Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.58
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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 31

Address : Plot 31

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)	18.5 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	8.47 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.6 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	48.2 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	

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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

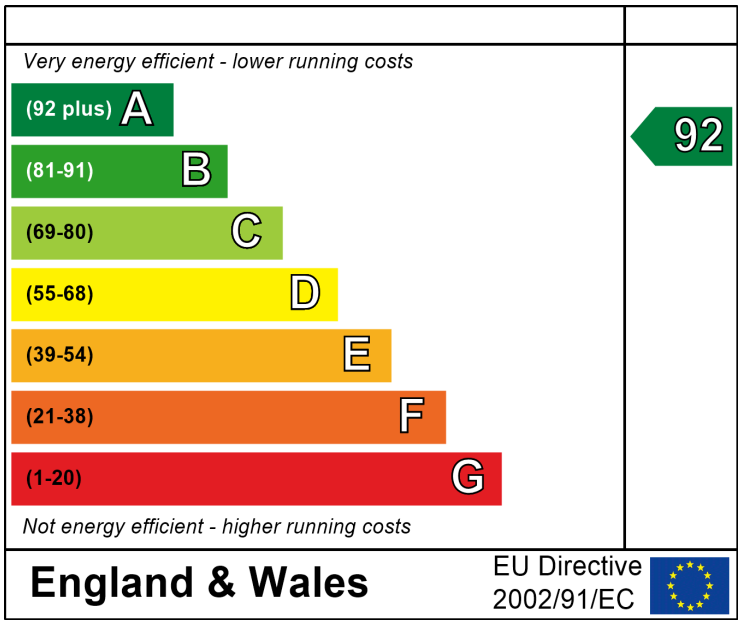
Plot 31

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

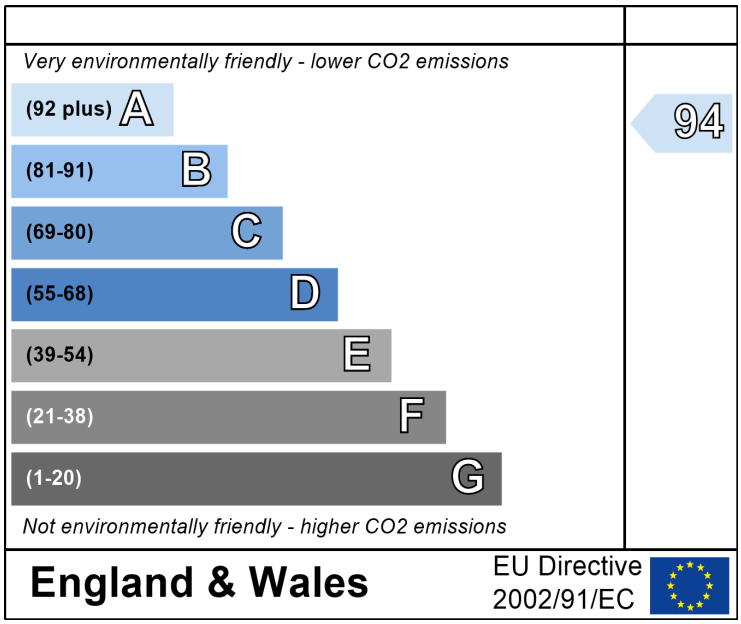
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



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

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

SAP Input

Property Details: Plot 31

Address:	Plot 31
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:	12.18 m² (fraction 0.158)
Front of dwelling faces:	South

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
D_16	Manufacturer	Solid			
W_137	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_138	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_139	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_140	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_141	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_142	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_143	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_144	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_145	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_146	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_147	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_148	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	
W_149	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
D_16	mm	0	0	1.2	1.97	1
W_137	16mm or more	0.7	0.63	1.4	0.55	1
W_138	16mm or more	0.7	0.63	1.4	1.46	1
W_139	16mm or more	0.7	0.63	1.4	0.94	1
W_140	16mm or more	0.7	0.63	1.4	0.73	1
W_141	16mm or more	0.7	0.63	1.4	3.18	1
W_142	16mm or more	0.7	0.63	1.4	1.46	1
W_143	16mm or more	0.7	0.63	1.4	0.94	1
W_144	16mm or more	0.7	0.63	1.4	1.32	1
W_145	16mm or more	0.7	0.63	1.4	1.46	1
W_146	16mm or more	0.7	0.63	1.4	0.82	1
W_147	16mm or more	0.7	0.63	1.4	0.64	1

SAP Input

W_148	16mm or more	0.7	0.63	1.4	0.7	1
W_149	16mm or more	0.7	0.63	1.4	2.22	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
D_16	Doors	Wall 1	East	1.97	1
W_137	Windows	Wall 1	East	0.55	1
W_138	Windows	Wall 1	South	1.46	1
W_139	Windows	Wall 1	East	0.94	1
W_140	Windows	Wall 1	East	0.73	1
W_141	Windows	Wall 1	North	3.18	1
W_142	Windows	Wall 1	South	1.46	1
W_143	Windows	Wall 1	East	0.94	1
W_144	Windows	Wall 1	North	1.32	1
W_145	Windows	Wall 1	North	1.46	1
W_146	Windows	Wall 1	East	0.82	1
W_147	Windows	Wall 1	South	0.64	1
W_148	Windows	Wall 1	North	0.7	1
W_149	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:
External Elements							
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
Internal Elements							
Party Elements							
Party Wall	41.72						N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0891

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)
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
0	0.16	P1	

SAP Input

0	0	P2	
8.18	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:	0
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
Unknown
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: 1.5
Tilt of collector: 45°
Overshading: None or very little
Collector Orientation: South

Assess Zero Carbon Home: No

SAP Input

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 31

Address : Plot 31

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
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		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.25	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.21	(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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	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	
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)

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Roof Type2	2.01	0	2.01	x	0.11	=	0.22		(30)
Total area of elements, m²			172.77						(31)
Party wall			41.72	x	0	=	0		(32)

** 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) = 47.12 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15982.16 (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 15.39 (36)

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

Total fabric heat loss (33) + (36) = 62.51 (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=	32.85	32.76	32.67	32.27	32.2	31.85	31.85	31.78	31.98	32.2	32.35	32.51	(38)

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

(39)m=	95.36	95.27	95.18	94.78	94.71	94.36	94.36	94.29	94.49	94.71	94.86	95.02	

Average = Sum(39)$_{1...12}$ /12= 94.78 (39)

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

(40)m=	1.23	1.23	1.23	1.23	1.23	1.22	1.22	1.22	1.22	1.23	1.23	1.23	

Average = Sum(40)$_{1...12}$ /12= 1.23 (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 2.41 (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 91.41 (43)

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

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

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

(44)m=	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)$_{1...12}$ = 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)$_{1...12}$ = 1438.3 (45)

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

(46)m=	22.37	19.56	20.19	17.6	16.89	14.57	13.5	15.5	15.68	18.27	19.95	21.66	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (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) × (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=	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 × (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 ´ [0.85 × (45)m + (61)m] + 0.8 x [(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

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

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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)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	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	0.55	0.43	0.47	0.65	0.83	0.91	0.94	(86)

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

(87)m=	18.79	19.06	19.49	20.02	20.48	20.79	20.92	20.9	20.66	20.07	19.33	18.73	(87)

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

(88)m=	19.89	19.89	19.89	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	(88)

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

(89)m=	0.92	0.9	0.85	0.77	0.64	0.48	0.33	0.37	0.59	0.8	0.89	0.93	(89)

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

(90)m=	16.99	17.37	17.98	18.73	19.34	19.72	19.85	19.84	19.58	18.81	17.77	16.89	(90)

fLA = Living area ÷ (4) = 0.16 (91)

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

(92)m=	17.27	17.64	18.22	18.93	19.52	19.89	20.02	20	19.75	19.01	18.02	17.18	(92)

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

(93)m=	17.12	17.49	18.07	18.78	19.37	19.74	19.87	19.85	19.6	18.86	17.87	17.03	(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=	582.85	635.1	662.77	654.61	582.83	434.65	294.22	306.19	435.81	524.32	545.92	560.2	(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=	1222.9	1199.27	1101.43	936.52	726.49	485.02	308.73	325.68	520.02	782.14	1021.5	1219.25	(97)

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

(98)m=	476.2	379.12	326.36	202.98	106.88	0	0	0	0	191.82	342.42	490.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2516.1 (98)

Space heating requirement in kWh/m²/year 32.56 (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) × [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)													
	476.2	379.12	326.36	202.98	106.88	0	0	0	0	191.82	342.42	490.33	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	515.37	410.3	353.2	219.67	115.67	0	0	0	0	207.59	370.58	530.66	

Total (kWh/year) =Sum(211)$_{1..5,10...12}$= 2723.06 (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)

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

Efficiency of water heater 87 (216)

(217)m=	89.17	89.11	88.99	88.74	88.28	87	87	87	87	88.67	89.03	89.21	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	196.2	172.52	180.19	160.27	156.62	140.19	132.92	148.23	148.73	166.42	177.41	190.84	

Total = Sum(219a)$_{1...12}$ = 1970.54 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2723.06
Water heating fuel used		1970.54
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		-1281.68 (233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3823.93 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)	**Fuel Cost** £/year
Space heating - main system 1	(211) x	3.48 x 0.01 =	94.76 (240)
Space heating - main system 2	(213) x	0 x 0.01 =	0 (241)

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Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	68.57	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(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 =	44.45	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	-169.05	(252)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)…(254) =			168.63	(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] =	0.58	(257)
SAP rating (Section 12)		91.92	(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	0.216	=	588.18	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	425.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1013.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	174.91	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-665.19	(269)
Total CO2, kg/year	sum of (265)…(271) =			562.46	(272)
CO2 emissions per m²	(272) ÷ (4) =			7.28	(273)
EI rating (section 14)				94	(274)

13a. Primary Energy

		Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3322.13	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2404.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5726.18	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1034.66	(268)

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Energy saving/generation technologies				
Item 1	3.07	=	-3934.77	(269)
‘Total Primary Energy	sum of (265)…(271) =		3056.32	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =		39.55	(273)

SAP 2012 Overheating Assessment

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

Property Details: Plot 31

Dwelling type:	Semi-detached House
Located in:	England
Region:	East Anglia
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	South
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:	62.5	
Summer heat loss coefficient:	307.3	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
East (W_137)	0	1
South (W_138)	0	1
East (W_139)	0	1
East (W_140)	0	1
North (W_141)	0	1
South (W_142)	0	1
East (W_143)	0	1
North (W_144)	0	1
North (W_145)	0	1
East (W_146)	0	1
South (W_147)	0	1
North (W_148)	0	1
East (W_149)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
East (W_137)	0.85	0.9	1	0.76	**(P8)**
South (W_138)	0.85	0.9	1	0.76	**(P8)**
East (W_139)	0.85	0.9	1	0.76	**(P8)**
East (W_140)	0.85	0.9	1	0.76	**(P8)**
North (W_141)	0.85	0.9	1	0.76	**(P8)**
South (W_142)	0.85	0.9	1	0.76	**(P8)**
East (W_143)	0.85	0.9	1	0.76	**(P8)**
North (W_144)	0.85	0.9	1	0.76	**(P8)**
North (W_145)	0.85	0.9	1	0.76	**(P8)**
East (W_146)	0.85	0.9	1	0.76	**(P8)**
South (W_147)	0.85	0.9	1	0.76	**(P8)**
North (W_148)	0.85	0.9	1	0.76	**(P8)**
East (W_149)	0.85	0.9	1	0.76	**(P8)**

Solar gains:

Orientation	**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**

SAP 2012 Overheating Assessment

East (W_137)	0.9 x	0.55	119.47	0.63	0.7	0.76	19.95	
South (W_138)	0.9 x	1.46	114.84	0.63	0.7	0.76	50.91	
East (W_139)	0.9 x	0.94	119.47	0.63	0.7	0.76	34.1	
East (W_140)	0.9 x	0.73	119.47	0.63	0.7	0.76	26.48	
North (W_141)	0.9 x	3.18	82.12	0.63	0.7	0.76	79.29	
South (W_142)	0.9 x	1.46	114.84	0.63	0.7	0.76	50.91	
East (W_143)	0.9 x	0.94	119.47	0.63	0.7	0.76	34.1	
North (W_144)	0.9 x	1.32	82.12	0.63	0.7	0.76	32.91	
North (W_145)	0.9 x	1.46	82.12	0.63	0.7	0.76	36.41	
East (W_146)	0.9 x	0.82	119.47	0.63	0.7	0.76	29.75	
South (W_147)	0.9 x	0.64	114.84	0.63	0.7	0.76	22.32	
North (W_148)	0.9 x	0.7	82.12	0.63	0.7	0.76	17.45	
East (W_149)	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	3.15	2.99	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	19.85	21.89	21.71	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight