

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.58
Printed on 29 November 2022 at 15:11:12

Project Information:

Assessed By: Liam Mason (STRO033679) **Building Type:** Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 77.27m²

Site Reference : Bell Road, Bottisham

Plot Reference: Plot 7

Address : Plot 7

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: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 18.48 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 8.14 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.5 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 48.1 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main Heating system: Database: (rev 508, product index 016841):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Vaillant
Model: ecoTEC plus 824
Model qualifier: VUW GB 246/5-5 (Combi)
Efficiency 89.1 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls TTZC by plumbing and electrical services **OK**
 Hot water controls: No cylinder thermostat

No cylinder
 Boiler interlock: Yes **OK**

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (East Anglia): Slight **OK**

Based on:

Overshading: Average or unknown
 Windows facing: East 0.55m²
 Windows facing: South 1.46m²
 Windows facing: East 0.94m²
 Windows facing: East 0.73m²
 Windows facing: North 3.18m²
 Windows facing: South 1.46m²
 Windows facing: East 0.94m²
 Windows facing: North 1.32m²
 Windows facing: North 1.46m²
 Windows facing: East 0.82m²
 Windows facing: South 0.64m²
 Windows facing: North 0.7m²
 Windows facing: East 2.22m²
 Ventilation rate: 4.00
 Blinds/curtains: Dark-coloured curtain or roller blind
 Closed 100% of daylight hours

10 Key features

Roofs U-value 0.11 W/m²K
 Party Walls U-value 0 W/m²K
 Floors U-value 0.11 W/m²K
 Photovoltaic array

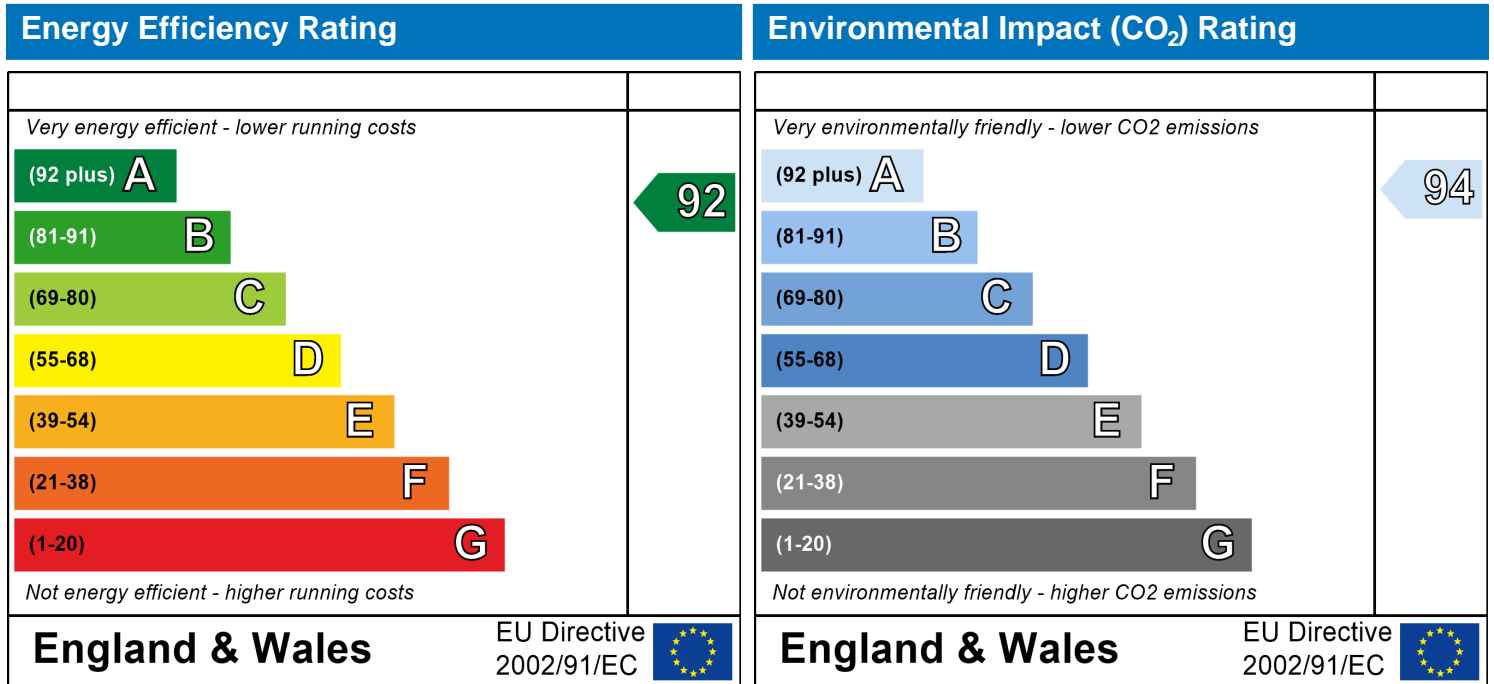
Predicted Energy Assessment



Plot 7
 Dwelling type: Semi-detached House
 Date of assessment: 03 November 2022
 Produced by: Liam Mason
 Total floor area: 77.27 m²

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

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



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

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

SAP Input

Property Details: Plot 7

Address: Plot 7
 Located in: England
 Region: East Anglia
 UPRN:
 Date of assessment: 03 November 2022
 Date of certificate: 29 November 2022
 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: 508

Property description:

Dwelling type: House
 Detachment: Semi-detached
 Year Completed: 2022
 Floor Location: Floor area: Storey height:
 Floor 0 39.64 m² 2.4 m
 Floor 1 37.63 m² 2.4 m
 Living area: 12.51 m² (fraction 0.162)
 Front of dwelling faces: East

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
D_10	Manufacturer	Solid			
W_72	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_73	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_74	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_75	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_76	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_77	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_78	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_79	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_80	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_81	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_82	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_83	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_84	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
D_10	mm	0	0	1.2	1.97	1
W_72	16mm or more	0.7	0.63	1.4	0.55	1
W_73	16mm or more	0.7	0.63	1.4	1.46	1
W_74	16mm or more	0.7	0.63	1.4	0.94	1
W_75	16mm or more	0.7	0.63	1.4	0.73	1
W_76	16mm or more	0.7	0.63	1.4	3.18	1
W_77	16mm or more	0.7	0.63	1.4	1.46	1
W_78	16mm or more	0.7	0.63	1.4	0.94	1
W_79	16mm or more	0.7	0.63	1.4	1.32	1
W_80	16mm or more	0.7	0.63	1.4	1.46	1
W_81	16mm or more	0.7	0.63	1.4	0.82	1
W_82	16mm or more	0.7	0.63	1.4	0.64	1

SAP Input

W_83	16mm or more	0.7	0.63	1.4	0.7	1
W_84	16mm or more	0.7	0.63	1.4	2.22	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
D_10	Doors	Wall 1	East	1.97	1
W_72	Windows	Wall 1	East	0.55	1
W_73	Windows	Wall 1	South	1.46	1
W_74	Windows	Wall 1	East	0.94	1
W_75	Windows	Wall 1	East	0.73	1
W_76	Windows	Wall 1	North	3.18	1
W_77	Windows	Wall 1	South	1.46	1
W_78	Windows	Wall 1	East	0.94	1
W_79	Windows	Wall 1	North	1.32	1
W_80	Windows	Wall 1	North	1.46	1
W_81	Windows	Wall 1	East	0.82	1
W_82	Windows	Wall 1	South	0.64	1
W_83	Windows	Wall 1	North	0.7	1
W_84	Windows	Wall 1	East	2.22	1

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall 1	93.49	18.39	75.1	0.19	0	False	N/A
Roof 1	37.63	0	37.63	0.11	0		N/A
Roof 2	2.01	0	2.01	0.11	0		N/A
Floor 1	39.64			0.11			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Wall	41.72						N/A

Thermal bridges:

Thermal bridges:		User-defined (individual PSI-values) Y-Value = 0.0881			
	Length	Psi-value			
	12.23	0.3	E2	Other lintels (including other steel lintels)	
	10.41	0.04	E3	Sill	
	28.04	0.05	E4	Jamb	
	19.4	0.16	E5	Ground floor (normal)	
	17.38	0.07	E6	Intermediate floor within a dwelling	
	8.18	0.06	E10	Eaves (insulation at ceiling level)	
	9.2	0.24	E12	Gable (insulation at ceiling level)	
	15	0.09	E16	Corner (normal)	
	4.8	-0.09	E17	Corner (inverted – internal area greater than external area)	
	6	0.08	E14	Flat roof	
	0	0.3	E2		
	0	0.04	E3		
	0	0.05	E4		
	0	0.16	E5		
	0	0.07	E6		
	0	0.06	E10		
	0	0.24	E12		
	0	0.09	E16		
	0	-0.09	E17		
	0	0.06	E18		
	8.18	0.16	P1	Ground floor	
	8.18	0	P2	Intermediate floor within a dwelling	

SAP Input

0	0.16	P1	
0	0	P2	
0	0.08	R4	Ridge (vaulted ceiling)
0	0.08	R4	

Ventilation:

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

Main heating system:

Main heating system: Boiler systems with radiators or underfloor heating
 Gas boilers and oil boilers
 Fuel: mains gas
 Info Source: Boiler Database
 Database: (rev 508, product index 016841) Efficiency: Winter 87.0 % Summer: 90.0
 Brand name: Vaillant
 Model: ecoTEC plus 824
 Model qualifier: VUW GB 246/5-5
 (Combi boiler)
 Systems with radiators
 Central heating pump : 2013 or later
 Design flow temperature: Design flow temperature <=45°C
 Room-sealed
 Boiler interlock: Yes
 Delayed start

Main heating Control:

Main heating Control: Time and temperature zone control by suitable arrangement of plumbing and electrical services
 Control code: 2110

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system
 Water code: 901
 Fuel :mains gas
 No hot water cylinder
 Solar panel: False

Others:

Electricity tariff: Standard Tariff
 In Smoke Control Area: Unknown
 Conservatory: No conservatory
 Low energy lights: 100%
 Terrain type: Low rise urban / suburban
 EPC language: English
 Wind turbine: No
 Photovoltaics: Photovoltaic 1
 Installed Peak power: 2
 Tilt of collector: 45°
 Overshading: None or very little
 Collector Orientation: East

SAP Input

Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Liam Mason	Stroma Number:	STRO033679
Software Name:	Stroma FSAP 2012	Software Version:	Version: 1.0.5.58

Property Address: Plot 7

Address : Plot 7

1. Overall dwelling dimensions:

	Area(m ²)		Av. Height(m)		Volume(m ³)
Ground floor	39.64	(1a) x	2.4	(2a) =	95.14 (3a)
First floor	37.63	(1b) x	2.4	(2b) =	90.31 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	77.27	(4)			
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	185.45 (5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m ³ per hour
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0 (6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0 (6b)
Number of intermittent fans							2	x 10 =	20 (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) =	20	÷ (5) =	0.11 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction <i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			0 (11)
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)			0.36 (18)
<i>Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used</i>			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (21)

Infiltration rate modified for monthly wind speed

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

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

Wind Factor (22a)m = (22)m ÷ 4

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

0.39	0.38	0.37	0.33	0.33	0.29	0.29	0.28	0.3	0.33	0.34	0.36
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

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

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

0	(23c)
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a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) x [1 - (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)
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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)
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c) If whole house extract ventilation or positive input ventilation from outside

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

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)
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d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(24d)
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Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56	(25)
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3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m ²)	Openings m ²	Net Area A ,m ²	U-value W/m ² K	A X U (W/K)	k-value kJ/m ² -K	A X k kJ/K
Doors			1.97	x 1.2	= 2.364		(26)
Windows Type 1			0.55	x1/[1/(1.4)+ 0.04]	= 0.73		(27)
Windows Type 2			1.46	x1/[1/(1.4)+ 0.04]	= 1.94		(27)
Windows Type 3			0.94	x1/[1/(1.4)+ 0.04]	= 1.25		(27)
Windows Type 4			0.73	x1/[1/(1.4)+ 0.04]	= 0.97		(27)
Windows Type 5			3.18	x1/[1/(1.4)+ 0.04]	= 4.22		(27)
Windows Type 6			1.46	x1/[1/(1.4)+ 0.04]	= 1.94		(27)
Windows Type 7			0.94	x1/[1/(1.4)+ 0.04]	= 1.25		(27)
Windows Type 8			1.32	x1/[1/(1.4)+ 0.04]	= 1.75		(27)
Windows Type 9			1.46	x1/[1/(1.4)+ 0.04]	= 1.94		(27)
Windows Type 10			0.82	x1/[1/(1.4)+ 0.04]	= 1.09		(27)
Windows Type 11			0.64	x1/[1/(1.4)+ 0.04]	= 0.85		(27)
Windows Type 12			0.7	x1/[1/(1.4)+ 0.04]	= 0.93		(27)
Windows Type 13			2.22	x1/[1/(1.4)+ 0.04]	= 2.94		(27)
Floor			39.64	x 0.11	= 4.3604		(28)
Walls	93.49	18.39	75.1	x 0.19	= 14.27		(29)
Roof Type1	37.63	0	37.63	x 0.11	= 4.14		(30)

SAP WorkSheet: New dwelling design stage

Roof Type2 x = (30)

Total area of elements, m² (31)

Party wall x = (32)

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

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

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

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

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low (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 (36)

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

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.2	35.02	34.85	34.02	33.87	33.15	33.15	33.02	33.43	33.87	34.18	34.51	(38)

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

(39)m=	97.54	97.36	97.18	96.36	96.21	95.49	95.49	95.36	95.77	96.21	96.52	96.84	
Average = Sum(39) _{1...12} / 12 =												<input type="text" value="96.36"/> (39)	

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

(40)m=	1.26	1.26	1.26	1.25	1.25	1.24	1.24	1.23	1.24	1.25	1.25	1.25	
Average = Sum(40) _{1...12} / 12 =												<input type="text" value="1.25"/> (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 (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 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	100.56	96.9	93.24	89.59	85.93	82.27	82.27	85.93	89.59	93.24	96.9	100.56	
Total = Sum(44) _{1...12} =												<input type="text" value="1096.97"/> (44)	

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

(45)m=	149.12	130.42	134.58	117.33	112.58	97.15	90.03	103.31	104.54	121.83	132.99	144.42	
Total = Sum(45) _{1...12} =												<input type="text" value="1438.3"/> (45)	

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

(46)m= (46)

Water storage loss:

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

SAP WorkSheet: New dwelling design stage

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) x (41)m

(56)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (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
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 (57)

Primary circuit loss (annual) from Table 3

0

 (58)

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

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

(61)m=

25.84	23.31	25.77	24.89	25.68	24.81	25.61	25.66	24.85	25.73	24.96	25.83
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (61)

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

(62)m=

174.96	153.74	160.35	142.22	138.27	121.96	115.64	128.96	129.39	147.56	157.95	170.24
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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=

174.96	153.74	160.35	142.22	138.27	121.96	115.64	128.96	129.39	147.56	157.95	170.24
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

1741.26

 (64)

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

(65)m=

56.04	49.19	51.19	45.24	43.86	38.51	36.34	40.76	40.97	46.94	50.46	54.47
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
144.54	144.54	144.54	144.54	144.54	144.54	144.54	144.54	144.54	144.54	144.54	144.54

 (66)

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

(67)m=

47.71	42.37	34.46	26.09	19.5	16.46	17.79	23.12	31.04	39.41	46	49.04
-------	-------	-------	-------	------	-------	-------	-------	-------	-------	----	-------

 (67)

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

(68)m=

318.87	322.18	313.84	296.09	273.68	252.62	238.55	235.24	243.58	261.33	283.74	304.8
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (68)

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

(69)m=

51.86	51.86	51.86	51.86	51.86	51.86	51.86	51.86	51.86	51.86	51.86	51.86
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

3	3	3	3	3	3	3	3	3	3	3	3
---	---	---	---	---	---	---	---	---	---	---	---

 (70)

SAP WorkSheet: New dwelling design stage

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

(71)m=	-96.36	-96.36	-96.36	-96.36	-96.36	-96.36	-96.36	-96.36	-96.36	-96.36	-96.36	-96.36	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	75.33	73.21	68.81	62.83	58.94	53.48	48.84	54.79	56.91	63.09	70.08	73.22	(72)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	544.95	540.8	520.15	488.05	455.17	425.61	408.22	416.2	434.57	466.88	502.86	530.09	(73)
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6. Solar gains:

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

Orientation:	Access Factor Table 6d	Area m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)							
North	0.9x	0.77	x	3.18	x	10.63	x	0.63	x	0.7	=	10.33	(74)
North	0.9x	0.77	x	1.32	x	10.63	x	0.63	x	0.7	=	4.29	(74)
North	0.9x	0.77	x	1.46	x	10.63	x	0.63	x	0.7	=	4.74	(74)
North	0.9x	0.77	x	0.7	x	10.63	x	0.63	x	0.7	=	2.27	(74)
North	0.9x	0.77	x	3.18	x	20.32	x	0.63	x	0.7	=	19.75	(74)
North	0.9x	0.77	x	1.32	x	20.32	x	0.63	x	0.7	=	8.2	(74)
North	0.9x	0.77	x	1.46	x	20.32	x	0.63	x	0.7	=	9.07	(74)
North	0.9x	0.77	x	0.7	x	20.32	x	0.63	x	0.7	=	4.35	(74)
North	0.9x	0.77	x	3.18	x	34.53	x	0.63	x	0.7	=	33.56	(74)
North	0.9x	0.77	x	1.32	x	34.53	x	0.63	x	0.7	=	13.93	(74)
North	0.9x	0.77	x	1.46	x	34.53	x	0.63	x	0.7	=	15.41	(74)
North	0.9x	0.77	x	0.7	x	34.53	x	0.63	x	0.7	=	7.39	(74)
North	0.9x	0.77	x	3.18	x	55.46	x	0.63	x	0.7	=	53.9	(74)
North	0.9x	0.77	x	1.32	x	55.46	x	0.63	x	0.7	=	22.37	(74)
North	0.9x	0.77	x	1.46	x	55.46	x	0.63	x	0.7	=	24.75	(74)
North	0.9x	0.77	x	0.7	x	55.46	x	0.63	x	0.7	=	11.87	(74)
North	0.9x	0.77	x	3.18	x	74.72	x	0.63	x	0.7	=	72.61	(74)
North	0.9x	0.77	x	1.32	x	74.72	x	0.63	x	0.7	=	30.14	(74)
North	0.9x	0.77	x	1.46	x	74.72	x	0.63	x	0.7	=	33.34	(74)
North	0.9x	0.77	x	0.7	x	74.72	x	0.63	x	0.7	=	15.98	(74)
North	0.9x	0.77	x	3.18	x	79.99	x	0.63	x	0.7	=	77.73	(74)
North	0.9x	0.77	x	1.32	x	79.99	x	0.63	x	0.7	=	32.27	(74)
North	0.9x	0.77	x	1.46	x	79.99	x	0.63	x	0.7	=	35.69	(74)
North	0.9x	0.77	x	0.7	x	79.99	x	0.63	x	0.7	=	17.11	(74)
North	0.9x	0.77	x	3.18	x	74.68	x	0.63	x	0.7	=	72.57	(74)
North	0.9x	0.77	x	1.32	x	74.68	x	0.63	x	0.7	=	30.13	(74)
North	0.9x	0.77	x	1.46	x	74.68	x	0.63	x	0.7	=	33.32	(74)
North	0.9x	0.77	x	0.7	x	74.68	x	0.63	x	0.7	=	15.98	(74)
North	0.9x	0.77	x	3.18	x	59.25	x	0.63	x	0.7	=	57.58	(74)
North	0.9x	0.77	x	1.32	x	59.25	x	0.63	x	0.7	=	23.9	(74)

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North	0.9x	0.77	x	1.46	x	59.25	x	0.63	x	0.7	=	26.44	(74)
North	0.9x	0.77	x	0.7	x	59.25	x	0.63	x	0.7	=	12.67	(74)
North	0.9x	0.77	x	3.18	x	41.52	x	0.63	x	0.7	=	40.35	(74)
North	0.9x	0.77	x	1.32	x	41.52	x	0.63	x	0.7	=	16.75	(74)
North	0.9x	0.77	x	1.46	x	41.52	x	0.63	x	0.7	=	18.52	(74)
North	0.9x	0.77	x	0.7	x	41.52	x	0.63	x	0.7	=	8.88	(74)
North	0.9x	0.77	x	3.18	x	24.19	x	0.63	x	0.7	=	23.51	(74)
North	0.9x	0.77	x	1.32	x	24.19	x	0.63	x	0.7	=	9.76	(74)
North	0.9x	0.77	x	1.46	x	24.19	x	0.63	x	0.7	=	10.79	(74)
North	0.9x	0.77	x	0.7	x	24.19	x	0.63	x	0.7	=	5.17	(74)
North	0.9x	0.77	x	3.18	x	13.12	x	0.63	x	0.7	=	12.75	(74)
North	0.9x	0.77	x	1.32	x	13.12	x	0.63	x	0.7	=	5.29	(74)
North	0.9x	0.77	x	1.46	x	13.12	x	0.63	x	0.7	=	5.85	(74)
North	0.9x	0.77	x	0.7	x	13.12	x	0.63	x	0.7	=	2.81	(74)
North	0.9x	0.77	x	3.18	x	8.86	x	0.63	x	0.7	=	8.61	(74)
North	0.9x	0.77	x	1.32	x	8.86	x	0.63	x	0.7	=	3.58	(74)
North	0.9x	0.77	x	1.46	x	8.86	x	0.63	x	0.7	=	3.96	(74)
North	0.9x	0.77	x	0.7	x	8.86	x	0.63	x	0.7	=	1.9	(74)
East	0.9x	0.77	x	0.55	x	19.64	x	0.63	x	0.7	=	3.3	(76)
East	0.9x	0.77	x	0.94	x	19.64	x	0.63	x	0.7	=	5.64	(76)
East	0.9x	0.77	x	0.73	x	19.64	x	0.63	x	0.7	=	4.38	(76)
East	0.9x	0.77	x	0.94	x	19.64	x	0.63	x	0.7	=	5.64	(76)
East	0.9x	0.77	x	0.82	x	19.64	x	0.63	x	0.7	=	4.92	(76)
East	0.9x	0.77	x	2.22	x	19.64	x	0.63	x	0.7	=	13.33	(76)
East	0.9x	0.77	x	0.55	x	38.42	x	0.63	x	0.7	=	6.46	(76)
East	0.9x	0.77	x	0.94	x	38.42	x	0.63	x	0.7	=	11.04	(76)
East	0.9x	0.77	x	0.73	x	38.42	x	0.63	x	0.7	=	8.57	(76)
East	0.9x	0.77	x	0.94	x	38.42	x	0.63	x	0.7	=	11.04	(76)
East	0.9x	0.77	x	0.82	x	38.42	x	0.63	x	0.7	=	9.63	(76)
East	0.9x	0.77	x	2.22	x	38.42	x	0.63	x	0.7	=	26.07	(76)
East	0.9x	0.77	x	0.55	x	63.27	x	0.63	x	0.7	=	10.64	(76)
East	0.9x	0.77	x	0.94	x	63.27	x	0.63	x	0.7	=	18.18	(76)
East	0.9x	0.77	x	0.73	x	63.27	x	0.63	x	0.7	=	14.12	(76)
East	0.9x	0.77	x	0.94	x	63.27	x	0.63	x	0.7	=	18.18	(76)
East	0.9x	0.77	x	0.82	x	63.27	x	0.63	x	0.7	=	15.86	(76)
East	0.9x	0.77	x	2.22	x	63.27	x	0.63	x	0.7	=	42.93	(76)
East	0.9x	0.77	x	0.55	x	92.28	x	0.63	x	0.7	=	15.51	(76)
East	0.9x	0.77	x	0.94	x	92.28	x	0.63	x	0.7	=	26.51	(76)
East	0.9x	0.77	x	0.73	x	92.28	x	0.63	x	0.7	=	20.59	(76)
East	0.9x	0.77	x	0.94	x	92.28	x	0.63	x	0.7	=	26.51	(76)
East	0.9x	0.77	x	0.82	x	92.28	x	0.63	x	0.7	=	23.13	(76)

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East	0.9x	0.77	x	2.22	x	92.28	x	0.63	x	0.7	=	62.61	(76)
East	0.9x	0.77	x	0.55	x	113.09	x	0.63	x	0.7	=	19.01	(76)
East	0.9x	0.77	x	0.94	x	113.09	x	0.63	x	0.7	=	32.49	(76)
East	0.9x	0.77	x	0.73	x	113.09	x	0.63	x	0.7	=	25.23	(76)
East	0.9x	0.77	x	0.94	x	113.09	x	0.63	x	0.7	=	32.49	(76)
East	0.9x	0.77	x	0.82	x	113.09	x	0.63	x	0.7	=	28.34	(76)
East	0.9x	0.77	x	2.22	x	113.09	x	0.63	x	0.7	=	76.73	(76)
East	0.9x	0.77	x	0.55	x	115.77	x	0.63	x	0.7	=	19.46	(76)
East	0.9x	0.77	x	0.94	x	115.77	x	0.63	x	0.7	=	33.26	(76)
East	0.9x	0.77	x	0.73	x	115.77	x	0.63	x	0.7	=	25.83	(76)
East	0.9x	0.77	x	0.94	x	115.77	x	0.63	x	0.7	=	33.26	(76)
East	0.9x	0.77	x	0.82	x	115.77	x	0.63	x	0.7	=	29.01	(76)
East	0.9x	0.77	x	2.22	x	115.77	x	0.63	x	0.7	=	78.55	(76)
East	0.9x	0.77	x	0.55	x	110.22	x	0.63	x	0.7	=	18.53	(76)
East	0.9x	0.77	x	0.94	x	110.22	x	0.63	x	0.7	=	31.66	(76)
East	0.9x	0.77	x	0.73	x	110.22	x	0.63	x	0.7	=	24.59	(76)
East	0.9x	0.77	x	0.94	x	110.22	x	0.63	x	0.7	=	31.66	(76)
East	0.9x	0.77	x	0.82	x	110.22	x	0.63	x	0.7	=	27.62	(76)
East	0.9x	0.77	x	2.22	x	110.22	x	0.63	x	0.7	=	74.78	(76)
East	0.9x	0.77	x	0.55	x	94.68	x	0.63	x	0.7	=	15.91	(76)
East	0.9x	0.77	x	0.94	x	94.68	x	0.63	x	0.7	=	27.2	(76)
East	0.9x	0.77	x	0.73	x	94.68	x	0.63	x	0.7	=	21.12	(76)
East	0.9x	0.77	x	0.94	x	94.68	x	0.63	x	0.7	=	27.2	(76)
East	0.9x	0.77	x	0.82	x	94.68	x	0.63	x	0.7	=	23.73	(76)
East	0.9x	0.77	x	2.22	x	94.68	x	0.63	x	0.7	=	64.23	(76)
East	0.9x	0.77	x	0.55	x	73.59	x	0.63	x	0.7	=	12.37	(76)
East	0.9x	0.77	x	0.94	x	73.59	x	0.63	x	0.7	=	21.14	(76)
East	0.9x	0.77	x	0.73	x	73.59	x	0.63	x	0.7	=	16.42	(76)
East	0.9x	0.77	x	0.94	x	73.59	x	0.63	x	0.7	=	21.14	(76)
East	0.9x	0.77	x	0.82	x	73.59	x	0.63	x	0.7	=	18.44	(76)
East	0.9x	0.77	x	2.22	x	73.59	x	0.63	x	0.7	=	49.93	(76)
East	0.9x	0.77	x	0.55	x	45.59	x	0.63	x	0.7	=	7.66	(76)
East	0.9x	0.77	x	0.94	x	45.59	x	0.63	x	0.7	=	13.1	(76)
East	0.9x	0.77	x	0.73	x	45.59	x	0.63	x	0.7	=	10.17	(76)
East	0.9x	0.77	x	0.94	x	45.59	x	0.63	x	0.7	=	13.1	(76)
East	0.9x	0.77	x	0.82	x	45.59	x	0.63	x	0.7	=	11.42	(76)
East	0.9x	0.77	x	2.22	x	45.59	x	0.63	x	0.7	=	30.93	(76)
East	0.9x	0.77	x	0.55	x	24.49	x	0.63	x	0.7	=	4.12	(76)
East	0.9x	0.77	x	0.94	x	24.49	x	0.63	x	0.7	=	7.04	(76)
East	0.9x	0.77	x	0.73	x	24.49	x	0.63	x	0.7	=	5.46	(76)
East	0.9x	0.77	x	0.94	x	24.49	x	0.63	x	0.7	=	7.04	(76)

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East	0.9x	0.77	x	0.82	x	24.49	x	0.63	x	0.7	=	6.14	(76)
East	0.9x	0.77	x	2.22	x	24.49	x	0.63	x	0.7	=	16.61	(76)
East	0.9x	0.77	x	0.55	x	16.15	x	0.63	x	0.7	=	2.71	(76)
East	0.9x	0.77	x	0.94	x	16.15	x	0.63	x	0.7	=	4.64	(76)
East	0.9x	0.77	x	0.73	x	16.15	x	0.63	x	0.7	=	3.6	(76)
East	0.9x	0.77	x	0.94	x	16.15	x	0.63	x	0.7	=	4.64	(76)
East	0.9x	0.77	x	0.82	x	16.15	x	0.63	x	0.7	=	4.05	(76)
East	0.9x	0.77	x	2.22	x	16.15	x	0.63	x	0.7	=	10.96	(76)
South	0.9x	0.77	x	1.46	x	46.75	x	0.63	x	0.7	=	20.86	(78)
South	0.9x	0.77	x	1.46	x	46.75	x	0.63	x	0.7	=	20.86	(78)
South	0.9x	0.77	x	0.64	x	46.75	x	0.63	x	0.7	=	9.14	(78)
South	0.9x	0.77	x	1.46	x	76.57	x	0.63	x	0.7	=	34.16	(78)
South	0.9x	0.77	x	1.46	x	76.57	x	0.63	x	0.7	=	34.16	(78)
South	0.9x	0.77	x	0.64	x	76.57	x	0.63	x	0.7	=	14.98	(78)
South	0.9x	0.77	x	1.46	x	97.53	x	0.63	x	0.7	=	43.52	(78)
South	0.9x	0.77	x	1.46	x	97.53	x	0.63	x	0.7	=	43.52	(78)
South	0.9x	0.77	x	0.64	x	97.53	x	0.63	x	0.7	=	19.08	(78)
South	0.9x	0.77	x	1.46	x	110.23	x	0.63	x	0.7	=	49.19	(78)
South	0.9x	0.77	x	1.46	x	110.23	x	0.63	x	0.7	=	49.19	(78)
South	0.9x	0.77	x	0.64	x	110.23	x	0.63	x	0.7	=	21.56	(78)
South	0.9x	0.77	x	1.46	x	114.87	x	0.63	x	0.7	=	51.25	(78)
South	0.9x	0.77	x	1.46	x	114.87	x	0.63	x	0.7	=	51.25	(78)
South	0.9x	0.77	x	0.64	x	114.87	x	0.63	x	0.7	=	22.47	(78)
South	0.9x	0.77	x	1.46	x	110.55	x	0.63	x	0.7	=	49.33	(78)
South	0.9x	0.77	x	1.46	x	110.55	x	0.63	x	0.7	=	49.33	(78)
South	0.9x	0.77	x	0.64	x	110.55	x	0.63	x	0.7	=	21.62	(78)
South	0.9x	0.77	x	1.46	x	108.01	x	0.63	x	0.7	=	48.19	(78)
South	0.9x	0.77	x	1.46	x	108.01	x	0.63	x	0.7	=	48.19	(78)
South	0.9x	0.77	x	0.64	x	108.01	x	0.63	x	0.7	=	21.13	(78)
South	0.9x	0.77	x	1.46	x	104.89	x	0.63	x	0.7	=	46.8	(78)
South	0.9x	0.77	x	1.46	x	104.89	x	0.63	x	0.7	=	46.8	(78)
South	0.9x	0.77	x	0.64	x	104.89	x	0.63	x	0.7	=	20.52	(78)
South	0.9x	0.77	x	1.46	x	101.89	x	0.63	x	0.7	=	45.46	(78)
South	0.9x	0.77	x	1.46	x	101.89	x	0.63	x	0.7	=	45.46	(78)
South	0.9x	0.77	x	0.64	x	101.89	x	0.63	x	0.7	=	19.93	(78)
South	0.9x	0.77	x	1.46	x	82.59	x	0.63	x	0.7	=	36.85	(78)
South	0.9x	0.77	x	1.46	x	82.59	x	0.63	x	0.7	=	36.85	(78)
South	0.9x	0.77	x	0.64	x	82.59	x	0.63	x	0.7	=	16.15	(78)
South	0.9x	0.77	x	1.46	x	55.42	x	0.63	x	0.7	=	24.73	(78)
South	0.9x	0.77	x	1.46	x	55.42	x	0.63	x	0.7	=	24.73	(78)
South	0.9x	0.77	x	0.64	x	55.42	x	0.63	x	0.7	=	10.84	(78)

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South	0.9x	0.77	x	1.46	x	40.4	x	0.63	x	0.7	=	18.03	(78)
South	0.9x	0.77	x	1.46	x	40.4	x	0.63	x	0.7	=	18.03	(78)
South	0.9x	0.77	x	0.64	x	40.4	x	0.63	x	0.7	=	7.9	(78)

Solar gains in watts, calculated for each month

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

(83)m=	109.72	197.46	296.29	407.68	491.34	502.44	478.35	414.1	334.79	225.47	133.39	92.6	(83)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------	------

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

(84)m=	654.67	738.26	816.44	895.72	946.51	928.04	886.58	830.3	769.36	692.35	636.25	622.69	(84)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.93	0.91	0.87	0.8	0.69	0.56	0.43	0.47	0.66	0.83	0.91	0.94	(86)

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

(87)m=	18.74	19.01	19.45	19.99	20.47	20.79	20.92	20.89	20.65	20.05	19.3	18.68	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	------

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

(88)m=	19.87	19.87	19.87	19.88	19.88	19.89	19.89	19.89	19.89	19.88	19.88	19.88	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.92	0.9	0.85	0.77	0.65	0.48	0.34	0.38	0.59	0.8	0.9	0.93	(89)
--------	------	-----	------	------	------	------	------	------	------	-----	-----	------	------

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

(90)m=	16.89	17.28	17.9	18.67	19.3	19.7	19.84	19.82	19.56	18.77	17.71	16.81	(90)
--------	-------	-------	------	-------	------	------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.16

 (91)

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

(92)m=	17.19	17.56	18.15	18.89	19.49	19.88	20.01	20	19.74	18.97	17.97	17.11	(92)
--------	-------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	------

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

(93)m=	17.04	17.41	18	18.74	19.34	19.73	19.86	19.85	19.59	18.82	17.82	16.96	(93)
--------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.89	0.86	0.81	0.73	0.62	0.47	0.33	0.37	0.57	0.76	0.86	0.9	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	-----	------

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

(95)m=	583.19	635.78	664.04	656.54	585.72	437.29	296.49	308.3	437.99	525.53	546.41	560.43	(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)
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Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m – (96)m]

(97)m=	1242.76	1217.99	1117.98	947.99	735.26	489.72	311.72	328.66	525.39	791.09	1034.27	1236.04	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	490.72	391.24	337.73	209.84	111.25	0	0	0	0	197.57	351.25	502.65	
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} =

2592.27

 (98)

Space heating requirement in kWh/m²/year

33.55

 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	$(202) = 1 - (201) =$	1	(202)
Fraction of total heating from main system 1	$(204) = (202) \times [1 - (203)] =$	1	(204)
Efficiency of main space heating system 1		92.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

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

Space heating requirement (calculated above)

490.72	391.24	337.73	209.84	111.25	0	0	0	0	197.57	351.25	502.65
--------	--------	--------	--------	--------	---	---	---	---	--------	--------	--------

$(211)_m = \{[(98)_m \times (204)]\} \times 100 \div (206)$ (211)

531.08	423.42	365.51	227.1	120.4	0	0	0	0	213.83	380.14	544
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 2805.49 (211)

Space heating fuel (secondary), kWh/month

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

(215)_m =

0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---

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

Water heating

Output from water heater (calculated above)

174.96	153.74	160.35	142.22	138.27	121.96	115.64	128.96	129.39	147.56	157.95	170.24
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Efficiency of water heater 87 (216)

(217)_m = 89.19 89.13 89.01 88.76 88.31 87 87 87 87 88.69 89.05 89.22 (217)

Fuel for water heating, kWh/month

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

(219)_m =

196.16	172.48	180.15	160.23	156.57	140.19	132.92	148.23	148.73	166.38	177.37	190.81
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1...12} = 1970.21 (219)

Annual totals

	kWh/year	kWh/year
Space heating fuel used, main system 1	2805.49	
Water heating fuel used		1970.21

Electricity for pumps, fans and electric keep-hot

central heating pump: 30 (230c)

boiler with a fan-assisted flue 45 (230e)

Total electricity for the above, kWh/year sum of (230a)...(230g) = 75 (231)

Electricity for lighting 337.02 (232)

Electricity generated by PVs -1364.85 (233)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) = 3822.88 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) ×	3.48	× 0.01 = 97.63 (240)
Space heating - main system 2	(213) ×	0	× 0.01 = 0 (241)

SAP WorkSheet: New dwelling design stage

Space heating - secondary	(215) x	<div style="border: 1px solid black; padding: 2px;">13.19</div>	x 0.01 =	<div style="border: 1px solid black; padding: 2px;">0</div>	(242)
Water heating cost (other fuel)	(219)	<div style="border: 1px solid black; padding: 2px;">3.48</div>	x 0.01 =	<div style="border: 1px solid black; padding: 2px;">68.56</div>	(247)
Pumps, fans and electric keep-hot	(231)	<div style="border: 1px solid black; padding: 2px;">13.19</div>	x 0.01 =	<div style="border: 1px solid black; padding: 2px;">9.89</div>	(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)	<div style="border: 1px solid black; padding: 2px;">13.19</div>	x 0.01 =	<div style="border: 1px solid black; padding: 2px;">44.45</div>	(250)
Additional standing charges (Table 12)				<div style="border: 1px solid black; padding: 2px;">120</div>	(251)
	one of (233) to (235) x	<div style="border: 1px solid black; padding: 2px;">13.19</div>	x 0.01 =	<div style="border: 1px solid black; padding: 2px;">-180.02</div>	(252)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)...(254) =			<div style="border: 1px solid black; padding: 2px;">160.52</div>	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)				<div style="border: 1px solid black; padding: 2px;">0.42</div>	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =			<div style="border: 1px solid black; padding: 2px;">0.55</div>	(257)
SAP rating (Section 12)				<div style="border: 1px solid black; padding: 2px;">92.31</div>	(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	<div style="border: 1px solid black; padding: 2px;">0.216</div>	=	<div style="border: 1px solid black; padding: 2px;">605.99</div>	(261)
Space heating (secondary)	(215) x	<div style="border: 1px solid black; padding: 2px;">0.519</div>	=	<div style="border: 1px solid black; padding: 2px;">0</div>	(263)
Water heating	(219) x	<div style="border: 1px solid black; padding: 2px;">0.216</div>	=	<div style="border: 1px solid black; padding: 2px;">425.57</div>	(264)
Space and water heating	(261) + (262) + (263) + (264) =			<div style="border: 1px solid black; padding: 2px;">1031.55</div>	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	<div style="border: 1px solid black; padding: 2px;">0.519</div>	=	<div style="border: 1px solid black; padding: 2px;">38.93</div>	(267)
Electricity for lighting	(232) x	<div style="border: 1px solid black; padding: 2px;">0.519</div>	=	<div style="border: 1px solid black; padding: 2px;">174.91</div>	(268)
Energy saving/generation technologies Item 1		<div style="border: 1px solid black; padding: 2px;">0.519</div>	=	<div style="border: 1px solid black; padding: 2px;">-708.36</div>	(269)
Total CO2, kg/year			sum of (265)...(271) =	<div style="border: 1px solid black; padding: 2px;">537.04</div>	(272)
CO2 emissions per m²			(272) ÷ (4) =	<div style="border: 1px solid black; padding: 2px;">6.95</div>	(273)
El rating (section 14)				<div style="border: 1px solid black; padding: 2px;">94</div>	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year
Space heating (main system 1)	(211) x	<div style="border: 1px solid black; padding: 2px;">1.22</div>	=	<div style="border: 1px solid black; padding: 2px;">3422.7</div>	(261)
Space heating (secondary)	(215) x	<div style="border: 1px solid black; padding: 2px;">3.07</div>	=	<div style="border: 1px solid black; padding: 2px;">0</div>	(263)
Energy for water heating	(219) x	<div style="border: 1px solid black; padding: 2px;">1.22</div>	=	<div style="border: 1px solid black; padding: 2px;">2403.66</div>	(264)
Space and water heating	(261) + (262) + (263) + (264) =			<div style="border: 1px solid black; padding: 2px;">5826.36</div>	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	<div style="border: 1px solid black; padding: 2px;">3.07</div>	=	<div style="border: 1px solid black; padding: 2px;">230.25</div>	(267)
Electricity for lighting	(232) x	<div style="border: 1px solid black; padding: 2px;">0</div>	=	<div style="border: 1px solid black; padding: 2px;">1034.66</div>	(268)

SAP WorkSheet: New dwelling design stage

Energy saving/generation technologies

Item 1

3.07

=

-4190.08

(269)

'Total Primary Energy

sum of (265)...(271) =

2901.19

(272)

Primary energy kWh/m²/year

(272) ÷ (4) =

37.55

(273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 29 November 2022

Property Details: Plot 7

Dwelling type:	Semi-detached House
Located in:	England
Region:	East Anglia
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Low
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	244.79	(P1)
Transmission heat loss coefficient:	62.3	
Summer heat loss coefficient:	307.13	(P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
East (W_72)	0	1
South (W_73)	0	1
East (W_74)	0	1
East (W_75)	0	1
North (W_76)	0	1
South (W_77)	0	1
East (W_78)	0	1
North (W_79)	0	1
North (W_80)	0	1
East (W_81)	0	1
South (W_82)	0	1
North (W_83)	0	1
East (W_84)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
East (W_72)	0.85	0.9	1	0.76	(P8)
South (W_73)	0.85	0.9	1	0.76	(P8)
East (W_74)	0.85	0.9	1	0.76	(P8)
East (W_75)	0.85	0.9	1	0.76	(P8)
North (W_76)	0.85	0.9	1	0.76	(P8)
South (W_77)	0.85	0.9	1	0.76	(P8)
East (W_78)	0.85	0.9	1	0.76	(P8)
North (W_79)	0.85	0.9	1	0.76	(P8)
North (W_80)	0.85	0.9	1	0.76	(P8)
East (W_81)	0.85	0.9	1	0.76	(P8)
South (W_82)	0.85	0.9	1	0.76	(P8)
North (W_83)	0.85	0.9	1	0.76	(P8)
East (W_84)	0.85	0.9	1	0.76	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
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SAP 2012 Overheating Assessment

East (W_72)	0.9 x	0.55	119.47	0.63	0.7	0.76	19.95	
South (W_73)	0.9 x	1.46	114.84	0.63	0.7	0.76	50.91	
East (W_74)	0.9 x	0.94	119.47	0.63	0.7	0.76	34.1	
East (W_75)	0.9 x	0.73	119.47	0.63	0.7	0.76	26.48	
North (W_76)	0.9 x	3.18	82.12	0.63	0.7	0.76	79.29	
South (W_77)	0.9 x	1.46	114.84	0.63	0.7	0.76	50.91	
East (W_78)	0.9 x	0.94	119.47	0.63	0.7	0.76	34.1	
North (W_79)	0.9 x	1.32	82.12	0.63	0.7	0.76	32.91	
North (W_80)	0.9 x	1.46	82.12	0.63	0.7	0.76	36.41	
East (W_81)	0.9 x	0.82	119.47	0.63	0.7	0.76	29.75	
South (W_82)	0.9 x	0.64	114.84	0.63	0.7	0.76	22.32	
North (W_83)	0.9 x	0.7	82.12	0.63	0.7	0.76	17.45	
East (W_84)	0.9 x	2.22	119.47	0.63	0.7	0.76	80.53	
Total							515.1	(P3/P4)

Internal gains:

	June	July	August
Internal gains	422.61	405.22	413.2
Total summer gains	969.06	920.33	862.36 (P5)
Summer gain/loss ratio	3.16	3	2.81 (P6)
Mean summer external temperature (East Anglia)	15.4	17.6	17.6
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	19.86	21.9	21.71 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight

Assessment of likelihood of high internal temperature: Slight