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Our Reference : YH-28

Sent By : E-Mail

30 October 2020

Dear Mark

SUSTAINABILITY STATEMENT (RENEWABLE ENERGY)

Statement By : Joe Solti Accredited SAP Assessor

Thank you for sending the drawings. We are pleased to present our report as follows.

Development Details

Site Location :	Warwick Nursery, Barnham Road, Eastergate PO20 3RT
Development :	44 New Dwellings (6 Flats + 38 Houses)
Local Authority :	Arun District Council
Policy ECC SP2 :	Energy : At Least 10% of energy from renewable or low carbon energy generation
Renewables :	Solar PV, or air source heat pumps, or a combination of the 2 (or other renewable/low carbon > 10% of total energy demand)

Baseline Demand (CO2 & Energy)

Development : 44 New Dwellings (6 Flats + 38 Houses)

Total Floor Area : Flats + Houses = 4020m²

Base CO2 Emissions : Total = 76,183 kg/year

Base Energy : Total = 289,575 kWh/year

Note 1 : Prior to renewables being added (see SAP calculations)

Note 2 : Calculations are based on SAP 2012 (Part L Building Regulations 2013)

Option 1 = Solar PV

Actual Demand (Energy)

Development : 44 New Dwellings (6 Flats + 38 Houses)

Total Floor Area : Flats + Houses = 4020m²

Base Energy : Total = 289,575 kWh/year

Actual Energy : Total = 260,574 kWh/year

Saving : $289,575 - 260,574 = 29,001 = 10.02\%$

Note 1 : Renewables (solar PV) added (see SAP calculations)

Note 2 : Calculations are based on SAP 2012 (Part L Building Regulations 2013)

Option 2 = Air Source Heat Pumps

Actual Demand (Energy)	
Development :	44 New Dwellings (6 Flats + 38 Houses)
Total Floor Area :	Flats + Houses = 4020m ²
Base Energy :	Total = 289,575 kWh/year
Actual Energy :	Total = 168,363 kWh/year
Saving :	289,575 - 168,363 = 121,212 = 41.86%
Note 1 : Renewables (air source heat pumps) added (see SAP calculations)	
Note 2 : Calculations are based on SAP 2012 (Part L Building Regulations 2013)	

Option 3 = Air Source Heat Pumps / Solar PV

A combination of air source heat pumps to some dwellings, and solar pv to other dwellings, which will result in between 10.02% to 41.86% of energy coming from renewables (depending upon how the different types of renewables are apportioned across the site).

Option 4 = Other Renewables

Other forms of renewables or low carbon energy generation on site that produce at least at least 10% of the development's energy requirements.

Water Use

Total Water Use : < 110 litres/person/day

Note 1 : Water efficient sanitary fittings (see water use calculation YH2801G)

Note 2 : Calculations are based on Part G Building Regulations 2010 (Approved Document 2015)

Design

Energy & CO₂ Emissions

- > Fabric insulation standards (including glazing), and air-tightness, will meet or exceed current (2013) Building Regulations Part L standards.
- > Advanced detailing to minimise thermal bridging and air leakage at junctions.
- > 100% of new internal fixed lighting and external lighting will be low-energy (eg LEDs).
- > Advanced heating controls (where suitable).
- > Where supplied, white goods will be energy efficient (A++, A+ or A rated or better).

Materials

- > Consideration will be given to using materials and construction that have a low environmental impact, such as those achieving an A+ or A rated under BRE's Green Guide.
- > Where possible, materials will be chosen that are responsibly sourced (such as FSC timber), recycled or reclaimed.
- > All insulation materials will have a GWP (Global Warming Potential) of 5 or less.

Water Use

- > Indoor water use will be restricted by use of fittings with lower flow rates, baths with smaller capacity (if applicable), dual-flush toilets, and (where applicable) washing machines and dishwashers with low water usage.

Surface Water & Flood Risk

- > Where possible, Sustainable Drainage Systems will be used to avoid, reduce, and delay the discharge of rain-fall run-off to public watercourses and sewers.
- > Measures are to be undertaken to reduce the risk of flooding where developments are in medium or high risk flood zones.

Waste

- > Construction site waste is to be minimised (diverted from landfill) by re-using materials on site (or to/from other sites), returning to the supplier where possible/practical, recovery/recycling, and composting.
- > Hazardous waste will be avoided (or minimised where unavoidable).
- > If available, the kitchen design will incorporate fixed bin(s) in the kitchen cupboards to encourage recycling.

Health & Wellbeing

- > Key rooms to have good levels of daylighting, with décor to enhance this (the need for artificial lighting will also be reduced).
- > Sound insulation (between dwellings, and within dwellings), will meet or be better than current Building Regulation Part E standards.
- > To ensure the dwellings are usable/adaptable for all potential existing and future owners or occupiers, as many as possible/practical of the 16 no Lifetime Homes criteria will be incorporated into the design and construction of the dwellings.

Management

- > Guidance will be provided to the end owner/occupier of the dwellings, providing information on the correct and efficient use of their home.
- > Security measures will be incorporated into the design and construction of the dwellings.

Renewable Energy (and LZCs)

Various other options were considered, with the following results :

- > Solar Thermal = Savings not as good as solar PV (does not meet the targets)
- > Ground Source Heat Pump = Limited ground area + more expensive than air source.
- > Biomass = Not practical/suitable. No saving in energy use.
- > Wind Power = Siting extremely difficult, location not suitable.
- > Combined Heat & Power (CHP) = Limited savings in energy and CO2 emissions.

Summary/Conclusion

The dwellings are to be designed to high levels of fabric insulation and air tightness, in line with current thinking, with solar pv panels added or air source heat pumps to ensure that at least 10% of the developments energy is from renewables or low carbon energy production.

Therefore the proposal meets the requirements of Arun District Council's Local Plan (July 2018) Policy ECC SP2 (Energy and Climate Change Mitigation).

Construction and Insulation

<u>Element</u>	<u>U-Value</u> (W/m²K)
<u>Exposed Wall</u> Construction/insulation to achieve a U-value of 0.25W/m²K (or better).	0.25
<u>Party Wall</u> Masonry construction (all cavities where applicable fully insulated, all edges fully sealed).	0.00
<u>Ground Floor</u> Construction/insulation to achieve a U-value of 0.16W/m²K (or better) - eg 100mm Celotex.	0.16
<u>Roof (voids)</u> Construction/insulation to achieve a U-value of 0.11W/m²K (or better) - eg 100mm + 300mm mineral wool quilt.	0.11
<u>Windows/Doors/Rooflights</u> PVC-u or timber or thermally-broken metal or composite frame double-glazed + 16mm cavity (argon gas fill) + soft coat low-E glass, or similar to achieve U-value of 1.40W/m²K (or better).	1.40

Heating, Ventilation & RenewablesMain Heating System (Option 1)

Conventional mains/natural gas central heating system with radiators. Condensing boilers (Band A rated).

Main Heating System (Option 2)

Air source heat pumps with radiators and/or underfloor heating.

Water Heating

From central heating boilers/heat pumps.

Ventilation

Background ventilators + intermittent extract fans (Approved Document F1, 2010, amended 2013).

Solar Panels (site wide) Option 1

36 kW/peak total (eg 120 no 300W panels), facing south/south-east/south-west or east/west (most favourable).

Note : The solar can be distributed as preferred to meet Planning. However, if some detached houses or blocks of houses/flats don't have any solar panels, additional insulation may be needed to achieve Building Regulations Part L1A compliance.

OtherDetailing (ACDs)

Accredited Construction Details (ACDs) - limiting thermal bridging and air leakage - fully adopted.

Water Use

Total water use < 110 litres/person/day. Water efficient sanitary fittings and white goods.

Lighting

100% of light fittings are dedicated low-energy (lamp luminous efficacy > 45 lumens/circuit watt, total output > 400 lamp lumens).

Air Tightness

Design air permeability is 5m³/h/m² at 50 Pa - to be achieved by air pressure test.

SAP Input

Property Details: Y122801

Address: BASE ENERGY, Flats (6 no), Barnham Road, Eastergate, PO20 3RT
Located in: England
Region: South East England
UPRN:
Date of assessment: 30 October 2020
Date of certificate: 30 October 2020
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/person/day: True
PCDF Version: 466

Property description

Dwelling type: Flat
Detachment:
Year Completed: 2020
Floor Location: **Floor area:** **Storey height:**
 Floor 0 64 m² 2.4 m
Living area: 15 m² (fraction 0.234)
Front of dwelling faces: East

Opening types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.4	2	1
Windows	16mm or more	0.7	0.63	1.4	10	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall	East	0	0
Windows		Wall	East	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall	50	12	38	0.25	0	False	N/A
Roof	32	0	32	0.11	0		N/A
Ground Floor	32			0.16			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0323

Length	Psi-value	
10	0.05	E2 Other lintels (including other steel lintels)
5	0.034	E3 Sill
20	0.04	E4 Jamb

SAP Input

	10	0.06	E5	Ground floor (normal)
	0	0	E6	Intermediate floor within a dwelling
[Approved]	10	0.06	E10	Eaves (insulation at ceiling level)
	5	0.058	E16	Corner (normal)
[Approved]	5	0.06	E18	Party wall between dwellings
	5	0.043	P1	Ground floor
	5	0.041	P4	Roof (insulation at ceiling level)

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: Manufacturer Declaration
	Manufacturer's data
	Efficiency: 89.0% (SEDBUK2009)
	Condensing combi with automatic ignition
	Fuel Burning Type:
	Systems with radiators
	Central heating pump : 2013 or later
	Design flow temperature: Design flow temperature >45°C
	Unknown
	Boiler interlock: Yes

Main heating Control:

Main heating Control:	Programmer, room thermostat and TRVs
	Control code: 2106

Secondary heating system:

Secondary heating system:	None
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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:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.9

Property Address: 4H2801

Address : BASE ENERGY, Flats (6 no), Barnham Road, Eastergate, PO20 3RT

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	64 (1a)	2.4 (2a)	153.6 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	153.6 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (5a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (5a)+(6b)+(7a)+(7b)+(7c) =	20	0.13 (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		0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 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)		0.38 (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) =	0.32 (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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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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SAP WorkSheet: New dwelling design stage

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

0.41	0.4	0.4	0.36	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 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)

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 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.57 0.57 (24d)

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

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.57 0.57 (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			2	1.4	2.8		(26)
Windows			10	$1/[1/(1.4) + 0.04]$	13.26		(27)
Floor			32	0.16	5.12		(28)
Walls	50	12	38	0.25	9.5		(29)
Roof	32	0	32	0.11	3.52		(30)
Total area of elements, m²			114				(31)

* 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) = 34.2 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 5348 (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 3.68 (36)

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

Total fabric heat loss (33) + (36) = 37.88 (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=	29.65	29.48	29.32	28.55	28.4	27.73	27.73	27.61	27.99	28.4	28.69	29

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

(39)m=	67.52	67.36	67.19	66.42	66.28	65.61	65.61	65.49	65.87	66.28	66.57	66.88
Average = Sum(39) ÷ 12 =	66.42 (39)											

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.02	1.03	1.04	1.04	1.04		
	Average = Sum(40) ₁₋₁₂ / 12 =												1.04	(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 equipment

litres/year

Assumed occupancy, N

2.09

(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

83.89

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

(44)m=	92.28	88.92	85.57	82.21	78.86	75.5	75.5	78.86	82.21	85.57	88.92	92.28		
	Total = Sum(44) ₁₋₁₂ =												1006.67	(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=	136.85	119.69	123.51	107.68	103.32	89.15	82.61	94.8	95.93	111.8	122.04	132.53		
	Total = Sum(45) ₁₋₁₂ =												1319.91	(45)

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

(46)m=	20.53	17.95	18.53	16.15	15.5	13.37	12.39	14.22	14.39	16.77	18.31	19.88		(46)
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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)

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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
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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)
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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		(59)
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SAP WorkSheet: New dwelling design stage

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

(61)m=	47.02	40.93	43.6	40.54	40.18	37.23	38.47	40.18	40.54	43.6	43.85	47.02	(61)
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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=	183.87	160.62	167.11	148.22	143.5	126.39	121.09	134.99	136.48	155.41	165.89	179.55	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

(64)m=	183.87	160.62	167.11	148.22	143.5	126.39	121.09	134.99	136.48	155.41	165.89	179.55	
Output from water heater (annual): 12												1823.1	(64)

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

(65)m=	57.26	50.03	51.97	45.94	44.4	38.95	37.09	41.57	42.03	48.08	51.54	55.82	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5 Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	(66)

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

(67)m=	42.73	37.96	30.87	23.37	17.47	14.75	15.94	20.71	27.8	35.3	41.2	43.92	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	273	275.83	268.7	253.5	234.31	216.28	204.24	201.4	208.54	223.74	242.93	260.96	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	(69)
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Pumps and fans gains (Table 5a)

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

(71)m=	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	(71)
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Water heating gains (Table 5)

(72)m=	76.96	74.45	69.85	63.8	59.68	54.1	49.85	55.87	58.38	64.62	71.59	75.03	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	487.18	482.72	463.9	435.16	405.95	379.62	364.51	372.48	389.21	418.15	450.2	474.39	(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)	
East	0.9x	0.77	x	10	x	19.64	x	0.63	x	0.7	=	60.02	(76)
East	0.9x	0.77	x	10	x	38.42	x	0.63	x	0.7	=	117.42	(76)
East	0.9x	0.77	x	10	x	63.27	x	0.63	x	0.7	=	193.37	(76)
East	0.9x	0.77	x	10	x	92.28	x	0.63	x	0.7	=	282.02	(76)
East	0.9x	0.77	x	10	x	113.09	x	0.63	x	0.7	=	345.63	(76)

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East	0.9x	0.77	x	10	x	115.77	x	0.63	x	0.7	=	353.81	(76)
East	0.9x	0.77	x	10	x	110.22	x	0.63	x	0.7	=	336.84	(76)
East	0.9x	0.77	x	10	x	94.68	x	0.63	x	0.7	=	289.34	(76)
East	0.9x	0.77	x	10	x	73.59	x	0.63	x	0.7	=	224.9	(76)
East	0.9x	0.77	x	10	x	45.59	x	0.63	x	0.7	=	139.33	(76)
East	0.9x	0.77	x	10	x	24.49	x	0.63	x	0.7	=	74.84	(76)
East	0.9x	0.77	x	10	x	16.15	x	0.63	x	0.7	=	49.36	(76)

Solar gains in watts, calculated for each month

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

(83)m=	60.02	117.42	193.37	282.02	345.63	353.81	336.84	289.34	224.9	139.33	74.84	49.36	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	547.2	600.14	657.27	717.18	751.57	733.43	701.35	661.82	614.11	557.47	525.04	523.75	(84)
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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	0.96	0.89	0.75	0.56	0.41	0.45	0.7	0.92	0.98	0.99	(86)

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

(87)m=	20.12	20.26	20.48	20.75	20.92	20.99	21	21	20.96	20.74	20.38	20.1	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.05	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.86	0.69	0.48	0.32	0.36	0.62	0.89	0.97	0.99	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.26	19.39	19.61	19.86	20.01	20.06	20.06	20.06	20.04	19.86	19.52	19.24	(90)
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fLA = Living area ÷ (4) =

0.23 (91)

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

(92)m=	19.46	19.59	19.82	20.07	20.22	20.28	20.28	20.28	20.26	20.06	19.73	19.44	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.46	19.59	19.82	20.07	20.22	20.28	20.28	20.28	20.26	20.06	19.73	19.44	(93)
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8. Space heating requirement

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

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

(94)m=	0.98	0.97	0.94	0.86	0.71	0.5	0.34	0.38	0.64	0.89	0.97	0.99	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.32	583.61	619.09	616.26	529.87	367.93	241.09	253.42	390.4	496.53	509.11	516.8	(95)
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Monthly average external temperature from Table 8

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

(97)m=	1023.68	989.8	894.72	742.12	564.76	372.34	241.54	254.22	405.47	627.28	840.51	1019	(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=	361.11	272.96	205.07	90.62	25.96	0	0	0	0	97.28	238.6	373.64	
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1665.23 (98)

Space heating requirement in kWh/m²/year 26.02 (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 89.8 (206)

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

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

361.11	272.96	205.07	90.62	25.96	0	0	0	0	97.28	238.6	373.64
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(211)m = {[(98)m × (204)] } × 100 ÷ (206) (211)

402.12	303.96	228.36	100.91	28.91	0	0	0	0	108.33	265.7	416.08
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 1854.37 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 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)

183.87	160.62	167.11	148.22	143.5	126.39	121.09	134.99	136.48	155.41	165.89	179.55
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Efficiency of water heater 80.5 (216)

(217)m = 86.43 86.11 85.37 83.79 81.8 80.5 80.5 80.5 80.5 83.84 85.74 86.55 (217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m = 212.74 186.51 195.74 176.89 175.43 157 150.42 167.68 169.54 185.35 193.49 207.44

Total = Sum(219a)_{1...12} = 2178.25 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year kWh/year

1854.37

Water heating fuel used

2178.25

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

301.87 (232)

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 = 64.53 (240)

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Space heating - main system 2	(213) ×	0	× 0.01 =	0	(241)
Space heating - secondary	(215) ×	13.19	× 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	× 0.01 =	75.8	(247)
Pumps, fans and electric keep-hot	(231)	13.19	× 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	× 0.01 =	39.82	(250)
Additional standing charges (Table 12)				120	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250) (254) =			310.04	(255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) × (256)] ÷ [(4) + 45.0] =	1.19	(257)
SAP rating (Section 12)		83.33	(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) ×	0.216	400.54 (261)
Space heating (secondary)	(215) ×	0.519	0 (263)
Water heating	(219) ×	0.216	470.5 (264)
Space and water heating	(261) + (262) + (263) + (264) =		871.05 (265)
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	38.93 (267)
Electricity for lighting	(232) ×	0.519	156.67 (268)
Total CO2, kg/year		sum of (265) (271) =	1066.64 (272)
CO2 emissions per m²		(272) ÷ (4) =	16.67 (273)
El rating (section 14)			87 (274)

13a Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) ×	1.22	2262.33 (261)
Space heating (secondary)	(215) ×	3.07	0 (263)
Energy for water heating	(219) ×	1.22	2657.46 (264)
Space and water heating	(261) + (262) + (263) + (264) =		4919.79 (265)
Electricity for pumps, fans and electric keep-hot	(231) ×	3.07	230.25 (267)
Electricity for lighting	(232) ×	0	926.75 (268)
Total Primary Energy		sum of (265) (271) =	6076.79 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	94.95 (273)

SAP WorkSheet: New dwelling design stage

SAP Input

Property Details: Y123012

Address: BASE ENERGY, Houses (38 no), Barnham Road, Eastergate, PO20 3RT
Located in: England
Region: South East England
UPRN:
Date of assessment: 30 October 2020
Date of certificate: 30 October 2020
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/person/day: True
PCDF Version: 466

Property description

Dwelling type: House
Detachment: Semi-detached
Year Completed: 2020
Floor Location: **Floor area:** **Storey height:**
 Floor 0 48 m² 2.4 m
 Floor 1 48 m² 2.6 m
Living area: 20 m² (fraction 0.208)
Front of dwelling faces: East

Opening types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.4	2	1
Windows	16mm or more	0.7	0.63	1.4	20	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall	East	0	0
Windows		Wall	East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall	105	22	83	0.25	0	False	N/A
Roof	48	0	48	0.11	0		N/A
Ground Floor	48			0.16			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0377

Length	Psi-value	
25	0.05	E2 Other lintels (including other steel lintels)
15	0.034	E3 Sill

SAP Input

	35	0.04	E4	Jamb
	20	0.06	E5	Ground floor (normal)
	20	0	E6	Intermediate floor within a dwelling
[Approved]	20	0.06	E10	Eaves (insulation at ceiling level)
	10	0.058	E16	Corner (normal)
[Approved]	10	0.06	E18	Party wall between dwellings
	10	0.043	P1	Ground floor
	10	0.041	P4	Roof (insulation at ceiling level)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	4
Number of passive stacks:	0
Number of sides sheltered:	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: Manufacturer Declaration
	Manufacturer's data
	Efficiency: 89.0% (SEDBUK2009)
	Condensing combi with automatic ignition
	Fuel Burning Type:
	Systems with radiators
	Central heating pump : 2013 or later
	Design flow temperature: Design flow temperature >45°C
	Unknown
	Boiler interlock: Yes

Main heating Control:

Main heating Control:	Programmer, room thermostat and TRVs
	Control code: 2106

Secondary heating system:

Secondary heating system:	None
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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:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.9

Property Address: 4H2802

Address : BASE ENERGY, Houses (38 no), Barnham Road, Eastergate, PO20 3RT

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	48 (1a) ×	2.4 (2a) =	115.2 (3a)
First floor	48 (1b) ×	2.6 (2b) =	124.8 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	240 (5)

2. Ventilation rate

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	+ (5) =	0.17 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 × (14) + 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) + 20]÷(8), otherwise (18) = (16)			0.42 (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 × (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.35 (21)
Infiltration rate modified for monthly wind speed			

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

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
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Wind Factor (22a)m = (22)m ÷ 4

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

	0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(23c)

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

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

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

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

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

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

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

d) If natural ventilation or whole house positive input ventilation from loft

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

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

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

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

3 Heat losses and heat capacity 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			2	1.4	2.8		(26)
Windows			20	$\times 1/[1/(1.4) + 0.04]$	26.52		(27)
Floor			48	0.16	7.68		(28)
Walls	105	22	83	0.25	20.75		(29)
Roof	48	0	48	0.11	5.28		(30)
Total area of elements, m²			201				(31)

* 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) (28) (30) + (32) = 63.03 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 9842 (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 7.58 (36)

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

Total fabric heat loss (33) + (36) = 70.61 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	47.67	47.36	47.05	45.61	45.34	44.08	44.08	43.85	44.57	45.34	45.89	46.46

(38)

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

(39)m=	118.28	117.97	117.66	116.22	115.95	114.69	114.69	114.46	115.17	115.95	116.49	117.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Average = Sum(39) ÷ 12 = 116.21 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=	1.23	1.23	1.23	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22		
	Average = Sum(40) ₁₋₁₂ / 12 =												1.21	(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 equipment

10th year

Assumed occupancy, N

2.7

(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

98.31

(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=	108.14	104.21	100.27	96.34	92.41	88.48	88.48	92.41	96.34	100.27	104.21	108.14		
	Total = Sum(44) ₁₋₁₂ =												1179.7	(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=	160.37	140.26	144.73	126.18	121.07	104.48	96.81	111.1	112.42	131.02	143.02	155.31		
	Total = Sum(45) ₁₋₁₂ =												1546.77	(45)

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

(46)m=	24.06	21.04	21.71	18.93	18.16	15.67	14.52	16.66	16.86	19.65	21.45	23.3		(46)
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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)

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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

(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)
--------	---	---	---	---	---	---	---	---	---	---	---	---	--	------

SAP WorkSheet: New dwelling design stage

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

(61)m=	50.96	46.03	50.96	47.51	47.09	43.63	45.09	47.09	47.51	50.96	49.32	50.96	(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=	211.33	186.29	195.69	173.69	168.17	148.11	141.9	158.19	159.93	181.98	192.33	206.27	(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=	211.33	186.29	195.69	173.69	168.17	148.11	141.9	158.19	159.93	181.98	192.33	206.27	
Output from water heater (annual): 12												2123.87	(64)

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

(65)m=	66.06	58.14	60.86	53.83	52.03	45.65	43.46	48.71	49.26	56.3	59.88	64.38	(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=	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	(66)

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

(67)m=	55.65	49.43	40.2	30.43	22.75	19.21	20.75	26.97	36.21	45.97	53.65	57.2	(67)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(68)m=	372.68	376.55	366.8	346.05	319.86	295.25	278.81	274.94	284.69	305.43	331.62	356.23	(68)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	(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=	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	(71)
--------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	------

Water heating gains (Table 5)

(72)m=	88.79	86.52	81.81	74.77	69.93	63.4	58.42	65.47	68.41	75.68	83.17	86.53	(72)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	628	623.38	599.68	562.14	523.43	488.74	468.86	478.27	500.19	537.96	579.32	610.84	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	20	x	19.64	x	0.63	x	0.7	≈	120.05	(76)
East	0.9x	0.77	x	20	x	38.42	x	0.63	x	0.7	≈	234.84	(76)
East	0.9x	0.77	x	20	x	63.27	x	0.63	x	0.7	≈	386.74	(76)
East	0.9x	0.77	x	20	x	92.28	x	0.63	x	0.7	≈	564.04	(76)
East	0.9x	0.77	x	20	x	113.09	x	0.63	x	0.7	≈	691.25	(76)

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East	0.9x	0.77	x	20	x	115.77	x	0.63	x	0.7	=	707.62	(76)
East	0.9x	0.77	x	20	x	110.22	x	0.63	x	0.7	=	673.68	(76)
East	0.9x	0.77	x	20	x	94.68	x	0.63	x	0.7	=	578.68	(76)
East	0.9x	0.77	x	20	x	73.59	x	0.63	x	0.7	=	449.8	(76)
East	0.9x	0.77	x	20	x	45.59	x	0.63	x	0.7	=	278.65	(76)
East	0.9x	0.77	x	20	x	24.49	x	0.63	x	0.7	=	149.68	(76)
East	0.9x	0.77	x	20	x	16.15	x	0.63	x	0.7	=	98.72	(76)

Solar gains in watts, calculated for each month

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

(83)m=	120.05	234.84	386.74	564.04	691.25	707.62	673.68	578.68	449.8	278.65	149.68	98.72	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	------

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

(84)m=	748.05	858.21	986.43	1126.18	1214.68	1196.36	1142.54	1056.95	949.98	816.61	729.01	709.56	(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	0.99	0.97	0.91	0.78	0.59	0.44	0.49	0.75	0.95	0.99	1	(86)

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

(87)m=	19.81	19.99	20.27	20.63	20.87	20.97	20.99	20.99	20.92	20.58	20.13	19.78	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.89	19.9	19.9	19.91	19.91	19.92	19.92	19.93	19.92	19.91	19.91	19.9	(88)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(89)m=	0.99	0.98	0.96	0.88	0.72	0.5	0.33	0.38	0.66	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=	18.83	19	19.29	19.63	19.83	19.91	19.92	19.92	19.88	19.6	19.16	18.81	(90)
--------	-------	----	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) = 0.21 (91)

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

(92)m=	19.04	19.21	19.49	19.84	20.05	20.13	20.15	20.15	20.1	19.8	19.36	19.01	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.04	19.21	19.49	19.84	20.05	20.13	20.15	20.15	20.1	19.8	19.36	19.01	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.87	0.72	0.52	0.35	0.4	0.68	0.92	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

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

(95)m=	740.36	841.09	939.57	984.61	878.57	620.79	405.02	425.66	643.24	749.98	714.73	703.76	(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=	1742.98	1687.99	1528.95	1270.99	967.97	634.68	406.73	428.79	690.6	1066.89	1428.41	1733.96	(97)
--------	---------	---------	---------	---------	--------	--------	--------	--------	-------	---------	---------	---------	------

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

(98)m=	745.95	569.11	438.5	206.19	66.51	0	0	0	0	235.78	513.85	766.47	
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3542.36 (98)

Space heating requirement in kWh/m²/year 36.9 (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 89.8 (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)

745.95	569.11	438.5	206.19	66.51	0	0	0	0	235.78	513.85	766.47
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(211)m = {[(98)m × (204)] } × 100 ÷ (206) (211)

830.68	633.76	488.31	229.61	74.07	0	0	0	0	262.56	572.21	853.53
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 3944.72 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 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)

211.33	186.29	195.69	173.69	168.17	148.11	141.9	158.19	159.93	181.98	192.33	206.27
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Efficiency of water heater 80.5 (216)

(217)m = 87.57 87.31 86.71 85.29 82.93 80.5 80.5 80.5 80.5 85.5 87.06 87.65 (217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m = 241.33 213.35 225.69 203.64 202.77 183.99 176.28 196.51 198.68 212.85 220.92 235.32

Total = Sum(219a)_{1...12} = 2511.31 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year kWh/year

3944.72

Water heating fuel used

2511.31

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

393.13 (232)

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 = 137.28 (240)

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Space heating - main system 2	(213) ×	0	× 0.01 =	0	(241)
Space heating - secondary	(215) ×	13.19	× 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	× 0.01 =	87.39	(247)
Pumps, fans and electric keep-hot	(231)	13.19	× 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	× 0.01 =	51.85	(250)
Additional standing charges (Table 12)				120	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250) (254) =			406.42	(255)

11a SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) × (256)] ÷ [(4) + 45.0] =	1.21	(257)
SAP rating (Section 12)		83.11	(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) ×	0.216	852.06 (261)
Space heating (secondary)	(215) ×	0.519	0 (263)
Water heating	(219) ×	0.216	542.44 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1394.5 (265)
Electricity for pumps, fans and electric keep-hot	(231) ×	0.519	38.93 (267)
Electricity for lighting	(232) ×	0.519	204.03 (268)
Total CO2, kg/year		sum of (265) (271) =	1637.46 (272)
CO2 emissions per m²		(272) ÷ (4) =	17.06 (273)
El rating (section 14)			84 (274)

13a Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) ×	1.22	4812.56 (261)
Space heating (secondary)	(215) ×	3.07	0 (263)
Energy for water heating	(219) ×	1.22	3063.8 (264)
Space and water heating	(261) + (262) + (263) + (264) =		7876.36 (265)
Electricity for pumps, fans and electric keep-hot	(231) ×	3.07	230.25 (267)
Electricity for lighting	(232) ×	0	1206.9 (268)
Total Primary Energy		sum of (265) (271) =	9313.51 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	97.02 (273)

SAP WorkSheet: New dwelling design stage

SAP Input

Property Details: Y122803

Address: ACTUAL ENERGY (1), Flats (6 no), Barnham Road, Eastergate, PO20 3RT
Located in: England
Region: South East England
UPRN:
Date of assessment: 30 October 2020
Date of certificate: 30 October 2020
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/person/day: True
PCDF Version: 466

Property description

Dwelling type: Flat
Detachment:
Year Completed: 2020
Floor Location: **Floor area:** **Storey height:**
 Floor 0 64 m² 2.4 m
Living area: 15 m² (fraction 0.234)
Front of dwelling faces: East

Opening types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.4	2	1
Windows	16mm or more	0.7	0.63	1.4	10	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall	East	0	0
Windows		Wall	East	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall	50	12	38	0.25	0	False	N/A
Roof	32	0	32	0.11	0		N/A
Ground Floor	32			0.16			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0323

Length	Psi-value	
10	0.05	E2 Other lintels (including other steel lintels)
5	0.034	E3 Sill
20	0.04	E4 Jamb

SAP Input

	10	0.06	E5	Ground floor (normal)
	0	0	E6	Intermediate floor within a dwelling
[Approved]	10	0.06	E10	Eaves (insulation at ceiling level)
	5	0.058	E16	Corner (normal)
[Approved]	5	0.06	E18	Party wall between dwellings
	5	0.043	P1	Ground floor
	5	0.041	P4	Roof (insulation at ceiling level)

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: Manufacturer Declaration
	Manufacturer's data
	Efficiency: 89.0% (SEDBUK2009)
	Condensing combi with automatic ignition
	Fuel Burning Type:
	Systems with radiators
	Central heating pump : 2013 or later
	Design flow temperature: Design flow temperature >45°C
	Unknown
	Boiler interlock: Yes

Main heating Control:

Main heating Control:	Programmer, room thermostat and TRVs
	Control code: 2106

Secondary heating system:

Secondary heating system:	None
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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:	<u>Photovoltaic 1</u>
	Installed Peak power: 0.5731
	Tilt of collector: 45°
	Overshading: None or very little
	Collector Orientation: South East

SAP Input

Assess Zero Carbon Home: No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.9

Property Address: 4H2803

Address : ACTUAL ENERGY (1), Flats (6 no), Barnham Road, Eastergate, PO20 3RT

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	64 (1a)	2.4 (2a)	153.6 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	153.6 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (5a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (5a)+(6b)+(7a)+(7b)+(7c) =	20	0.13 (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		0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 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)		0.38 (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) =	0.32 (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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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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SAP WorkSheet: New dwelling design stage

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

0.41	0.4	0.4	0.36	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 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)

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 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.57 0.57 (24d)

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

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.57 0.57 (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			2	1.4	2.8		(26)
Windows			10	$1/[1/(1.4) + 0.04]$	13.26		(27)
Floor			32	0.16	5.12		(28)
Walls	50	12	38	0.25	9.5		(29)
Roof	32	0	32	0.11	3.52		(30)
Total area of elements, m²			114				(31)

* 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) = 34.2 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 5348 (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 3.68 (36)

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

Total fabric heat loss (33) + (36) = 37.88 (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=	29.65	29.48	29.32	28.55	28.4	27.73	27.73	27.61	27.99	28.4	28.69	29

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

(39)m=	67.52	67.36	67.19	66.42	66.28	65.61	65.61	65.49	65.87	66.28	66.57	66.88
Average = Sum(39) ÷ 12 =	66.42											(39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.02	1.03	1.04	1.04	1.04		
	Average = Sum(40) ₁₋₁₂ / 12 =												1.04	(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 equipment

Assumed occupancy, N

2.09

(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

83.89

(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=	92.28	88.92	85.57	82.21	78.86	75.5	75.5	78.86	82.21	85.57	88.92	92.28		
	Total = Sum(44) ₁₋₁₂ =												1006.67	(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=	136.85	119.69	123.51	107.68	103.32	89.15	82.61	94.8	95.93	111.8	122.04	132.53		
	Total = Sum(45) ₁₋₁₂ =												1319.91	(45)

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

(46)m=	20.53	17.95	18.53	16.15	15.5	13.37	12.39	14.22	14.39	16.77	18.31	19.88		(46)
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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)

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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

(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)
--------	---	---	---	---	---	---	---	---	---	---	---	---	--	------

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

(61)m=	47.02	40.93	43.6	40.54	40.18	37.23	38.47	40.18	40.54	43.6	43.85	47.02	(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=	183.87	160.62	167.11	148.22	143.5	126.39	121.09	134.99	136.48	155.41	165.89	179.55	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

(64)m=	183.87	160.62	167.11	148.22	143.5	126.39	121.09	134.99	136.48	155.41	165.89	179.55	
Output from water heater (annual): 12												1823.1	(64)

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

(65)m=	57.26	50.03	51.97	45.94	44.4	38.95	37.09	41.57	42.03	48.08	51.54	55.82	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5 Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	(66)

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

(67)m=	42.73	37.96	30.87	23.37	17.47	14.75	15.94	20.71	27.8	35.3	41.2	43.92	(67)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	------	-------	------

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

(68)m=	273	275.83	268.7	253.5	234.31	216.28	204.24	201.4	208.54	223.74	242.93	260.96	(68)
--------	-----	--------	-------	-------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	(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=	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	76.96	74.45	69.85	63.8	59.68	54.1	49.85	55.87	58.38	64.62	71.59	75.03	(72)
--------	-------	-------	-------	------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	487.18	482.72	463.9	435.16	405.95	379.62	364.51	372.48	389.21	418.15	450.2	474.39	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	10	x	19.64	x	0.63	x	0.7	=	60.02	(76)
East	0.9x	0.77	x	10	x	38.42	x	0.63	x	0.7	=	117.42	(76)
East	0.9x	0.77	x	10	x	63.27	x	0.63	x	0.7	=	193.37	(76)
East	0.9x	0.77	x	10	x	92.28	x	0.63	x	0.7	=	282.02	(76)
East	0.9x	0.77	x	10	x	113.09	x	0.63	x	0.7	=	345.63	(76)

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East	0.9x	0.77	x	10	x	115.77	x	0.63	x	0.7	=	353.81	(76)
East	0.9x	0.77	x	10	x	110.22	x	0.63	x	0.7	=	336.84	(76)
East	0.9x	0.77	x	10	x	94.68	x	0.63	x	0.7	=	289.34	(76)
East	0.9x	0.77	x	10	x	73.59	x	0.63	x	0.7	=	224.9	(76)
East	0.9x	0.77	x	10	x	45.59	x	0.63	x	0.7	=	139.33	(76)
East	0.9x	0.77	x	10	x	24.49	x	0.63	x	0.7	=	74.84	(76)
East	0.9x	0.77	x	10	x	16.15	x	0.63	x	0.7	=	49.36	(76)

Solar gains in watts, calculated for each month

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

(83)m=	60.02	117.42	193.37	282.02	345.63	353.81	336.84	289.34	224.9	139.33	74.84	49.36	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	-------	------

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

(84)m=	547.2	600.14	657.27	717.18	751.57	733.43	701.35	661.82	614.11	557.47	525.04	523.75	(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	0.96	0.89	0.75	0.56	0.41	0.45	0.7	0.92	0.98	0.99	(86)

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

(87)m=	20.12	20.26	20.48	20.75	20.92	20.99	21	21	20.96	20.74	20.38	20.1	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	------	------

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

(88)m=	20.04	20.04	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.05	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.99	0.98	0.95	0.86	0.69	0.48	0.32	0.36	0.62	0.89	0.97	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	19.26	19.39	19.61	19.86	20.01	20.06	20.06	20.06	20.04	19.86	19.52	19.24	(90)
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fLA = Living area ÷ (4) =

0.23 (91)

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

(92)m=	19.46	19.59	19.82	20.07	20.22	20.28	20.28	20.28	20.26	20.06	19.73	19.44	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.46	19.59	19.82	20.07	20.22	20.28	20.28	20.28	20.26	20.06	19.73	19.44	(93)
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8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.94	0.86	0.71	0.5	0.34	0.38	0.64	0.89	0.97	0.99	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	538.32	583.61	619.09	616.26	529.87	367.93	241.09	253.42	390.4	496.53	509.11	516.8	(95)
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Monthly average external temperature from Table 8

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

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

(97)m=	1023.68	989.8	894.72	742.12	564.76	372.34	241.54	254.22	405.47	627.28	840.51	1019	(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=	361.11	272.96	205.07	90.62	25.96	0	0	0	0	97.28	238.6	373.64	
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SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1665.23 (98)

Space heating requirement in kWh/m²/year 26.02 (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 89.8 (206)

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

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

361.11	272.96	205.07	90.62	25.96	0	0	0	0	97.28	238.6	373.64	
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(211)m = {[(98)m × (204)] } × 100 ÷ (206) (211)

402.12	303.96	228.36	100.91	28.91	0	0	0	0	108.33	265.7	416.08	
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 1854.37 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

(215)m =

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

Water heating

Output from water heater (calculated above)

183.87	160.62	167.11	148.22	143.5	126.39	121.09	134.99	136.48	155.41	165.89	179.55	
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Efficiency of water heater 80.5 (216)

(217)m = 86.43 86.11 85.37 83.79 81.8 80.5 80.5 80.5 80.5 83.84 85.74 86.55 (217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m =

212.74	186.51	195.74	176.89	175.43	157	150.42	167.68	169.54	185.35	193.49	207.44	
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Total = Sum(219a)_{1...12} = 2178.25 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year kWh/year

1854.37

Water heating fuel used

2178.25

Electricity for pumps, fans and electric keep-hot

central heating pump:

30 (230e)

boiler with a fan-assisted flue

45 (230e)

Total electricity for the above, kWh/year

sum of (230a) (230g) = 75 (231)

Electricity for lighting

301.87 (232)

Electricity generated by PVs

-460.31 (233)

10a Fuel costs – individual heating systems

Fuel
kWh/year

Fuel Price
(Table 12)

Fuel Cost
£/year

SAP WorkSheet: New dwelling design stage

Space heating - main system 1	(211) x	3.48	x 0.01 =	64.53	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	75.8	(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 =	39.82	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	0	(252)

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

Total energy cost (245)...(247) + (250) (254) = 310.04 (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] =	1.19	(257)
SAP rating (Section 12)		83.33	(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	400.54 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	470.5 (264)
Space and water heating	(261) + (262) + (263) + (264) =		871.05 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	156.67 (268)
Energy saving/generation technologies Item 1		0.519	-238.9 (269)
Total CO2, kg/year		sum of (265) (271) =	827.74 (272)
CO2 emissions per m²		(272) ÷ (4) =	12.93 (273)
EI rating (section 14)			90 (274)

13a Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	2262.33 (261)
Space heating (secondary)	(215) x	3.07	0 (263)
Energy for water heating	(219) x	1.22	2657.46 (264)
Space and water heating	(261) + (262) + (263) + (264) =		4919.79 (265)

SAP WorkSheet: New dwelling design stage

Electricity for pumps, fans and electric keep-hot	{231} x	3.07	≡	230.25	{267}
Electricity for lighting	{232} x	0	≡	926.75	{268}
Energy saving/generation technologies					
Item 1		3.07	≡	-1413.16	{269}
'Total Primary Energy		sum of {265} {271} =		4663.63	{272}
Primary energy kWh/m²/year		{272} ÷ {4} =		72.87	{273}

SAP Input

Property Details: 7142604

Address: ACTUAL ENERGY (1), Houses (38 no), Barnham Road, Eastergate, PO20 3RT
Located in: England
Region: South East England
UPRN:
Date of assessment: 30 October 2020
Date of certificate: 30 October 2020
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/person/day: True
PCDF Version: 466

Property description

Dwelling type: House
Detachment: Semi-detached
Year Completed: 2020
Floor Location: **Floor area:** **Storey height:**
 Floor 0 48 m² 2.4 m
 Floor 1 48 m² 2.6 m
Living area: 20 m² (fraction 0.208)
Front of dwelling faces: East

Opening types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.4	2	1
Windows	16mm or more	0.7	0.63	1.4	20	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall	East	0	0
Windows		Wall	East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall	105	22	83	0.25	0	False	N/A
Roof	48	0	48	0.11	0		N/A
Ground Floor	48			0.16			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0377

Length	Psi-value	
25	0.05	E2 Other lintels (including other steel lintels)
15	0.034	E3 Sill

SAP Input

	35	0.04	E4	Jamb
	20	0.06	E5	Ground floor (normal)
	20	0	E6	Intermediate floor within a dwelling
[Approved]	20	0.06	E10	Eaves (insulation at ceiling level)
	10	0.058	E16	Corner (normal)
[Approved]	10	0.06	E18	Party wall between dwellings
	10	0.043	P1	Ground floor
	10	0.041	P4	Roof (insulation at ceiling level)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	4
Number of passive stacks:	0
Number of sides sheltered:	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: Manufacturer Declaration
	Manufacturer's data
	Efficiency: 89.0% (SEDBUK2009)
	Condensing combi with automatic ignition
	Fuel Burning Type:
	Systems with radiators
	Central heating pump : 2013 or later
	Design flow temperature: Design flow temperature >45°C
	Unknown
	Boiler interlock: Yes

Main heating Control:

Main heating Control:	Programmer, room thermostat and TRVs
	Control code: 2106

Secondary heating system:

Secondary heating system:	None
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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:	<u>Photovoltaic 1</u>
	Installed Peak power: 0.8597
	Tilt of collector: 45°
	Overshading: None or very little

SAP Input

Assess Zero Carbon Home:

Collector Orientation: South East
No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.9

Property Address: 4H2804

Address : ACTUAL ENERGY (1), Houses (38 no), Barnham Road, Eastergate, PO20 3RT

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	48 (1a) ×	2.4 (2a) =	115.2 (3a)
First floor	48 (1b) ×	2.6 (2b) =	124.8 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	240 (5)

2. Ventilation rate

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	+ (5) =	0.17 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 × (14) + 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) + 20]÷(8), otherwise (18) = (16)			0.42 (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 × (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.35 (21)
Infiltration rate modified for monthly wind speed			

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

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

Wind Factor (22a)m = (22)m ÷ 4

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

	0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(23c)

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

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

(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
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(24c)

d) If natural ventilation or whole house positive input ventilation from loft

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

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

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

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

3 Heat losses and heat 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			2	1.4	2.8		(26)
Windows			20	$\times 1/[1/(1.4) + 0.04]$	26.52		(27)
Floor			48	0.16	7.68		(28)
Walls	105	22	83	0.25	20.75		(29)
Roof	48	0	48	0.11	5.28		(30)
Total area of elements, m²			201				(31)

* 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) (28) (30) + (32) = 63.03 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 9842 (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 7.58 (36)

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

Total fabric heat loss (33) + (36) = 70.61 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	47.67	47.36	47.05	45.61	45.34	44.08	44.08	43.85	44.57	45.34	45.89	46.46

(38)

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

(39)m=	118.28	117.97	117.66	116.22	115.95	114.69	114.69	114.46	115.17	115.95	116.49	117.06
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Average = Sum(39) ÷ 12 = 116.21 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=	1.23	1.23	1.23	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22		
	Average = Sum(40) ₁₋₁₂ / 12 =												1.21	(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 equipment

10th year

Assumed occupancy, N

2.7

(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

98.31

(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=	108.14	104.21	100.27	96.34	92.41	88.48	88.48	92.41	96.34	100.27	104.21	108.14		
	Total = Sum(44) ₁₋₁₂ =												1179.7	(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=	160.37	140.26	144.73	126.18	121.07	104.48	96.81	111.1	112.42	131.02	143.02	155.31		
	Total = Sum(45) ₁₋₁₂ =												1546.77	(45)

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

(46)m=	24.06	21.04	21.71	18.93	18.16	15.67	14.52	16.66	16.86	19.65	21.45	23.3		(46)
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Water storage loss:

Storage volume (litres) including any solar or VVHRS 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)

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

$$(48) \times (49) =$$

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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0

(55)

Water storage loss calculated for each month

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

(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)
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SAP WorkSheet: New dwelling design stage

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

(61)m=	50.96	46.03	50.96	47.51	47.09	43.63	45.09	47.09	47.51	50.96	49.32	50.96	(61)
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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=	211.33	186.29	195.69	173.69	168.17	148.11	141.9	158.19	159.93	181.98	192.33	206.27	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

Output from water heater

(64)m=	211.33	186.29	195.69	173.69	168.17	148.11	141.9	158.19	159.93	181.98	192.33	206.27	
Output from water heater (annual): 12												2123.87	(64)

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

(65)m=	66.06	58.14	60.86	53.83	52.03	45.65	43.46	48.71	49.26	56.3	59.88	64.38	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5 Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	(66)

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

(67)m=	55.65	49.43	40.2	30.43	22.75	19.21	20.75	26.97	36.21	45.97	53.65	57.2	(67)
--------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(68)m=	372.68	376.55	366.8	346.05	319.86	295.25	278.81	274.94	284.69	305.43	331.62	356.23	(68)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(69)m=	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	(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=	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	(71)
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Water heating gains (Table 5)

(72)m=	88.79	86.52	81.81	74.77	69.93	63.4	58.42	65.47	68.41	75.68	83.17	86.53	(72)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------

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

(73)m=	628	623.38	599.68	562.14	523.43	488.74	468.86	478.27	500.19	537.96	579.32	610.84	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	20	x	19.64	x	0.63	x	0.7	≈	120.05	(76)
East	0.9x	0.77	x	20	x	38.42	x	0.63	x	0.7	≈	234.84	(76)
East	0.9x	0.77	x	20	x	63.27	x	0.63	x	0.7	≈	386.74	(76)
East	0.9x	0.77	x	20	x	92.28	x	0.63	x	0.7	≈	564.04	(76)
East	0.9x	0.77	x	20	x	113.09	x	0.63	x	0.7	≈	691.25	(76)

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East	0.9x	0.77	x	20	x	115.77	x	0.63	x	0.7	=	707.62	(76)
East	0.9x	0.77	x	20	x	110.22	x	0.63	x	0.7	=	673.68	(76)
East	0.9x	0.77	x	20	x	94.68	x	0.63	x	0.7	=	578.68	(76)
East	0.9x	0.77	x	20	x	73.59	x	0.63	x	0.7	=	449.8	(76)
East	0.9x	0.77	x	20	x	45.59	x	0.63	x	0.7	=	278.65	(76)
East	0.9x	0.77	x	20	x	24.49	x	0.63	x	0.7	=	149.68	(76)
East	0.9x	0.77	x	20	x	16.15	x	0.63	x	0.7	=	98.72	(76)

Solar gains in watts, calculated for each month

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

(83)m=	120.05	234.84	386.74	564.04	691.25	707.62	673.68	578.68	449.8	278.65	149.68	98.72	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	------

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

(84)m=	748.05	858.21	986.43	1126.18	1214.68	1196.36	1142.54	1056.95	949.98	816.61	729.01	709.56	(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	0.99	0.97	0.91	0.78	0.59	0.44	0.49	0.75	0.95	0.99	1	(86)

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

(87)m=	19.81	19.99	20.27	20.63	20.87	20.97	20.99	20.99	20.92	20.58	20.13	19.78	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	19.89	19.9	19.9	19.91	19.91	19.92	19.92	19.93	19.92	19.91	19.91	19.9	(88)
--------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	------	------

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

(89)m=	0.99	0.98	0.96	0.88	0.72	0.5	0.33	0.38	0.66	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=	18.83	19	19.29	19.63	19.83	19.91	19.92	19.92	19.88	19.6	19.16	18.81	(90)
--------	-------	----	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) = 0.21 (91)

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

(92)m=	19.04	19.21	19.49	19.84	20.05	20.13	20.15	20.15	20.1	19.8	19.36	19.01	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	------

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

(93)m=	19.04	19.21	19.49	19.84	20.05	20.13	20.15	20.15	20.1	19.8	19.36	19.01	(93)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	------

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.87	0.72	0.52	0.35	0.4	0.68	0.92	0.98	0.99	(94)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

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

(95)m=	740.36	841.09	939.57	984.61	878.57	620.79	405.02	425.66	643.24	749.98	714.73	703.76	(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=	1742.98	1687.99	1528.95	1270.99	967.97	634.68	406.73	428.79	690.6	1066.89	1428.41	1733.96	(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=	745.95	569.11	438.5	206.19	66.51	0	0	0	0	235.78	513.85	766.47	
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3542.36 (98)

Space heating requirement in kWh/m²/year 36.9 (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 89.8 (206)

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

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

745.95	569.11	438.5	206.19	66.51	0	0	0	0	235.78	513.85	766.47
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(211)m = {[(98)m × (204)] } × 100 ÷ (206) (211)

830.68	633.76	488.31	229.61	74.07	0	0	0	0	262.56	572.21	853.53
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 3944.72 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

211.33	186.29	195.69	173.69	168.17	148.11	141.9	158.19	159.93	181.98	192.33	206.27
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Efficiency of water heater 80.5 (216)

(217)m = 87.57 87.31 86.71 85.29 82.93 80.5 80.5 80.5 80.5 85.5 87.06 87.65 (217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m = 241.33	213.35	225.69	203.64	202.77	183.99	176.28	196.51	198.68	212.85	220.92	235.32
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Total = Sum(219a)_{1...12} = 2511.31 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year kWh/year

3944.72

Water heating fuel used

2511.31

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

393.13 (232)

Electricity generated by PVs

-690.51 (233)

10a Fuel costs – individual heating systems

Fuel
kWh/year

Fuel Price
(Table 12)

Fuel Cost
£/year

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Space heating - main system 1	(211) x	3.48	x 0.01 =	137.28	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	87.39	(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 =	51.85	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	0	(252)

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

Total energy cost (245)...(247) + (250) (254) = 406.42 (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] =	1.21	(257)
SAP rating (Section 12)		83.11	(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	852.06 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.216	542.44 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1394.5 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	38.93 (267)
Electricity for lighting	(232) x	0.519	204.03 (268)
Energy saving/generation technologies Item 1		0.519	-358.37 (269)
Total CO2, kg/year		sum of (265) (271) =	1279.09 (272)
CO2 emissions per m²		(272) ÷ (4) =	13.32 (273)
EI rating (section 14)			88 (274)

13a Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22	4812.56 (261)
Space heating (secondary)	(215) x	3.07	0 (263)
Energy for water heating	(219) x	1.22	3063.8 (264)
Space and water heating	(261) + (262) + (263) + (264) =		7876.36 (265)

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Electricity for pumps, fans and electric keep-hot	{231} x	3.07	::	230.25	{267}
Electricity for lighting	{232} x	0	::	1206.9	{268}
Energy saving/generation technologies					
Item 1		3.07	::	-2119.86	{269}
'Total Primary Energy		sum of {265} {271} =		7193.65	{272}
Primary energy kWh/m²/year		{272} ÷ {4} =		74.93	{273}

SAP Input

Property Details: 1112805

Address: ACTUAL ENERGY (2), Flats (6 no), Barnham Road, Eastergate, PO20 3RT
Located in: England
Region: South East England
UPRN:
Date of assessment: 30 October 2020
Date of certificate: 30 October 2020
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/person/day: True
PCDF Version: 466

Property description

Dwelling type: Flat
Detachment:
Year Completed: 2020
Floor Location: **Floor area:** **Storey height:**
 Floor 0 64 m² 2.4 m
Living area: 15 m² (fraction 0.234)
Front of dwelling faces: East

Opening types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Solid	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.4	2	1
Windows	16mm or more	0.7	0.63	1.4	10	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall	East	0	0
Windows		Wall	East	0	0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall	50	12	38	0.25	0	False	N/A
Roof	32	0	32	0.11	0		N/A
Ground Floor	32			0.16			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0323

Length	Psi-value	
10	0.05	E2 Other lintels (including other steel lintels)
5	0.034	E3 Sill
20	0.04	E4 Jamb

SAP Input

	10	0.06	E5	Ground floor (normal)
	0	0	E6	Intermediate floor within a dwelling
[Approved]	10	0.06	E10	Eaves (insulation at ceiling level)
	5	0.058	E16	Corner (normal)
[Approved]	5	0.06	E18	Party wall between dwellings
	5	0.043	P1	Ground floor
	5	0.041	P4	Roof (insulation at ceiling level)

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:	Heat pumps with radiators or underfloor heating
	Electric heat pumps
	Fuel: Electricity
	Info Source: SAP Tables
	SAP Table: 224
	Air source heat pump in other cases
	Underfloor heating and radiators, pipes in screed above insulation
	Design flow temperature: Design flow temperature >45°C
	Unknown
	Boiler interlock: No

Main heating Control:

Main heating Control:	Programmer and room thermostat
	Control code: 2204

Secondary heating system:

Secondary heating system:	None
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Water heating:

Water heating:	From main heating system
	Water code: 901
	Fuel :Electricity
	Hot water cylinder
	Cylinder volume: 210 litres
	Cylinder insulation: Measured loss, 2.3kWh/day
	Primary pipework insulation: True
	Cylinderstat: True
	Cylinder in heated space: True
	Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.9

Property Address: 4H2805

Address : ACTUAL ENERGY (2), Flats (6 no), Barnham Road, Eastergate, PO20 3RT

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	64 (1a)	2.4 (2a)	153.6 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	64 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	153.6 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (5a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				2	20 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (5a)+(6b)+(7a)+(7b)+(7c) =	20	0.13 (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		0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>		
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0 (12)
If no draught lobby, enter 0.05, else enter 0		0 (13)
Percentage of windows and doors draught stripped		0 (14)
Window infiltration	0.25 - [0.2 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)		0.38 (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) =	0.32 (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
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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

0.41	0.4	0.4	0.36	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x 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) x [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 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)

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 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.57 0.57 (24d)

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

(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.57 0.57 (25)

3. Heat losses and heat capacity 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			2	1.4	2.8		(26)
Windows			10	$1/[1/(1.4) + 0.04]$	13.26		(27)
Floor			32	0.16	5.12		(28)
Walls	50	12	38	0.25	9.5		(29)
Roof	32	0	32	0.11	3.52		(30)
Total area of elements, m²			114				(31)

* 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) = 34.2 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 5348 (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 3.68 (36)

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

Total fabric heat loss (33) + (36) = 37.88 (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=	29.65	29.48	29.32	28.55	28.4	27.73	27.73	27.61	27.99	28.4	28.69	29

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

(39)m=	67.52	67.36	67.19	66.42	66.28	65.61	65.61	65.49	65.87	66.28	66.57	66.88
Average = Sum(39) ÷ 12 =	66.42 (39)											

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.02	1.03	1.04	1.04	1.04		
	Average = Sum(40) ₁₋₁₂ / 12 =												1.04	(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 equipment

litres/year

Assumed occupancy, N

2.09

(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

83.89

(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=	92.28	88.92	85.57	82.21	78.86	75.5	75.5	78.86	82.21	85.57	88.92	92.28		
	Total = Sum(44) ₁₋₁₂ =												1006.67	(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=	136.85	119.69	123.51	107.68	103.32	89.15	82.61	94.8	95.93	111.8	122.04	132.53		
	Total = Sum(45) ₁₋₁₂ =												1319.91	(45)

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

(46)m=	20.53	17.95	18.53	16.15	15.5	13.37	12.39	14.22	14.39	16.77	18.31	19.88		(46)
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Water storage loss:

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

210

(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):

2.3

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

1.24

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

1.24

(55)

Water storage loss calculated for each month

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

(56)m=	38.5	34.78	38.5	37.26	38.5	37.26	38.5	38.5	37.26	38.5	37.26	38.5		(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=	38.5	34.78	38.5	37.26	38.5	37.26	38.5	38.5	37.26	38.5	37.26	38.5		(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)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--	------

SAP WorkSheet: New dwelling design stage

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	(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=	198.61	175.47	185.27	167.45	165.08	148.93	144.38	156.57	155.71	173.57	181.81	194.29	(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	(63)
--------	---	---	---	---	---	---	---	---	---	---	---	------

Output from water heater

(64)m=	198.61	175.47	185.27	167.45	165.08	148.93	144.38	156.57	155.71	173.57	181.81	194.29	
Output from water heater (annual): 12												2047.13	(64)

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

(65)m=	94.91	84.43	90.48	83.62	83.76	77.46	76.88	80.93	79.72	86.59	88.4	93.48	(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=	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	125.53	(66)

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

(67)m=	42.73	37.96	30.87	23.37	17.47	14.75	15.94	20.71	27.8	35.3	41.2	43.92	(67)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	------	-------	------

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

(68)m=	273	275.83	268.7	253.5	234.31	216.28	204.24	201.4	208.54	223.74	242.93	260.96	(68)
--------	-----	--------	-------	-------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(69)m=	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	49.65	(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=	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	-83.69	(71)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Water heating gains (Table 5)

(72)m=	127.57	125.63	121.61	116.14	112.59	107.59	103.33	108.78	110.72	116.38	122.77	125.64	(72)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(73)m=	534.79	530.91	512.66	484.49	455.86	430.1	415	422.39	438.55	466.91	498.39	522.01	(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 m ²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	10	x	19.64	x	0.63	x	0.7	=	60.02	(76)
East	0.9x	0.77	x	10	x	38.42	x	0.63	x	0.7	=	117.42	(76)
East	0.9x	0.77	x	10	x	63.27	x	0.63	x	0.7	=	193.37	(76)
East	0.9x	0.77	x	10	x	92.28	x	0.63	x	0.7	=	282.02	(76)
East	0.9x	0.77	x	10	x	113.09	x	0.63	x	0.7	=	345.63	(76)

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East	0.9x	0.77	x	10	x	115.77	x	0.63	x	0.7	=	353.81	(76)
East	0.9x	0.77	x	10	x	110.22	x	0.63	x	0.7	=	336.84	(76)
East	0.9x	0.77	x	10	x	94.68	x	0.63	x	0.7	=	289.34	(76)
East	0.9x	0.77	x	10	x	73.59	x	0.63	x	0.7	=	224.9	(76)
East	0.9x	0.77	x	10	x	45.59	x	0.63	x	0.7	=	139.33	(76)
East	0.9x	0.77	x	10	x	24.49	x	0.63	x	0.7	=	74.84	(76)
East	0.9x	0.77	x	10	x	16.15	x	0.63	x	0.7	=	49.36	(76)

Solar gains in watts, calculated for each month

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

(83)m=	60.02	117.42	193.37	282.02	345.63	353.81	336.84	289.34	224.9	139.33	74.84	49.36	(83)
--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	-------	------

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

(84)m=	594.82	648.33	706.03	766.51	801.48	783.91	751.84	711.73	663.45	606.23	573.23	571.37	(84)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

7. Mean internal temperature (heating season)

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

21 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.94	0.86	0.72	0.53	0.38	0.42	0.66	0.89	0.97	0.99	(86)

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

(87)m=	20.34	20.44	20.61	20.79	20.9	20.94	20.95	20.95	20.93	20.78	20.54	20.32	(87)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.47	20.47	20.48	20.48	20.48	20.49	20.49	20.49	20.49	20.48	20.48	20.48	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.98	0.97	0.94	0.85	0.69	0.49	0.34	0.38	0.61	0.88	0.97	0.99	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	19.85	19.95	20.11	20.3	20.4	20.43	20.44	20.44	20.42	20.29	20.05	19.84	(90)
--------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.23 (91)

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

(92)m=	19.97	20.07	20.23	20.41	20.52	20.55	20.56	20.56	20.54	20.41	20.16	19.95	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.97	20.07	20.23	20.41	20.52	20.55	20.56	20.56	20.54	20.41	20.16	19.95	(93)
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8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.93	0.84	0.69	0.49	0.34	0.38	0.62	0.87	0.96	0.98	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(95)m=	582.82	626.82	658.47	647.1	552.03	386.34	259.18	271.46	410.36	529.48	551.62	561.75	(95)
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Monthly average external temperature from Table 8

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

(97)m=	1057.98	1021.65	922.49	764.7	584.31	390.59	259.67	272.3	424.2	650.12	869.76	1053.39	(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=	353.52	265.32	196.43	84.67	24.02	0	0	0	0	89.75	229.06	365.78	
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1608.56 (98)

Space heating requirement in kWh/m²/year 25.13 (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 1 170 (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)

353.52	265.32	196.43	84.67	24.02	0	0	0	0	89.75	229.06	365.78
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m × (204)] } × 100 ÷ (206) (211)

207.96	156.07	115.55	49.81	14.13	0	0	0	0	52.8	134.74	215.17
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 946.21 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 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)

198.61	175.47	185.27	167.45	165.08	148.93	144.38	156.57	155.71	173.57	181.81	194.29
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Efficiency of water heater 170 (216)

(217)m = 170 170 170 170 170 170 170 170 170 170 170 170 (217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m = 116.83 103.22 108.98 98.5 97.11 87.6 84.93 92.1 91.59 102.1 106.95 114.29

Total = Sum(219a)_{1...12} = 1204.19 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

946.21

Water heating fuel used

1204.19

Electricity for pumps, fans and electric keep-hot

central heating pump:

120 (230c)

Total electricity for the above, kWh/year

sum of (230a) (230g) = 120 (231)

Electricity for lighting

301.87 (232)

9a Fuel costs – individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) ×	13.19 × 0.01 =	124.81 (240)
Space heating - main system 2	(213) ×	0 × 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)	13.19	x 0.01 =	158.83	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	15.83	(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 =	39.82	(250)
Additional standing charges (Table 12)				0	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245) ... (247) + (250) (254) =			339.28	(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] =	1.31	(257)
SAP rating (Section 12)		81.76	(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	491.08 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	624.98 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1116.06 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	62.28 (267)
Electricity for lighting	(232) x	0.519	156.67 (268)
Total CO2, kg/year		sum of (265) (271) =	1335.01 (272)
CO2 emissions per m²		(272) ÷ (4) =	20.86 (273)
El rating (section 14)			84 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	3.07	2904.87 (261)
Space heating (secondary)	(215) x	3.07	0 (263)
Energy for water heating	(219) x	3.07	3696.88 (264)
Space and water heating	(261) + (262) + (263) + (264) =		6601.75 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	368.4 (267)
Electricity for lighting	(232) x	0	926.75 (268)
'Total Primary Energy		sum of (265) (271) =	7896.9 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	123.39 (273)

SAP Input

Property Details: 1112406

Address: ACTUAL ENERGY (2), Houses (38 no), Barnham Road, Eastergate, PO20 3RT
Located in: England
Region: South East England
UPRN:
Date of assessment: 30 October 2020
Date of certificate: 30 October 2020
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/person/day: True
PCDF Version: 466

Property description

Dwelling type: House
Detachment: Semi-detached
Year Completed: 2020
Floor Location: **Floor area:** **Storey height:**
 Floor 0 48 m² 2.4 m
 Floor 1 48 m² 2.6 m
Living area: 20 m² (fraction 0.208)
Front of dwelling faces: East

Opening types

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front Door	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Front Door	16mm or more mm	0.7	0.63	1.4	2	1
Windows	16mm or more	0.7	0.63	1.4	20	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Front Door		Wall	East	0	0
Windows		Wall	East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
Wall	105	22	83	0.25	0	False	N/A
Roof	48	0	48	0.11	0		N/A
Ground Floor	48			0.16			N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0377

Length	Psi-value	
25	0.05	E2 Other lintels (including other steel lintels)
15	0.034	E3 Sill

SAP Input

	35	0.04	E4	Jamb
	20	0.06	E5	Ground floor (normal)
	20	0	E6	Intermediate floor within a dwelling
[Approved]	20	0.06	E10	Eaves (insulation at ceiling level)
	10	0.058	E16	Corner (normal)
[Approved]	10	0.06	E18	Party wall between dwellings
	10	0.043	P1	Ground floor
	10	0.041	P4	Roof (insulation at ceiling level)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	4
Number of passive stacks:	0
Number of sides sheltered:	2
Pressure test:	5

Main heating system:

Main heating system:	Heat pumps with radiators or underfloor heating
	Electric heat pumps
	Fuel: Electricity
	Info Source: SAP Tables
	SAP Table: 224
	Air source heat pump in other cases
	Underfloor heating and radiators, pipes in screed above insulation
	Design flow temperature: Design flow temperature >45°C
	Unknown
	Boiler interlock: No

Main heating Control:

Main heating Control:	Programmer and room thermostat
	Control code: 2204

Secondary heating system:

Secondary heating system:	None
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Water heating:

Water heating:	From main heating system
	Water code: 901
	Fuel :Electricity
	Hot water cylinder
	Cylinder volume: 300 litres
	Cylinder insulation: Measured loss, 2.8kWh/day
	Primary pipework insulation: True
	Cylinderstat: True
	Cylinder in heated space: True
	Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Unknown
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP Input

SAP WorkSheet: New dwelling design stage

User Details

Assessor Name: Joe Solti **Stroma Number:** STRO003946
Software Name: Stroma FSAP 2012 **Software Version:** Version: 1.0.5.9

Property Address: 4H2806

Address : ACTUAL ENERGY (2), Houses (38 no), Barnham Road, Eastergate, PO20 3RT

1. Overall dwelling dimensions

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	48 (1a) ×	2.4 (2a) =	115.2 (3a)
First floor	48 (1b) ×	2.6 (2b) =	124.8 (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	240 (5)

2. Ventilation rate

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

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	+ (5) =	0.17 (8)
<i>If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)</i>			
Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		{(9)-1}×0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
<i>if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35</i>			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - {0.2 × (14) + 100} =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = {(17) + 20}÷(8), otherwise (18) = (16)			0.42 (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 × (19)} =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) × (20) =		0.35 (21)
Infiltration rate modified for monthly wind speed			

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

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

Wind Factor (22a)m = (22)m ÷ 4

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

	0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

(23a)

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

(23b)

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

(23c)

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

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

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

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

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

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

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

d) If natural ventilation or whole house positive input ventilation from loft

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

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

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

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

3 Heat losses and heat losses 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			2	1.4	2.8		(26)
Windows			20	$\times 1/[1/(1.4) + 0.04]$	26.52		(27)
Floor			48	0.16	7.68		(28)
Walls	105	22	83	0.25	20.75		(29)
Roof	48	0	48	0.11	5.28		(30)
Total area of elements, m²			201				(31)

* 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) (28) (30) + (32) = 63.03 (33)

Heat capacity Cm = S(A x k) ((28) (30) + (32) + (32a) (32e) = 9842 (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 7.58 (36)

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

Total fabric heat loss (33) + (36) = 70.61 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m=	47.67	47.36	47.05	45.61	45.34	44.08	44.08	43.85	44.57	45.34	45.89	46.46

(38)

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

(39)m=	118.28	117.97	117.66	116.22	115.95	114.69	114.69	114.46	115.17	115.95	116.49	117.06
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Average = Sum(39) ÷ 12 = 116.21 (39)

SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m + (4)$$

(40)m=	1.23	1.23	1.23	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22		
	Average = Sum(40) ₁₋₁₂ / 12 =												1.21	(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 equipment

Assumed occupancy, N

2.7

(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

98.31

(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=	108.14	104.21	100.27	96.34	92.41	88.48	88.48	92.41	96.34	100.27	104.21	108.14		
	Total = Sum(44) ₁₋₁₂ =												1179.7	(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=	160.37	140.26	144.73	126.18	121.07	104.48	96.81	111.1	112.42	131.02	143.02	155.31		
	Total = Sum(45) ₁₋₁₂ =												1546.77	(45)

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

(46)m=	24.06	21.04	21.71	18.93	18.16	15.67	14.52	16.66	16.86	19.65	21.45	23.3		(46)
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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):

2.8

(48)

Temperature factor from Table 2b

0.54

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

1.51

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

1.51

(55)

Water storage loss calculated for each month

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

(56)m=	46.87	42.34	46.87	45.36	46.87	45.36	46.87	46.87	45.36	46.87	45.36	46.87		(56)
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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=	46.87	42.34	46.87	45.36	46.87	45.36	46.87	46.87	45.36	46.87	45.36	46.87		(57)
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Primary circuit loss (annual) from Table 3

0

(58)

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

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

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)
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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	(61)
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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=	230.5	203.6	214.87	194.05	191.21	172.35	166.95	181.23	180.29	201.15	210.89	225.44	(62)
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Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

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

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

(64)m=	230.5	203.6	214.87	194.05	191.21	172.35	166.95	181.23	180.29	201.15	210.89	225.44	
Output from water heater (annual): 12												2372.54	(64)

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

(65)m=	109.43	97.31	104.23	96.25	96.36	89.04	88.3	93.05	91.68	99.67	101.85	107.75	(65)
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include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5 Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	161.96	(66)

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

(67)m=	55.65	49.43	40.2	30.43	22.75	19.21	20.75	26.97	36.21	45.97	53.65	57.2	(67)
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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	372.68	376.55	366.8	346.05	319.86	295.25	278.81	274.94	284.69	305.43	331.62	356.23	(68)
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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	53.89	(69)
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Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	-107.97	(71)
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Water heating gains (Table 5)

(72)m=	147.08	144.81	140.1	133.68	129.52	123.66	118.68	125.06	127.33	133.97	141.46	144.82	(72)
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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	683.29	678.67	654.97	618.05	580.02	546	526.12	534.86	556.1	593.25	634.61	666.13	(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 _l Table 6b	FF Table 6c	Gains (W)	
East	0.9x 0.77	20	19.64	0.63	0.7	120.05	(76)
East	0.9x 0.77	20	38.42	0.63	0.7	234.84	(76)
East	0.9x 0.77	20	63.27	0.63	0.7	386.74	(76)
East	0.9x 0.77	20	92.28	0.63	0.7	564.04	(76)
East	0.9x 0.77	20	113.09	0.63	0.7	691.25	(76)

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East	0.9x	0.77	x	20	x	115.77	x	0.63	x	0.7	=	707.62	(76)
East	0.9x	0.77	x	20	x	110.22	x	0.63	x	0.7	=	673.68	(76)
East	0.9x	0.77	x	20	x	94.68	x	0.63	x	0.7	=	578.68	(76)
East	0.9x	0.77	x	20	x	73.59	x	0.63	x	0.7	=	449.8	(76)
East	0.9x	0.77	x	20	x	45.59	x	0.63	x	0.7	=	278.65	(76)
East	0.9x	0.77	x	20	x	24.49	x	0.63	x	0.7	=	149.68	(76)
East	0.9x	0.77	x	20	x	16.15	x	0.63	x	0.7	=	98.72	(76)

Solar gains in watts, calculated for each month

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

(83)m=	120.05	234.84	386.74	564.04	691.25	707.62	673.68	578.68	449.8	278.65	149.68	98.72	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	------

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

(84)m=	803.34	913.5	1041.72	1182.09	1271.27	1253.62	1199.8	1113.54	1005.9	871.9	784.3	764.85	(84)
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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	0.96	0.89	0.75	0.57	0.42	0.47	0.72	0.93	0.98	0.99	(86)

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

(87)m=	20.09	20.22	20.43	20.69	20.86	20.93	20.94	20.94	20.89	20.66	20.33	20.07	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.38	20.39	20.39	20.39	20.4	20.4	20.4	20.4	20.4	20.4	20.39	20.39	(88)
--------	-------	-------	-------	-------	------	------	------	------	------	------	-------	-------	------

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

(89)m=	0.99	0.98	0.95	0.87	0.72	0.52	0.36	0.41	0.67	0.92	0.98	0.99	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.53	19.66	19.87	20.12	20.27	20.34	20.35	20.35	20.31	20.1	19.77	19.51	(90)
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fLA = Living area ÷ (4) = 0.21 (91)

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

(92)m=	19.64	19.77	19.99	20.24	20.39	20.46	20.47	20.47	20.43	20.21	19.89	19.63	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.64	19.77	19.99	20.24	20.39	20.46	20.47	20.47	20.43	20.21	19.89	19.63	(93)
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8. Space heating requirement

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

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

(94)m=	0.99	0.98	0.95	0.87	0.72	0.52	0.37	0.41	0.68	0.91	0.98	0.99	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	793.98	893.54	989.16	1028.39	916.4	656.71	441.6	461.9	679.59	795.8	766.97	757.65	(95)
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Monthly average external temperature from Table 8

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

(97)m=	1814.93	1754.54	1586.66	1317.64	1008.14	672.02	443.8	465.76	729.11	1114.62	1489.68	1805.91	(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=	759.58	578.59	444.54	208.26	68.26	0	0	0	0	237.2	520.35	779.9	
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SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 3596.68 (98)

Space heating requirement in kWh/m²/year 37.47 (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 1 170 (206)
 Efficiency of secondary/supplementary heating system, % 0 (208)

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

759.58	578.59	444.54	208.26	68.26	0	0	0	0	237.2	520.35	779.9
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(211)m = {[(98)m × (204)] } × 100 ÷ (206) (211)

446.81	340.35	261.49	122.51	40.15	0	0	0	0	139.53	306.09	458.77
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Total (kWh/year) = Sum(211)_{1...5,10...12} = 2115.7 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m × (201)] } × 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)

230.5	203.6	214.87	194.05	191.21	172.35	166.95	181.23	180.29	201.15	210.89	225.44
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Efficiency of water heater 170 (216)

(217)m = 170 170 170 170 170 170 170 170 170 170 170 170 (217)

Fuel for water heating, kWh/month

(219)m = (64)m × 100 ÷ (217)m

(219)m = 135.59 119.77 126.39 114.15 112.48 101.38 98.21 106.61 106.06 118.32 124.05 132.61

Total = Sum(219a)_{1...12} = 1395.61 (219)

Annual totals

Space heating fuel used, main system 1

kWh/year kWh/year

2115.7

Water heating fuel used

1395.61

Electricity for pumps, fans and electric keep-hot

central heating pump:

120 (230c)

Total electricity for the above, kWh/year

sum of (230a) (230g) = 120 (231)

Electricity for lighting

393.13 (232)

9a Fuel costs – individual heating systems

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) ×	13.19 × 0.01 =	279.06 (240)
Space heating - main system 2	(213) ×	0 × 0.01 =	0 (241)

SAP WorkSheet: New dwelling design stage

Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	13.19	x 0.01 =	184.08	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	15.83	(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 =	51.85	(250)
Additional standing charges (Table 12)				0	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245) ... (247) + (250) (254) =			530.82	(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] =	1.58	(257)
SAP rating (Section 12)		77.94	(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	1098.05 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	724.32 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1822.37 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	62.28 (267)
Electricity for lighting	(232) x	0.519	204.03 (268)
Total CO2, kg/year		sum of (265) (271) =	2088.68 (272)
CO2 emissions per m²		(272) ÷ (4) =	21.76 (273)
El rating (section 14)			80 (274)

13a. Primary Energy

	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	3.07	6495.19 (261)
Space heating (secondary)	(215) x	3.07	0 (263)
Energy for water heating	(219) x	3.07	4284.53 (264)
Space and water heating	(261) + (262) + (263) + (264) =		10779.72 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	368.4 (267)
Electricity for lighting	(232) x	0	1206.9 (268)
'Total Primary Energy		sum of (265) (271) =	12355.02 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	128.7 (273)

Part G Compliance Report

PROJECT DETAILS

Project Reference: YH2801G
Client: Landacre (Eastergate) Ltd
Property: Warwick Nursery
Barnham Road
Eastergate PO20 3RT

Local Authority: Arun District Council
Agent:

Assessor: Joe Solti
Address: Therm Energy Ltd
Contact: 01903 884357
Software: G-Calc 2015 version 3.0.2
Prepared on: 02-Nov-20

RESULT SUMMARY

By following the Government's national calculation methodology for assessing water efficiency in new dwellings this 2 bed dwelling, as designed, achieves a water consumption of 109.9 litres per person per day.

Compliance with Building Regulation 36(1) has been demonstrated.

Table 1: The Water Calculator for New Dwellings

Installation Type	Unit of measure	Value	Use factor	Fixed use	litres/person/day
WC(single flush)	Flush volume (litres)		4.42	0.00	0
WC(dual flush)	Full flush vol.	6	1.46	0.00	8.76
	Part flush vol.	3	2.96	0.00	8.88
WC(multiple fittings)	Average effective Flush vol. (litres)		4.42	0.00	0
Taps(excl. Kitchen)	Flow rate (litres/min)	5	1.58	1.58	9.48
Bath (shower also present)	Capacity to overflow (litres)	180	0.11	0.00	19.8
Shower (bath also present)	Flow rate (litres/min)	8	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)	0	0.50	0.00	0
Shower only	Flow rate (litres/minute)	0	5.6	0.00	0
Kitchen sink taps	Flow rate (litres/minute)	7	0.44	10.36	13.44
Washing Machine	litres/kg dry load	7.6	2.1	0.0	15.96
Dishwasher	litres/place setting	1.1	3.6	0.0	3.96
Waste disposal	litres/use	0	3.08	0.0	0
Water softener	litres/person/day	0	1.0	0.0	0
Total calculated use (litres/person/day)					115.24
Contribution from greywater (litres/person/day)					-
Contribution from rainwater (litres/person/day)					-
Normalisation factor					0.91
Total Water Consumption. Code for Sustainable Homes (litres/person/day)					104.9
External water use					5.0
Total Water Consumption. (36(1)) (litres/person/day)					109.9

Summary of fitting types "As Designed"			
Type	Description	Flow rates, volumes etc.	Qty
Taps	Taps	5 litres/min	1
Baths	Baths	180 litres to overflow	1
Dishwashers	Dishwasher	1.1 litres/place	1
Washing Machines	Washing Machine	7.6 litres/kg	1
Showers	Showers	8 litres/min	1
WC's	Toilets	6 / 3 litres flush vols.	1
Kitchen/Utility taps	Taps	7 litres/min	1

The lower section of this table is to be filled in by the builder prior to completion. The descriptions, values and quantities should represent the 'as built' specification. Please note the values above represent design values and should not be exceeded without prior consultation with the agent/designer ().

The completed table should be returned to the assessor: Joe Solti (Contact: 01903 884357).

Declaration of fitting types "As Built"			
Type	Make and Model	Flow rates, volumes etc.	Qty
Taps			
Baths			
Dishwashers			
Washing Machines			
Showers			
WC's			
Kitchen/Utility taps			

Project ref: YH2801G - Warwick Nursery

The above declaration of fittings, values and quantities is a true reflection of those installed on this project.

Name: Signature: Date:

-----End of Report-----