61	x	24.19	x	0.63	x	0.7	=	11.9	(74)
North	0.9x	0.77	x	1.61	x	24.19	x	0.63	x	0.7	=	11.9	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.63	x	0.7	=	10.65	(74)
North	0.9x	0.77	x	8.51	x	13.12	x	0.63	x	0.7	=	34.12	(74)
North	0.9x	0.77	x	1.61	x	13.12	x	0.63	x	0.7	=	6.45	(74)
North	0.9x	0.77	x	1.61	x	13.12	x	0.63	x	0.7	=	6.45	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.63	x	0.7	=	5.77	(74)
North	0.9x	0.77	x	8.51	x	8.86	x	0.63	x	0.7	=	23.05	(74)
North	0.9x	0.77	x	1.61	x	8.86	x	0.63	x	0.7	=	4.36	(74)
North	0.9x	0.77	x	1.61	x	8.86	x	0.63	x	0.7	=	4.36	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.63	x	0.7	=	3.9	(74)
East	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.7	=	9.72	(76)
East	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.7	=	9.72	(76)
East	0.9x	1	x	0.3	x	19.64	x	0.63	x	0.7	=	1.8	(76)
East	0.9x	1	x	2.84	x	19.64	x	0.63	x	0.7	=	17.05	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.7	=	19.02	(76)
East	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.7	=	19.02	(76)
East	0.9x	1	x	0.3	x	38.42	x	0.63	x	0.7	=	3.52	(76)
East	0.9x	1	x	2.84	x	38.42	x	0.63	x	0.7	=	33.35	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.7	=	31.33	(76)
East	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.7	=	31.33	(76)
East	0.9x	1	x	0.3	x	63.27	x	0.63	x	0.7	=	5.8	(76)
East	0.9x	1	x	2.84	x	63.27	x	0.63	x	0.7	=	54.92	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.7	=	45.69	(76)
East	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.7	=	45.69	(76)
East	0.9x	1	x	0.3	x	92.28	x	0.63	x	0.7	=	8.46	(76)
East	0.9x	1	x	2.84	x	92.28	x	0.63	x	0.7	=	80.09	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.7	=	55.99	(76)
East	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.7	=	55.99	(76)
East	0.9x	1	x	0.3	x	113.09	x	0.63	x	0.7	=	10.37	(76)
East	0.9x	1	x	2.84	x	113.09	x	0.63	x	0.7	=	98.16	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.7	=	57.32	(76)
East	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.7	=	57.32	(76)
East	0.9x	1	x	0.3	x	115.77	x	0.63	x	0.7	=	10.61	(76)
East	0.9x	1	x	2.84	x	115.77	x	0.63	x	0.7	=	100.48	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.7	=	54.57	(76)
East	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.7	=	54.57	(76)
East	0.9x	1	x	0.3	x	110.22	x	0.63	x	0.7	=	10.11	(76)
East	0.9x	1	x	2.84	x	110.22	x	0.63	x	0.7	=	95.66	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.7	=	46.87	(76)
East	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.7	=	46.87	(76)
East	0.9x	1	x	0.3	x	94.68	x	0.63	x	0.7	=	8.68	(76)
East	0.9x	1	x	2.84	x	94.68	x	0.63	x	0.7	=	82.17	(76)
East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)
East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)
East	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.7	=	36.43	(76)
East	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.7	=	36.43	(76)
East	0.9x	1	x	0.3	x	73.59	x	0.63	x	0.7	=	6.75	(76)
East	0.9x	1	x	2.84	x	73.59	x	0.63	x	0.7	=	63.87	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.7	=	22.57	(76)
East	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.7	=	22.57	(76)
East	0.9x	1	x	0.3	x	45.59	x	0.63	x	0.7	=	4.18	(76)
East	0.9x	1	x	2.84	x	45.59	x	0.63	x	0.7	=	39.57	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.7	=	12.12	(76)
East	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.7	=	12.12	(76)
East	0.9x	1	x	0.3	x	24.49	x	0.63	x	0.7	=	2.25	(76)
East	0.9x	1	x	2.84	x	24.49	x	0.63	x	0.7	=	21.26	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.7	=	8	(76)
East	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.7	=	8	(76)
East	0.9x	1	x	0.3	x	16.15	x	0.63	x	0.7	=	1.48	(76)
East	0.9x	1	x	2.84	x	16.15	x	0.63	x	0.7	=	14.02	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
South	0.9x	0.77	x	4.18	x	46.75	x	0.63	x	0.7	=	59.72	(78)
South	0.9x	0.77	x	14.83	x	46.75	x	0.63	x	0.7	=	211.89	(78)
South	0.9x	0.77	x	4.18	x	76.57	x	0.63	x	0.7	=	97.81	(78)
South	0.9x	0.77	x	14.83	x	76.57	x	0.63	x	0.7	=	347.02	(78)
South	0.9x	0.77	x	4.18	x	97.53	x	0.63	x	0.7	=	124.6	(78)
South	0.9x	0.77	x	14.83	x	97.53	x	0.63	x	0.7	=	442.05	(78)
South	0.9x	0.77	x	4.18	x	110.23	x	0.63	x	0.7	=	140.82	(78)
South	0.9x	0.77	x	14.83	x	110.23	x	0.63	x	0.7	=	499.61	(78)
South	0.9x	0.77	x	4.18	x	114.87	x	0.63	x	0.7	=	146.74	(78)
South	0.9x	0.77	x	14.83	x	114.87	x	0.63	x	0.7	=	520.62	(78)
South	0.9x	0.77	x	4.18	x	110.55	x	0.63	x	0.7	=	141.22	(78)
South	0.9x	0.77	x	14.83	x	110.55	x	0.63	x	0.7	=	501.03	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	4.18	x	108.01	x	0.63	x	0.7	=	137.98	(78)
South	0.9x	0.77	x	14.83	x	108.01	x	0.63	x	0.7	=	489.54	(78)
South	0.9x	0.77	x	4.18	x	104.89	x	0.63	x	0.7	=	134	(78)
South	0.9x	0.77	x	14.83	x	104.89	x	0.63	x	0.7	=	475.41	(78)
South	0.9x	0.77	x	4.18	x	101.89	x	0.63	x	0.7	=	130.16	(78)
South	0.9x	0.77	x	14.83	x	101.89	x	0.63	x	0.7	=	461.77	(78)
South	0.9x	0.77	x	4.18	x	82.59	x	0.63	x	0.7	=	105.5	(78)
South	0.9x	0.77	x	14.83	x	82.59	x	0.63	x	0.7	=	374.3	(78)
South	0.9x	0.77	x	4.18	x	55.42	x	0.63	x	0.7	=	70.79	(78)
South	0.9x	0.77	x	14.83	x	55.42	x	0.63	x	0.7	=	251.16	(78)
South	0.9x	0.77	x	4.18	x	40.4	x	0.63	x	0.7	=	51.61	(78)
South	0.9x	0.77	x	14.83	x	40.4	x	0.63	x	0.7	=	183.09	(78)
West	0.9x	0.77	x	7.73	x	19.64	x	0.63	x	0.7	=	46.4	(80)
West	0.9x	0.77	x	1.87	x	19.64	x	0.63	x	0.7	=	11.22	(80)
West	0.9x	0.77	x	1.87	x	19.64	x	0.63	x	0.7	=	11.22	(80)
West	0.9x	0.77	x	7.73	x	38.42	x	0.63	x	0.7	=	90.76	(80)
West	0.9x	0.77	x	1.87	x	38.42	x	0.63	x	0.7	=	21.96	(80)
West	0.9x	0.77	x	1.87	x	38.42	x	0.63	x	0.7	=	21.96	(80)
West	0.9x	0.77	x	7.73	x	63.27	x	0.63	x	0.7	=	149.48	(80)
West	0.9x	0.77	x	1.87	x	63.27	x	0.63	x	0.7	=	36.16	(80)
West	0.9x	0.77	x	1.87	x	63.27	x	0.63	x	0.7	=	36.16	(80)
West	0.9x	0.77	x	7.73	x	92.28	x	0.63	x	0.7	=	218	(80)
West	0.9x	0.77	x	1.87	x	92.28	x	0.63	x	0.7	=	52.74	(80)
West	0.9x	0.77	x	1.87	x	92.28	x	0.63	x	0.7	=	52.74	(80)
West	0.9x	0.77	x	7.73	x	113.09	x	0.63	x	0.7	=	267.17	(80)
West	0.9x	0.77	x	1.87	x	113.09	x	0.63	x	0.7	=	64.63	(80)
West	0.9x	0.77	x	1.87	x	113.09	x	0.63	x	0.7	=	64.63	(80)
West	0.9x	0.77	x	7.73	x	115.77	x	0.63	x	0.7	=	273.49	(80)
West	0.9x	0.77	x	1.87	x	115.77	x	0.63	x	0.7	=	66.16	(80)
West	0.9x	0.77	x	1.87	x	115.77	x	0.63	x	0.7	=	66.16	(80)
West	0.9x	0.77	x	7.73	x	110.22	x	0.63	x	0.7	=	260.38	(80)
West	0.9x	0.77	x	1.87	x	110.22	x	0.63	x	0.7	=	62.99	(80)
West	0.9x	0.77	x	1.87	x	110.22	x	0.63	x	0.7	=	62.99	(80)
West	0.9x	0.77	x	7.73	x	94.68	x	0.63	x	0.7	=	223.66	(80)
West	0.9x	0.77	x	1.87	x	94.68	x	0.63	x	0.7	=	54.11	(80)
West	0.9x	0.77	x	1.87	x	94.68	x	0.63	x	0.7	=	54.11	(80)
West	0.9x	0.77	x	7.73	x	73.59	x	0.63	x	0.7	=	173.85	(80)
West	0.9x	0.77	x	1.87	x	73.59	x	0.63	x	0.7	=	42.06	(80)
West	0.9x	0.77	x	1.87	x	73.59	x	0.63	x	0.7	=	42.06	(80)
West	0.9x	0.77	x	7.73	x	45.59	x	0.63	x	0.7	=	107.7	(80)
West	0.9x	0.77	x	1.87	x	45.59	x	0.63	x	0.7	=	26.05	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.87	x	45.59	x	0.63	x	0.7	=	26.05	(80)
West	0.9x	0.77	x	7.73	x	24.49	x	0.63	x	0.7	=	57.85	(80)
West	0.9x	0.77	x	1.87	x	24.49	x	0.63	x	0.7	=	14	(80)
West	0.9x	0.77	x	1.87	x	24.49	x	0.63	x	0.7	=	14	(80)
West	0.9x	0.77	x	7.73	x	16.15	x	0.63	x	0.7	=	38.16	(80)
West	0.9x	0.77	x	1.87	x	16.15	x	0.63	x	0.7	=	9.23	(80)
West	0.9x	0.77	x	1.87	x	16.15	x	0.63	x	0.7	=	9.23	(80)
Northwest	0.9x	0.77	x	6.35	x	11.28	x	0.63	x	0.7	=	21.9	(81)
Northwest	0.9x	0.77	x	6.35	x	11.28	x	0.63	x	0.7	=	21.9	(81)
Northwest	0.9x	0.77	x	4.12	x	11.28	x	0.63	x	0.7	=	14.21	(81)
Northwest	0.9x	0.77	x	4.12	x	11.28	x	0.63	x	0.7	=	14.21	(81)
Northwest	0.9x	0.77	x	6.35	x	22.97	x	0.63	x	0.7	=	44.57	(81)
Northwest	0.9x	0.77	x	6.35	x	22.97	x	0.63	x	0.7	=	44.57	(81)
Northwest	0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest	0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest	0.9x	0.77	x	6.35	x	41.38	x	0.63	x	0.7	=	80.3	(81)
Northwest	0.9x	0.77	x	6.35	x	41.38	x	0.63	x	0.7	=	80.3	(81)
Northwest	0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest	0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest	0.9x	0.77	x	6.35	x	67.96	x	0.63	x	0.7	=	131.88	(81)
Northwest	0.9x	0.77	x	6.35	x	67.96	x	0.63	x	0.7	=	131.88	(81)
Northwest	0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest	0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest	0.9x	0.77	x	6.35	x	91.35	x	0.63	x	0.7	=	177.27	(81)
Northwest	0.9x	0.77	x	6.35	x	91.35	x	0.63	x	0.7	=	177.27	(81)
Northwest	0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest	0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest	0.9x	0.77	x	6.35	x	97.38	x	0.63	x	0.7	=	188.99	(81)
Northwest	0.9x	0.77	x	6.35	x	97.38	x	0.63	x	0.7	=	188.99	(81)
Northwest	0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest	0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest	0.9x	0.77	x	6.35	x	91.1	x	0.63	x	0.7	=	176.79	(81)
Northwest	0.9x	0.77	x	6.35	x	91.1	x	0.63	x	0.7	=	176.79	(81)
Northwest	0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest	0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest	0.9x	0.77	x	6.35	x	72.63	x	0.63	x	0.7	=	140.94	(81)
Northwest	0.9x	0.77	x	6.35	x	72.63	x	0.63	x	0.7	=	140.94	(81)
Northwest	0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest	0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest	0.9x	0.77	x	6.35	x	50.42	x	0.63	x	0.7	=	97.85	(81)
Northwest	0.9x	0.77	x	6.35	x	50.42	x	0.63	x	0.7	=	97.85	(81)

DER WorkSheet: New dwelling design stage

Northwest	0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest	0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest	0.9x	0.77	x	6.35	x	28.07	x	0.63	x	0.7	=	54.47	(81)
Northwest	0.9x	0.77	x	6.35	x	28.07	x	0.63	x	0.7	=	54.47	(81)
Northwest	0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest	0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest	0.9x	0.77	x	6.35	x	14.2	x	0.63	x	0.7	=	27.55	(81)
Northwest	0.9x	0.77	x	6.35	x	14.2	x	0.63	x	0.7	=	27.55	(81)
Northwest	0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	6.35	x	9.21	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	6.35	x	9.21	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Northwest	0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Rooflights	0.9x	1	x	8.5	x	26.46	x	0.63	x	0.7	=	89.28	(82)
Rooflights	0.9x	1	x	0.68	x	16.18	x	0.63	x	0.7	=	4.37	(82)
Rooflights	0.9x	1	x	1.2	x	26	x	0.63	x	0.7	=	12.38	(82)
Rooflights	0.9x	1	x	1.2	x	26	x	0.63	x	0.7	=	12.38	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	8.5	x	53.3	x	0.63	x	0.7	=	179.83	(82)
Rooflights	0.9x	1	x	0.68	x	30.63	x	0.63	x	0.7	=	8.27	(82)
Rooflights	0.9x	1	x	1.2	x	54	x	0.63	x	0.7	=	25.72	(82)
Rooflights	0.9x	1	x	1.2	x	54	x	0.63	x	0.7	=	25.72	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	8.5	x	91.66	x	0.63	x	0.7	=	309.24	(82)
Rooflights	0.9x	1	x	0.68	x	55.7	x	0.63	x	0.7	=	15.03	(82)
Rooflights	0.9x	1	x	1.2	x	96	x	0.63	x	0.7	=	45.72	(82)
Rooflights	0.9x	1	x	1.2	x	96	x	0.63	x	0.7	=	45.72	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	8.5	x	139.87	x	0.63	x	0.7	=	471.87	(82)
Rooflights	0.9x	1	x	0.68	x	101.28	x	0.63	x	0.7	=	27.34	(82)
Rooflights	0.9x	1	x	1.2	x	150	x	0.63	x	0.7	=	71.44	(82)
Rooflights	0.9x	1	x	1.2	x	150	x	0.63	x	0.7	=	71.44	(82)
Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)
Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)

DER WorkSheet: New dwelling design stage

Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)
Rooflights	0.9x	1	x	8.5	x	176.97	x	0.63	x	0.7	=	597.03	(82)
Rooflights	0.9x	1	x	0.68	x	149.52	x	0.63	x	0.7	=	40.35	(82)
Rooflights	0.9x	1	x	1.2	x	192	x	0.63	x	0.7	=	91.45	(82)
Rooflights	0.9x	1	x	1.2	x	192	x	0.63	x	0.7	=	91.45	(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52	(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52	(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52	(82)
Rooflights	0.9x	1	x	8.5	x	183.63	x	0.63	x	0.7	=	619.52	(82)
Rooflights	0.9x	1	x	0.68	x	166.08	x	0.63	x	0.7	=	44.82	(82)
Rooflights	0.9x	1	x	1.2	x	200	x	0.63	x	0.7	=	95.26	(82)
Rooflights	0.9x	1	x	1.2	x	200	x	0.63	x	0.7	=	95.26	(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12	(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12	(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12	(82)
Rooflights	0.9x	1	x	8.5	x	173.81	x	0.63	x	0.7	=	586.37	(82)
Rooflights	0.9x	1	x	0.68	x	152.65	x	0.63	x	0.7	=	41.2	(82)
Rooflights	0.9x	1	x	1.2	x	189	x	0.63	x	0.7	=	90.02	(82)
Rooflights	0.9x	1	x	1.2	x	189	x	0.63	x	0.7	=	90.02	(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82	(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82	(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82	(82)
Rooflights	0.9x	1	x	8.5	x	145.57	x	0.63	x	0.7	=	491.1	(82)
Rooflights	0.9x	1	x	0.68	x	112.79	x	0.63	x	0.7	=	30.44	(82)
Rooflights	0.9x	1	x	1.2	x	157	x	0.63	x	0.7	=	74.78	(82)
Rooflights	0.9x	1	x	1.2	x	157	x	0.63	x	0.7	=	74.78	(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58	(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58	(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58	(82)
Rooflights	0.9x	1	x	8.5	x	108.61	x	0.63	x	0.7	=	366.42	(82)
Rooflights	0.9x	1	x	0.68	x	70.26	x	0.63	x	0.7	=	18.96	(82)
Rooflights	0.9x	1	x	1.2	x	115	x	0.63	x	0.7	=	54.77	(82)
Rooflights	0.9x	1	x	1.2	x	115	x	0.63	x	0.7	=	54.77	(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63	(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63	(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63	(82)
Rooflights	0.9x	1	x	8.5	x	64.26	x	0.63	x	0.7	=	216.81	(82)
Rooflights	0.9x	1	x	0.68	x	37.03	x	0.63	x	0.7	=	10	(82)
Rooflights	0.9x	1	x	1.2	x	66	x	0.63	x	0.7	=	31.43	(82)
Rooflights	0.9x	1	x	1.2	x	66	x	0.63	x	0.7	=	31.43	(82)
Rooflights	0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)

DER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)
Rooflights 0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)
Rooflights 0.9x	1	x	8.5	x	33.27	x	0.63	x	0.7	=	112.25	(82)
Rooflights 0.9x	1	x	0.68	x	19.8	x	0.63	x	0.7	=	5.34	(82)
Rooflights 0.9x	1	x	1.2	x	33	x	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	x	1.2	x	33	x	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	8.5	x	21.59	x	0.63	x	0.7	=	72.83	(82)
Rooflights 0.9x	1	x	0.68	x	13.64	x	0.63	x	0.7	=	3.68	(82)
Rooflights 0.9x	1	x	1.2	x	21	x	0.63	x	0.7	=	10	(82)
Rooflights 0.9x	1	x	1.2	x	21	x	0.63	x	0.7	=	10	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)

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

(83)m=	754.42	1403.5	2199.98	3137.57	3848.81	3957.08	3759.22	3215.09	2526.38	1629.94	926.04	630.67	(83)

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

(84)m=	1604.86	2251.54	3019.2	3908.66	4567.92	4628.46	4401.06	3864.05	3201.34	2353.29	1705.22	1454.7	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.93	0.83	0.67	0.49	0.37	0.43	0.69	0.92	0.98	0.99	(86)

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

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

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

(88)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.21	20.2	20.19	20.19	20.18	(88)

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

(89)m=	0.99	0.97	0.92	0.8	0.63	0.44	0.31	0.37	0.63	0.9	0.98	0.99	(89)

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

(90)m=	20.16	20.17	20.17	20.19	20.19	20.21	20.21	20.21	20.2	20.19	20.19	20.18	(90)

fLA = Living area ÷ (4) = 0.31 (91)

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

(92)m=	20.42	20.42	20.43	20.44	20.44	20.45	20.45	20.45	20.45	20.44	20.44	20.43	(92)

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

(93)m=	20.42	20.42	20.43	20.44	20.44	20.45	20.45	20.45	20.45	20.44	20.44	20.43	(93)

8. Space heating requirement

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

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

DER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.81	0.64	0.46	0.33	0.39	0.65	0.9	0.98	0.99	(94)

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

(95)m=	1588.29	2188.28	2793.66	3170.89	2927.42	2121.51	1445.66	1495.42	2085.33	2129	1670.49	1443.53	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	6566.99	6294.8	5621.15	4550.38	3430.83	2243.03	1476.47	1546.55	2456.32	3862.63	5284.04	6491.38	(97)

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

(98)m=	3704.15	2759.58	2103.65	993.23	374.54	0	0	0	0	1289.82	2601.75	3755.6	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 17582.32 (98)

Space heating requirement in kWh/m²/year 39 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 383.46 (206)

Efficiency of secondary/supplementary heating system, % 76.5 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	3704.15	2759.58	2103.65	993.23	374.54	0	0	0	0	1289.82	2601.75	3755.6	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	965.99	719.66	548.6	259.02	97.67	0	0	0	0	336.37	678.5	979.4	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4585.2 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	252.25	222.55	234.24	210.7	206.99	185.69	179.05	195.5	194.85	218.44	230.09	246.42	

Efficiency of water heater 121.26 (216)

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

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

(219)m=	208.02	183.53	193.17	173.76	170.7	153.14	147.65	161.22	160.68	180.15	189.75	203.22	

Total = Sum(219a)$_{1...12}$ = 2125 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4585.2
Water heating fuel used		2125
Electricity for pumps, fans and electric keep-hot		

DER WorkSheet: New dwelling design stage

mechanical ventilation - balanced, extract or positive input from outside		1482.67	(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	1482.67	(231)
Electricity for lighting		899.64	(232)
Electricity generated by PVs		-9880.19	(233)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	2379.72	(261)
Space heating (secondary)	(215) x		0.016	=	0	(263)
Water heating	(219) x		0.519	=	1102.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =				3482.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	769.51	(267)
Electricity for lighting	(232) x		0.519	=	466.91	(268)
Energy saving/generation technologies Item 1			0.519	=	-5127.82	(269)
Total CO2, kg/year		sum of (265)…(271) =			-408.81	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			-0.91	(273)
EI rating (section 14)					101	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Chloe Hewitt	**Stroma Number:**	STRO029693
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.16

Property Address: Weston Hills, Low Fulney

Address : Weston Hills Road, Low Fulney, Spalding

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	227.64 (1a)	x	2.7 (2a)	=	614.63	(3a)
First floor	223.21 (1b)	x	2.76 (2b)	=	616.06	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	450.85 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		1230.69	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	1	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.03 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.28 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.28 (21)

Infiltration rate modified for monthly wind speed

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

TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

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

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

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

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

(24a)

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

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

(24b)

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

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

(24c)

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

(24d)m=	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.53	0.54	0.55	0.55	0.56

(24d)

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

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

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			4.18	x1/[1/(1.4)+ 0.04] =	5.54			(27)
Windows Type 2			7.73	x1/[1/(1.4)+ 0.04] =	10.25			(27)
Windows Type 3			1.87	x1/[1/(1.4)+ 0.04] =	2.48			(27)
Windows Type 4			8.51	x1/[1/(1.4)+ 0.04] =	11.28			(27)
Windows Type 5			6.35	x1/[1/(1.4)+ 0.04] =	8.42			(27)
Windows Type 6			6.35	x1/[1/(1.4)+ 0.04] =	8.42			(27)
Windows Type 7			1.62	x1/[1/(1.4)+ 0.04] =	2.15			(27)
Windows Type 8			1.62	x1/[1/(1.4)+ 0.04] =	2.15			(27)
Windows Type 9			0.3	x1/[1/(1.4)+ 0.04] =	0.4			(27)
Windows Type 10			2.84	x1/[1/(1.4)+ 0.04] =	3.77			(27)
Windows Type 11			14.83	x1/[1/(1.4)+ 0.04] =	19.66			(27)
Windows Type 12			1.87	x1/[1/(1.4)+ 0.04] =	2.48			(27)
Windows Type 13			1.61	x1/[1/(1.4)+ 0.04] =	2.13			(27)
Windows Type 14			1.61	x1/[1/(1.4)+ 0.04] =	2.13			(27)
Windows Type 15			4.12	x1/[1/(1.4)+ 0.04] =	5.46			(27)
Windows Type 16			4.12	x1/[1/(1.4)+ 0.04] =	5.46			(27)
Windows Type 17			1.44	x1/[1/(1.4)+ 0.04] =	1.91			(27)

TER WorkSheet: New dwelling design stage

Windows Type 18			5.52	x1/[1/(1.4)+ 0.04] =	7.32				(27)
Windows Type 19			5.52	x1/[1/(1.4)+ 0.04] =	7.32				(27)
Windows Type 20			5.52	x1/[1/(1.4)+ 0.04] =	7.32				(27)
Rooflights Type 1			8.5	x1/[1/(1.7) + 0.04] =	14.45				(27b)
Rooflights Type 2			0.68	x1/[1/(1.7) + 0.04] =	1.156				(27b)
Rooflights Type 3			1.2	x1/[1/(1.7) + 0.04] =	2.04				(27b)
Rooflights Type 4			1.2	x1/[1/(1.7) + 0.04] =	2.04				(27b)
Rooflights Type 5			1.36	x1/[1/(1.7) + 0.04] =	2.312				(27b)
Rooflights Type 6			1.36	x1/[1/(1.7) + 0.04] =	2.312				(27b)
Rooflights Type 7			1.36	x1/[1/(1.7) + 0.04] =	2.312				(27b)
Floor Type 1			227.64	x 0.13 =	29.5932				(28)
Floor Type 2			7.28	x 0.13 =	0.9464				(28)
Walls	313.93	87.53	226.4	x 0.18 =	40.75				(29)
Roof Type1	290.48	13.26	277.22	x 0.13 =	36.04				(30)
Roof Type2	10.86	2.4	8.46	x 0.13 =	1.1				(30)
Total area of elements, m²			850.19						(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 249.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21827.32 (34)

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

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

Thermal bridges : S (L x Y) calculated using Appendix K 32.25 (36)

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

Total fabric heat loss (33) + (36) = 281.65 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	229.41	228.39	227.38	222.67	221.79	217.69	217.69	216.93	219.27	221.79	223.57	225.44	(38)

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

(39)m=	511.06	510.04	509.04	504.33	503.45	499.34	499.34	498.58	500.92	503.45	505.23	507.09	

Average = Sum(39)$_{1...12}$ /12= 504.32 (39)

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

(40)m=	1.13	1.13	1.13	1.12	1.12	1.11	1.11	1.11	1.11	1.12	1.12	1.12	

Average = Sum(40)$_{1...12}$ /12= 1.12 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 3.33 (42)

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

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 113.24 (43)

TER WorkSheet: New dwelling design stage

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

(45)m=	184.73	161.56	166.72	145.35	139.47	120.35	111.52	127.97	129.5	150.92	164.74	178.9	
										Total = Sum(45)$_{1...12}$ =			1781.72 (45)

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

(46)m=	27.71	24.23	25.01	21.8	20.92	18.05	16.73	19.2	19.42	22.64	24.71	26.83	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0.54 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

Enter (50) or (54) in (55) 1.14 (55)

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

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

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

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

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

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

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

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

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

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

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

(62)m=	243.35	214.52	225.35	202.09	198.09	177.09	170.15	186.6	186.24	209.55	221.48	237.53	(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=	243.35	214.52	225.35	202.09	198.09	177.09	170.15	186.6	186.24	209.55	221.48	237.53	
											Output from water heater (annual)$_{1...12}$		2472.03 (64)

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

(65)m=	108.32	96.08	102.34	93.72	93.28	85.41	83.98	89.45	88.45	97.08	100.17	106.39	(65)

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

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

Metabolic gains (Table 5), Watts

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

TER WorkSheet: New dwelling design stage

(66)m=	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	166.4	(66)

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

(67)m=	50.94	45.25	36.8	27.86	20.82	17.58	19	24.69	33.14	42.08	49.11	52.36	(67)

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

(68)m=	571.41	577.34	562.39	530.58	490.43	452.69	427.48	421.55	436.49	468.3	508.46	546.2	(68)

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

(69)m=	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	39.64	(69)

Pumps and fans gains (Table 5a)

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

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

(71)m=	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	-133.12	(71)

Water heating gains (Table 5)

(72)m=	145.6	142.98	137.55	130.16	125.37	118.62	112.88	120.23	122.85	130.49	139.12	142.99	(72)

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

(73)m=	843.87	841.48	812.66	764.53	712.55	664.81	635.28	642.4	668.4	716.79	772.61	817.47	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	8.51		10.63		0.63		0.7	=	27.65	(74)
North	0.9x	0.77	1.61		10.63		0.63		0.7	=	5.23	(74)
North	0.9x	0.77	1.61		10.63		0.63		0.7	=	5.23	(74)
North	0.9x	0.77	1.44		10.63		0.63		0.7	=	4.68	(74)
North	0.9x	0.77	8.51		20.32		0.63		0.7	=	52.85	(74)
North	0.9x	0.77	1.61		20.32		0.63		0.7	=	10	(74)
North	0.9x	0.77	1.61		20.32		0.63		0.7	=	10	(74)
North	0.9x	0.77	1.44		20.32		0.63		0.7	=	8.94	(74)
North	0.9x	0.77	8.51		34.53		0.63		0.7	=	89.81	(74)
North	0.9x	0.77	1.61		34.53		0.63		0.7	=	16.99	(74)
North	0.9x	0.77	1.61		34.53		0.63		0.7	=	16.99	(74)
North	0.9x	0.77	1.44		34.53		0.63		0.7	=	15.2	(74)
North	0.9x	0.77	8.51		55.46		0.63		0.7	=	144.25	(74)
North	0.9x	0.77	1.61		55.46		0.63		0.7	=	27.29	(74)
North	0.9x	0.77	1.61		55.46		0.63		0.7	=	27.29	(74)
North	0.9x	0.77	1.44		55.46		0.63		0.7	=	24.41	(74)
North	0.9x	0.77	8.51		74.72		0.63		0.7	=	194.32	(74)
North	0.9x	0.77	1.61		74.72		0.63		0.7	=	36.76	(74)
North	0.9x	0.77	1.61		74.72		0.63		0.7	=	36.76	(74)
North	0.9x	0.77	1.44		74.72		0.63		0.7	=	32.88	(74)
North	0.9x	0.77	8.51		79.99		0.63		0.7	=	208.02	(74)

TER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.61	x	79.99	x	0.63	x	0.7	=	39.36	(74)
North	0.9x	0.77	x	1.61	x	79.99	x	0.63	x	0.7	=	39.36	(74)
North	0.9x	0.77	x	1.44	x	79.99	x	0.63	x	0.7	=	35.2	(74)
North	0.9x	0.77	x	8.51	x	74.68	x	0.63	x	0.7	=	194.22	(74)
North	0.9x	0.77	x	1.61	x	74.68	x	0.63	x	0.7	=	36.74	(74)
North	0.9x	0.77	x	1.61	x	74.68	x	0.63	x	0.7	=	36.74	(74)
North	0.9x	0.77	x	1.44	x	74.68	x	0.63	x	0.7	=	32.86	(74)
North	0.9x	0.77	x	8.51	x	59.25	x	0.63	x	0.7	=	154.09	(74)
North	0.9x	0.77	x	1.61	x	59.25	x	0.63	x	0.7	=	29.15	(74)
North	0.9x	0.77	x	1.61	x	59.25	x	0.63	x	0.7	=	29.15	(74)
North	0.9x	0.77	x	1.44	x	59.25	x	0.63	x	0.7	=	26.07	(74)
North	0.9x	0.77	x	8.51	x	41.52	x	0.63	x	0.7	=	107.97	(74)
North	0.9x	0.77	x	1.61	x	41.52	x	0.63	x	0.7	=	20.43	(74)
North	0.9x	0.77	x	1.61	x	41.52	x	0.63	x	0.7	=	20.43	(74)
North	0.9x	0.77	x	1.44	x	41.52	x	0.63	x	0.7	=	18.27	(74)
North	0.9x	0.77	x	8.51	x	24.19	x	0.63	x	0.7	=	62.91	(74)
North	0.9x	0.77	x	1.61	x	24.19	x	0.63	x	0.7	=	11.9	(74)
North	0.9x	0.77	x	1.61	x	24.19	x	0.63	x	0.7	=	11.9	(74)
North	0.9x	0.77	x	1.44	x	24.19	x	0.63	x	0.7	=	10.65	(74)
North	0.9x	0.77	x	8.51	x	13.12	x	0.63	x	0.7	=	34.12	(74)
North	0.9x	0.77	x	1.61	x	13.12	x	0.63	x	0.7	=	6.45	(74)
North	0.9x	0.77	x	1.61	x	13.12	x	0.63	x	0.7	=	6.45	(74)
North	0.9x	0.77	x	1.44	x	13.12	x	0.63	x	0.7	=	5.77	(74)
North	0.9x	0.77	x	8.51	x	8.86	x	0.63	x	0.7	=	23.05	(74)
North	0.9x	0.77	x	1.61	x	8.86	x	0.63	x	0.7	=	4.36	(74)
North	0.9x	0.77	x	1.61	x	8.86	x	0.63	x	0.7	=	4.36	(74)
North	0.9x	0.77	x	1.44	x	8.86	x	0.63	x	0.7	=	3.9	(74)
East	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.7	=	9.72	(76)
East	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.7	=	9.72	(76)
East	0.9x	1	x	0.3	x	19.64	x	0.63	x	0.7	=	1.8	(76)
East	0.9x	1	x	2.84	x	19.64	x	0.63	x	0.7	=	17.05	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	5.52	x	19.64	x	0.63	x	0.7	=	33.13	(76)
East	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.7	=	19.02	(76)
East	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.7	=	19.02	(76)
East	0.9x	1	x	0.3	x	38.42	x	0.63	x	0.7	=	3.52	(76)
East	0.9x	1	x	2.84	x	38.42	x	0.63	x	0.7	=	33.35	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)
East	0.9x	1	x	5.52	x	38.42	x	0.63	x	0.7	=	64.81	(76)

TER WorkSheet: New dwelling design stage

East	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.7	=	31.33	(76)
East	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.7	=	31.33	(76)
East	0.9x	1	x	0.3	x	63.27	x	0.63	x	0.7	=	5.8	(76)
East	0.9x	1	x	2.84	x	63.27	x	0.63	x	0.7	=	54.92	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	5.52	x	63.27	x	0.63	x	0.7	=	106.74	(76)
East	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.7	=	45.69	(76)
East	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.7	=	45.69	(76)
East	0.9x	1	x	0.3	x	92.28	x	0.63	x	0.7	=	8.46	(76)
East	0.9x	1	x	2.84	x	92.28	x	0.63	x	0.7	=	80.09	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	5.52	x	92.28	x	0.63	x	0.7	=	155.68	(76)
East	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.7	=	55.99	(76)
East	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.7	=	55.99	(76)
East	0.9x	1	x	0.3	x	113.09	x	0.63	x	0.7	=	10.37	(76)
East	0.9x	1	x	2.84	x	113.09	x	0.63	x	0.7	=	98.16	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	5.52	x	113.09	x	0.63	x	0.7	=	190.79	(76)
East	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.7	=	57.32	(76)
East	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.7	=	57.32	(76)
East	0.9x	1	x	0.3	x	115.77	x	0.63	x	0.7	=	10.61	(76)
East	0.9x	1	x	2.84	x	115.77	x	0.63	x	0.7	=	100.48	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	5.52	x	115.77	x	0.63	x	0.7	=	195.3	(76)
East	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.7	=	54.57	(76)
East	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.7	=	54.57	(76)
East	0.9x	1	x	0.3	x	110.22	x	0.63	x	0.7	=	10.11	(76)
East	0.9x	1	x	2.84	x	110.22	x	0.63	x	0.7	=	95.66	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	5.52	x	110.22	x	0.63	x	0.7	=	185.94	(76)
East	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.7	=	46.87	(76)
East	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.7	=	46.87	(76)
East	0.9x	1	x	0.3	x	94.68	x	0.63	x	0.7	=	8.68	(76)
East	0.9x	1	x	2.84	x	94.68	x	0.63	x	0.7	=	82.17	(76)
East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)
East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)

TER WorkSheet: New dwelling design stage

East	0.9x	1	x	5.52	x	94.68	x	0.63	x	0.7	=	159.72	(76)
East	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.7	=	36.43	(76)
East	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.7	=	36.43	(76)
East	0.9x	1	x	0.3	x	73.59	x	0.63	x	0.7	=	6.75	(76)
East	0.9x	1	x	2.84	x	73.59	x	0.63	x	0.7	=	63.87	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	5.52	x	73.59	x	0.63	x	0.7	=	124.14	(76)
East	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.7	=	22.57	(76)
East	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.7	=	22.57	(76)
East	0.9x	1	x	0.3	x	45.59	x	0.63	x	0.7	=	4.18	(76)
East	0.9x	1	x	2.84	x	45.59	x	0.63	x	0.7	=	39.57	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	5.52	x	45.59	x	0.63	x	0.7	=	76.91	(76)
East	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.7	=	12.12	(76)
East	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.7	=	12.12	(76)
East	0.9x	1	x	0.3	x	24.49	x	0.63	x	0.7	=	2.25	(76)
East	0.9x	1	x	2.84	x	24.49	x	0.63	x	0.7	=	21.26	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	5.52	x	24.49	x	0.63	x	0.7	=	41.31	(76)
East	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.7	=	8	(76)
East	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.7	=	8	(76)
East	0.9x	1	x	0.3	x	16.15	x	0.63	x	0.7	=	1.48	(76)
East	0.9x	1	x	2.84	x	16.15	x	0.63	x	0.7	=	14.02	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
East	0.9x	1	x	5.52	x	16.15	x	0.63	x	0.7	=	27.25	(76)
South	0.9x	0.77	x	4.18	x	46.75	x	0.63	x	0.7	=	59.72	(78)
South	0.9x	0.77	x	14.83	x	46.75	x	0.63	x	0.7	=	211.89	(78)
South	0.9x	0.77	x	4.18	x	76.57	x	0.63	x	0.7	=	97.81	(78)
South	0.9x	0.77	x	14.83	x	76.57	x	0.63	x	0.7	=	347.02	(78)
South	0.9x	0.77	x	4.18	x	97.53	x	0.63	x	0.7	=	124.6	(78)
South	0.9x	0.77	x	14.83	x	97.53	x	0.63	x	0.7	=	442.05	(78)
South	0.9x	0.77	x	4.18	x	110.23	x	0.63	x	0.7	=	140.82	(78)
South	0.9x	0.77	x	14.83	x	110.23	x	0.63	x	0.7	=	499.61	(78)
South	0.9x	0.77	x	4.18	x	114.87	x	0.63	x	0.7	=	146.74	(78)
South	0.9x	0.77	x	14.83	x	114.87	x	0.63	x	0.7	=	520.62	(78)
South	0.9x	0.77	x	4.18	x	110.55	x	0.63	x	0.7	=	141.22	(78)
South	0.9x	0.77	x	14.83	x	110.55	x	0.63	x	0.7	=	501.03	(78)

TER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	4.18	x	108.01	x	0.63	x	0.7	=	137.98	(78)
South	0.9x	0.77	x	14.83	x	108.01	x	0.63	x	0.7	=	489.54	(78)
South	0.9x	0.77	x	4.18	x	104.89	x	0.63	x	0.7	=	134	(78)
South	0.9x	0.77	x	14.83	x	104.89	x	0.63	x	0.7	=	475.41	(78)
South	0.9x	0.77	x	4.18	x	101.89	x	0.63	x	0.7	=	130.16	(78)
South	0.9x	0.77	x	14.83	x	101.89	x	0.63	x	0.7	=	461.77	(78)
South	0.9x	0.77	x	4.18	x	82.59	x	0.63	x	0.7	=	105.5	(78)
South	0.9x	0.77	x	14.83	x	82.59	x	0.63	x	0.7	=	374.3	(78)
South	0.9x	0.77	x	4.18	x	55.42	x	0.63	x	0.7	=	70.79	(78)
South	0.9x	0.77	x	14.83	x	55.42	x	0.63	x	0.7	=	251.16	(78)
South	0.9x	0.77	x	4.18	x	40.4	x	0.63	x	0.7	=	51.61	(78)
South	0.9x	0.77	x	14.83	x	40.4	x	0.63	x	0.7	=	183.09	(78)
West	0.9x	0.77	x	7.73	x	19.64	x	0.63	x	0.7	=	46.4	(80)
West	0.9x	0.77	x	1.87	x	19.64	x	0.63	x	0.7	=	11.22	(80)
West	0.9x	0.77	x	1.87	x	19.64	x	0.63	x	0.7	=	11.22	(80)
West	0.9x	0.77	x	7.73	x	38.42	x	0.63	x	0.7	=	90.76	(80)
West	0.9x	0.77	x	1.87	x	38.42	x	0.63	x	0.7	=	21.96	(80)
West	0.9x	0.77	x	1.87	x	38.42	x	0.63	x	0.7	=	21.96	(80)
West	0.9x	0.77	x	7.73	x	63.27	x	0.63	x	0.7	=	149.48	(80)
West	0.9x	0.77	x	1.87	x	63.27	x	0.63	x	0.7	=	36.16	(80)
West	0.9x	0.77	x	1.87	x	63.27	x	0.63	x	0.7	=	36.16	(80)
West	0.9x	0.77	x	7.73	x	92.28	x	0.63	x	0.7	=	218	(80)
West	0.9x	0.77	x	1.87	x	92.28	x	0.63	x	0.7	=	52.74	(80)
West	0.9x	0.77	x	1.87	x	92.28	x	0.63	x	0.7	=	52.74	(80)
West	0.9x	0.77	x	7.73	x	113.09	x	0.63	x	0.7	=	267.17	(80)
West	0.9x	0.77	x	1.87	x	113.09	x	0.63	x	0.7	=	64.63	(80)
West	0.9x	0.77	x	1.87	x	113.09	x	0.63	x	0.7	=	64.63	(80)
West	0.9x	0.77	x	7.73	x	115.77	x	0.63	x	0.7	=	273.49	(80)
West	0.9x	0.77	x	1.87	x	115.77	x	0.63	x	0.7	=	66.16	(80)
West	0.9x	0.77	x	1.87	x	115.77	x	0.63	x	0.7	=	66.16	(80)
West	0.9x	0.77	x	7.73	x	110.22	x	0.63	x	0.7	=	260.38	(80)
West	0.9x	0.77	x	1.87	x	110.22	x	0.63	x	0.7	=	62.99	(80)
West	0.9x	0.77	x	1.87	x	110.22	x	0.63	x	0.7	=	62.99	(80)
West	0.9x	0.77	x	7.73	x	94.68	x	0.63	x	0.7	=	223.66	(80)
West	0.9x	0.77	x	1.87	x	94.68	x	0.63	x	0.7	=	54.11	(80)
West	0.9x	0.77	x	1.87	x	94.68	x	0.63	x	0.7	=	54.11	(80)
West	0.9x	0.77	x	7.73	x	73.59	x	0.63	x	0.7	=	173.85	(80)
West	0.9x	0.77	x	1.87	x	73.59	x	0.63	x	0.7	=	42.06	(80)
West	0.9x	0.77	x	1.87	x	73.59	x	0.63	x	0.7	=	42.06	(80)
West	0.9x	0.77	x	7.73	x	45.59	x	0.63	x	0.7	=	107.7	(80)
West	0.9x	0.77	x	1.87	x	45.59	x	0.63	x	0.7	=	26.05	(80)

TER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	1.87	x	45.59	x	0.63	x	0.7	=	26.05	(80)
West	0.9x	0.77	x	7.73	x	24.49	x	0.63	x	0.7	=	57.85	(80)
West	0.9x	0.77	x	1.87	x	24.49	x	0.63	x	0.7	=	14	(80)
West	0.9x	0.77	x	1.87	x	24.49	x	0.63	x	0.7	=	14	(80)
West	0.9x	0.77	x	7.73	x	16.15	x	0.63	x	0.7	=	38.16	(80)
West	0.9x	0.77	x	1.87	x	16.15	x	0.63	x	0.7	=	9.23	(80)
West	0.9x	0.77	x	1.87	x	16.15	x	0.63	x	0.7	=	9.23	(80)
Northwest	0.9x	0.77	x	6.35	x	11.28	x	0.63	x	0.7	=	21.9	(81)
Northwest	0.9x	0.77	x	6.35	x	11.28	x	0.63	x	0.7	=	21.9	(81)
Northwest	0.9x	0.77	x	4.12	x	11.28	x	0.63	x	0.7	=	14.21	(81)
Northwest	0.9x	0.77	x	4.12	x	11.28	x	0.63	x	0.7	=	14.21	(81)
Northwest	0.9x	0.77	x	6.35	x	22.97	x	0.63	x	0.7	=	44.57	(81)
Northwest	0.9x	0.77	x	6.35	x	22.97	x	0.63	x	0.7	=	44.57	(81)
Northwest	0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest	0.9x	0.77	x	4.12	x	22.97	x	0.63	x	0.7	=	28.92	(81)
Northwest	0.9x	0.77	x	6.35	x	41.38	x	0.63	x	0.7	=	80.3	(81)
Northwest	0.9x	0.77	x	6.35	x	41.38	x	0.63	x	0.7	=	80.3	(81)
Northwest	0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest	0.9x	0.77	x	4.12	x	41.38	x	0.63	x	0.7	=	52.1	(81)
Northwest	0.9x	0.77	x	6.35	x	67.96	x	0.63	x	0.7	=	131.88	(81)
Northwest	0.9x	0.77	x	6.35	x	67.96	x	0.63	x	0.7	=	131.88	(81)
Northwest	0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest	0.9x	0.77	x	4.12	x	67.96	x	0.63	x	0.7	=	85.56	(81)
Northwest	0.9x	0.77	x	6.35	x	91.35	x	0.63	x	0.7	=	177.27	(81)
Northwest	0.9x	0.77	x	6.35	x	91.35	x	0.63	x	0.7	=	177.27	(81)
Northwest	0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest	0.9x	0.77	x	4.12	x	91.35	x	0.63	x	0.7	=	115.02	(81)
Northwest	0.9x	0.77	x	6.35	x	97.38	x	0.63	x	0.7	=	188.99	(81)
Northwest	0.9x	0.77	x	6.35	x	97.38	x	0.63	x	0.7	=	188.99	(81)
Northwest	0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest	0.9x	0.77	x	4.12	x	97.38	x	0.63	x	0.7	=	122.62	(81)
Northwest	0.9x	0.77	x	6.35	x	91.1	x	0.63	x	0.7	=	176.79	(81)
Northwest	0.9x	0.77	x	6.35	x	91.1	x	0.63	x	0.7	=	176.79	(81)
Northwest	0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest	0.9x	0.77	x	4.12	x	91.1	x	0.63	x	0.7	=	114.71	(81)
Northwest	0.9x	0.77	x	6.35	x	72.63	x	0.63	x	0.7	=	140.94	(81)
Northwest	0.9x	0.77	x	6.35	x	72.63	x	0.63	x	0.7	=	140.94	(81)
Northwest	0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest	0.9x	0.77	x	4.12	x	72.63	x	0.63	x	0.7	=	91.45	(81)
Northwest	0.9x	0.77	x	6.35	x	50.42	x	0.63	x	0.7	=	97.85	(81)
Northwest	0.9x	0.77	x	6.35	x	50.42	x	0.63	x	0.7	=	97.85	(81)

TER WorkSheet: New dwelling design stage

Northwest	0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest	0.9x	0.77	x	4.12	x	50.42	x	0.63	x	0.7	=	63.49	(81)
Northwest	0.9x	0.77	x	6.35	x	28.07	x	0.63	x	0.7	=	54.47	(81)
Northwest	0.9x	0.77	x	6.35	x	28.07	x	0.63	x	0.7	=	54.47	(81)
Northwest	0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest	0.9x	0.77	x	4.12	x	28.07	x	0.63	x	0.7	=	35.34	(81)
Northwest	0.9x	0.77	x	6.35	x	14.2	x	0.63	x	0.7	=	27.55	(81)
Northwest	0.9x	0.77	x	6.35	x	14.2	x	0.63	x	0.7	=	27.55	(81)
Northwest	0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	4.12	x	14.2	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	6.35	x	9.21	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	6.35	x	9.21	x	0.63	x	0.7	=	17.88	(81)
Northwest	0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Northwest	0.9x	0.77	x	4.12	x	9.21	x	0.63	x	0.7	=	11.6	(81)
Rooflights	0.9x	1	x	8.5	x	26.46	x	0.63	x	0.7	=	89.28	(82)
Rooflights	0.9x	1	x	0.68	x	16.18	x	0.63	x	0.7	=	4.37	(82)
Rooflights	0.9x	1	x	1.2	x	26	x	0.63	x	0.7	=	12.38	(82)
Rooflights	0.9x	1	x	1.2	x	26	x	0.63	x	0.7	=	12.38	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	1.36	x	26.46	x	0.63	x	0.7	=	14.28	(82)
Rooflights	0.9x	1	x	8.5	x	53.3	x	0.63	x	0.7	=	179.83	(82)
Rooflights	0.9x	1	x	0.68	x	30.63	x	0.63	x	0.7	=	8.27	(82)
Rooflights	0.9x	1	x	1.2	x	54	x	0.63	x	0.7	=	25.72	(82)
Rooflights	0.9x	1	x	1.2	x	54	x	0.63	x	0.7	=	25.72	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	1.36	x	53.3	x	0.63	x	0.7	=	28.77	(82)
Rooflights	0.9x	1	x	8.5	x	91.66	x	0.63	x	0.7	=	309.24	(82)
Rooflights	0.9x	1	x	0.68	x	55.7	x	0.63	x	0.7	=	15.03	(82)
Rooflights	0.9x	1	x	1.2	x	96	x	0.63	x	0.7	=	45.72	(82)
Rooflights	0.9x	1	x	1.2	x	96	x	0.63	x	0.7	=	45.72	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	1.36	x	91.66	x	0.63	x	0.7	=	49.48	(82)
Rooflights	0.9x	1	x	8.5	x	139.87	x	0.63	x	0.7	=	471.87	(82)
Rooflights	0.9x	1	x	0.68	x	101.28	x	0.63	x	0.7	=	27.34	(82)
Rooflights	0.9x	1	x	1.2	x	150	x	0.63	x	0.7	=	71.44	(82)
Rooflights	0.9x	1	x	1.2	x	150	x	0.63	x	0.7	=	71.44	(82)
Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)
Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5	(82)

TER WorkSheet: New dwelling design stage

Rooflights	0.9x	1	x	1.36	x	139.87	x	0.63	x	0.7	=	75.5		(82)
Rooflights	0.9x	1	x	8.5	x	176.97	x	0.63	x	0.7	=	597.03		(82)
Rooflights	0.9x	1	x	0.68	x	149.52	x	0.63	x	0.7	=	40.35		(82)
Rooflights	0.9x	1	x	1.2	x	192	x	0.63	x	0.7	=	91.45		(82)
Rooflights	0.9x	1	x	1.2	x	192	x	0.63	x	0.7	=	91.45		(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52		(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52		(82)
Rooflights	0.9x	1	x	1.36	x	176.97	x	0.63	x	0.7	=	95.52		(82)
Rooflights	0.9x	1	x	8.5	x	183.63	x	0.63	x	0.7	=	619.52		(82)
Rooflights	0.9x	1	x	0.68	x	166.08	x	0.63	x	0.7	=	44.82		(82)
Rooflights	0.9x	1	x	1.2	x	200	x	0.63	x	0.7	=	95.26		(82)
Rooflights	0.9x	1	x	1.2	x	200	x	0.63	x	0.7	=	95.26		(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12		(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12		(82)
Rooflights	0.9x	1	x	1.36	x	183.63	x	0.63	x	0.7	=	99.12		(82)
Rooflights	0.9x	1	x	8.5	x	173.81	x	0.63	x	0.7	=	586.37		(82)
Rooflights	0.9x	1	x	0.68	x	152.65	x	0.63	x	0.7	=	41.2		(82)
Rooflights	0.9x	1	x	1.2	x	189	x	0.63	x	0.7	=	90.02		(82)
Rooflights	0.9x	1	x	1.2	x	189	x	0.63	x	0.7	=	90.02		(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82		(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82		(82)
Rooflights	0.9x	1	x	1.36	x	173.81	x	0.63	x	0.7	=	93.82		(82)
Rooflights	0.9x	1	x	8.5	x	145.57	x	0.63	x	0.7	=	491.1		(82)
Rooflights	0.9x	1	x	0.68	x	112.79	x	0.63	x	0.7	=	30.44		(82)
Rooflights	0.9x	1	x	1.2	x	157	x	0.63	x	0.7	=	74.78		(82)
Rooflights	0.9x	1	x	1.2	x	157	x	0.63	x	0.7	=	74.78		(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58		(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58		(82)
Rooflights	0.9x	1	x	1.36	x	145.57	x	0.63	x	0.7	=	78.58		(82)
Rooflights	0.9x	1	x	8.5	x	108.61	x	0.63	x	0.7	=	366.42		(82)
Rooflights	0.9x	1	x	0.68	x	70.26	x	0.63	x	0.7	=	18.96		(82)
Rooflights	0.9x	1	x	1.2	x	115	x	0.63	x	0.7	=	54.77		(82)
Rooflights	0.9x	1	x	1.2	x	115	x	0.63	x	0.7	=	54.77		(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63		(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63		(82)
Rooflights	0.9x	1	x	1.36	x	108.61	x	0.63	x	0.7	=	58.63		(82)
Rooflights	0.9x	1	x	8.5	x	64.26	x	0.63	x	0.7	=	216.81		(82)
Rooflights	0.9x	1	x	0.68	x	37.03	x	0.63	x	0.7	=	10		(82)
Rooflights	0.9x	1	x	1.2	x	66	x	0.63	x	0.7	=	31.43		(82)
Rooflights	0.9x	1	x	1.2	x	66	x	0.63	x	0.7	=	31.43		(82)
Rooflights	0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69		(82)

TER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)
Rooflights 0.9x	1	x	1.36	x	64.26	x	0.63	x	0.7	=	34.69	(82)
Rooflights 0.9x	1	x	8.5	x	33.27	x	0.63	x	0.7	=	112.25	(82)
Rooflights 0.9x	1	x	0.68	x	19.8	x	0.63	x	0.7	=	5.34	(82)
Rooflights 0.9x	1	x	1.2	x	33	x	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	x	1.2	x	33	x	0.63	x	0.7	=	15.72	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	1.36	x	33.27	x	0.63	x	0.7	=	17.96	(82)
Rooflights 0.9x	1	x	8.5	x	21.59	x	0.63	x	0.7	=	72.83	(82)
Rooflights 0.9x	1	x	0.68	x	13.64	x	0.63	x	0.7	=	3.68	(82)
Rooflights 0.9x	1	x	1.2	x	21	x	0.63	x	0.7	=	10	(82)
Rooflights 0.9x	1	x	1.2	x	21	x	0.63	x	0.7	=	10	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)
Rooflights 0.9x	1	x	1.36	x	21.59	x	0.63	x	0.7	=	11.65	(82)

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

(83)m=	754.42	1403.5	2199.98	3137.57	3848.81	3957.08	3759.22	3215.09	2526.38	1629.94	926.04	630.67	(83)

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

(84)m=	1598.29	2244.98	3012.64	3902.09	4561.36	4621.89	4394.5	3857.48	3194.78	2346.73	1698.65	1448.13	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.85	0.66	0.49	0.58	0.87	0.99	1	1	(86)

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

(87)m=	19.55	19.75	20.08	20.51	20.83	20.97	20.99	20.99	20.86	20.39	19.88	19.52	(87)

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

(88)m=	19.97	19.98	19.98	19.99	19.99	19.99	19.99	20	19.99	19.99	19.98	19.98	(88)

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

(89)m=	1	1	0.99	0.95	0.8	0.57	0.38	0.46	0.8	0.99	1	1	(89)

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

(90)m=	18.01	18.31	18.79	19.4	19.82	19.97	19.99	19.99	19.87	19.25	18.51	17.97	(90)

fLA = Living area ÷ (4) = 0.31 (91)

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

(92)m=	18.48	18.75	19.19	19.74	20.13	20.28	20.3	20.3	20.17	19.6	18.93	18.45	(92)

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

(93)m=	18.48	18.75	19.19	19.74	20.13	20.28	20.3	20.3	20.17	19.6	18.93	18.45	(93)

8. Space heating requirement

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

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

TER WorkSheet: New dwelling design stage

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.94	0.81	0.59	0.42	0.5	0.82	0.98	1	1	(94)

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

(95)m=	1597.72	2240.51	2979.43	3676.25	3675.44	2743.27	1835.11	1914.46	2609.44	2307.69	1696.74	1447.82	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	7248.46	7064.33	6458.06	5467.82	4245	2834.87	1847.19	1942.32	3043	4529.65	5976.85	7224.2	(97)

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

(98)m=	4204.15	3241.61	2588.1	1289.93	423.75	0	0	0	0	1653.13	3081.68	4297.63	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 20779.98 (98)

Space heating requirement in kWh/m²/year 46.09 (99)

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

Space heating:

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

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

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

Efficiency of main space heating system 1 93.5 (206)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	4204.15	3241.61	2588.1	1289.93	423.75	0	0	0	0	1653.13	3081.68	4297.63	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	4496.42	3466.96	2768.02	1379.6	453.21	0	0	0	0	1768.06	3295.91	4596.39	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 22224.58 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	243.35	214.52	225.35	202.09	198.09	177.09	170.15	186.6	186.24	209.55	221.48	237.53	

Efficiency of water heater 79.8 (216)

(217)m=	89.84	89.75	89.54	88.89	86.79	79.8	79.8	79.8	79.8	89.16	89.69	89.87	(217)

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

(219)m=	270.87	239.01	251.68	227.36	228.24	221.91	213.22	233.83	233.38	235.04	246.93	264.3	

Total = Sum(219a)$_{1...12}$ = 2865.77 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		22224.58
Water heating fuel used		2865.77
Electricity for pumps, fans and electric keep-hot		

TER WorkSheet: New dwelling design stage

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		899.64	(232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	4800.51	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	619.01	(264)
Space and water heating	(261) + (262) + (263) + (264) =				5419.51	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	466.91	(268)
Total CO2, kg/year		sum of (265)…(271) =			5925.35	(272)

TER = 19.75 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on Thursday, December 20, 2018

Property Details: Weston Hills, Low Fulney

Dwelling type:	Detached House
Located in:	England
Region:	East Pennines
Cross ventilation possible:	No
Number of storeys:	2
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	2.5 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	1015.32	**(P1)**
Transmission heat loss coefficient:	270.3	
Summer heat loss coefficient:	1285.64	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South (Snug/Kitchen)	0	1
West (Entrance Door)	0	1
West (Family/Playroom)	0	1
North (Family/Playroom Sliding Door)	0	1
North West (Lounge Sliding Doors)	0	1
North West (Lounge Sliding Doors)	0	1
East (Lounge)	0	1
East (Study)	0	1
East (WC)	0	1
East (Utility Door & Side Light)	0	1
South (Master Bedroom)	0	1
West (Bedroom 3)	0	1
North (Bedroom 3)	0	1
North (Bedroom 4)	0	1
North West (Void)	0	1
North West (Void)	0	1
North (Bedroom 5)	0	1
East (Bedroom 5)	0	1
East (Bedroom 2)	0	1
East (Bedroom 2)	0	1
West (Void - Stairs)	0	1
North (En-suite)	0	1
Horizontal (Bedroom 5)	0	1
Horizontal (Bedroom 2)	0	1
East (Bathroom)	0	1
East (Dressing)	0	1
East (En-suite)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South (Snug/Kitchen)	1	0.9	1	0.9	**(P8)**

SAP 2012 Overheating Assessment

West (Entrance Door)	1	0.9	1	0.9	**(P8)**
West (Family/Playroom)	1	0.9	1	0.9	**(P8)**
North (Family/Playroom Sliding Door)	1	0.9	1	0.9	**(P8)**
North West (Lounge Sliding Doors)	1	0.9	1	0.9	**(P8)**
North West (Lounge Sliding Doors)	1	0.9	1	0.9	**(P8)**
East (Lounge)	1	0.9	1	0.9	**(P8)**
East (Study)	1	0.9	1	0.9	**(P8)**
East (WC)	1	0.9	1	0.9	**(P8)**
East (Utility Door & Side Light)	1	0.9	1	0.9	**(P8)**
South (Master Bedroom)	1	0.9	1	0.9	**(P8)**
West (Bedroom 3)	1	0.9	1	0.9	**(P8)**
North (Bedroom 3)	1	0.9	1	0.9	**(P8)**
North (Bedroom 4)	1	0.9	1	0.9	**(P8)**
North West (Void)	1	0.9	1	0.9	**(P8)**
North West (Void)	1	0.9	1	0.9	**(P8)**
North (Bedroom 5)	1	0.9	1	0.9	**(P8)**
East (Bedroom 5)	1	0.9	1	0.9	**(P8)**
East (Bedroom 2)	1	0.9	1	0.9	**(P8)**
East (Bedroom 2)	1	0.9	1	0.9	**(P8)**
West (Void - Stairs)	1	1	1	1	**(P8)**
North (En-suite)	1	1	1	1	**(P8)**
Horizontal (Bedroom 5)	1	1	1	1	**(P8)**
Horizontal (Bedroom 2)	1	1	1	1	**(P8)**
East (Bathroom)	1	1	1	1	**(P8)**
East (Dressing)	1	1	1	1	**(P8)**
East (En-suite)	1	1	1	1	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**
South (Snug/Kitchen)	0.9 x	4.18	108.01	0.63	0.7	0.9	161.28
West (Entrance Door)	0.9 x	7.73	110.22	0.63	0.7	0.9	304.34
West (Family/Playroom)	0.9 x	1.87	110.22	0.63	0.7	0.9	73.62
North (Family/Playroom Sliding Door)	0.9 x	8.51	74.68	0.63	0.7	0.9	227.01
North West (Lounge Sliding Doors)	0.9 x	6.35	91.1	0.63	0.7	0.9	206.64
North West (Lounge Sliding Doors)	0.9 x	6.35	91.1	0.63	0.7	0.9	206.64
East (Lounge)	0.9 x	1.62	110.22	0.63	0.7	0.9	63.78
East (Study)	0.9 x	1.62	110.22	0.63	0.7	0.9	63.78
East (WC)	0.9 x	0.3	110.22	0.63	0.7	0.9	11.81
East (Utility Door & Side Light)	0.9 x	2.84	110.22	0.63	0.7	0.9	111.81
South (Master Bedroom)	0.9 x	14.83	108.01	0.63	0.7	0.9	572.18
West (Bedroom 3)	0.9 x	1.87	110.22	0.63	0.7	0.9	73.62
North (Bedroom 3)	0.9 x	1.61	74.68	0.63	0.7	0.9	42.95
North (Bedroom 4)	0.9 x	1.61	74.68	0.63	0.7	0.9	42.95
North West (Void)	0.9 x	4.12	91.1	0.63	0.7	0.9	134.07
North West (Void)	0.9 x	4.12	91.1	0.63	0.7	0.9	134.07
North (Bedroom 5)	0.9 x	1.44	74.68	0.63	0.7	0.9	38.41
East (Bedroom 5)	0.9 x	5.52	110.22	0.63	0.7	0.9	217.33
East (Bedroom 2)	0.9 x	5.52	110.22	0.63	0.7	0.9	217.33
East (Bedroom 2)	0.9 x	5.52	110.22	0.63	0.7	0.9	217.33
	1 x	8.5	173.81	0.63	0.7	1	586.37
	1 x	0.68	152.65	0.63	0.7	1	41.2
	1 x	1.2	189	0.63	0.7	1	90.02

SAP 2012 Overheating Assessment

1 x	1.2	189	0.63	0.7	1	90.02	
1 x	1.36	173.81	0.63	0.7	1	93.82	
1 x	1.36	173.81	0.63	0.7	1	93.82	
1 x	1.36	173.81	0.63	0.7	1	93.82	
					Total	4210.03	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	972.65	932.82	945.56	
Total summer gains	5403.28	5142.85	4550.36	**(P5)**
Summer gain/loss ratio	4.2	4	3.54	**(P6)**
Mean summer external temperature (East Pennines)	14.6	16.6	16.4	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.1	21.9	21.24	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight