thermenergy

Zac Denton
Henry Adams

c/c Peter Cleveland

Therm Energy Limited
45 Graham Road
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[redacted]

Our Reference : AD-20 Sent By : E-Mail

24 May 2022

Dear Zac

PLANNING CONDITION 7	
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 :	The Old Barn, 42 Felpham Road, Felpham PO22 7DF
Development :	Change of Use of Ground Floor to Habitable Accommodation (entire building to become single-occupancy dwelling)
Local Authority :	Arun District Council
Policy ECC SP2 :	Development to incorporate decentralised, renewable and low carbon energy systems
Renewables :	Solar PV (3kW peak)

REGISTERED ADDRESS : 5 TUSCAN AVENUE, MIDDLETON-ON-SEA, WEST SUSSEX PO22 7TE COMPANY NO : 05193292 VAT NO : 838 0185 23

Table 1 : Baseline CO2 Emissions	
Development :	5 Bedroom House
LZCs :	None
Base CO2 Emissions :	Total = 10,665 kg/year
Note 1 : Prior to renewables being added (see SAP calculations) Note 2 : Calculations are based on current SAP version/software	

Table 2 : Actual CO2 Emissions	
Development :	5 Bedroom House
LZCs :	Solar PV (3kW)
Actual CO2 Emissions :	Total = 9,589 kg/year
Note 1 : After renewables are added (see SAP calculations) Note 2 : Calculations are based on current SAP version/software	

Table 3 : CO2 Savings	
Development :	5 Bedroom House
LZCs :	Solar PV (3kW)
Base CO2 Emissions :	Total = 10,665 kg/year
Actual CO2 Emissions :	Total = 9,589 kg/year
CO2 Emissions Saving :	Total = 1,076 kg/year = 10.09%
Note 1 : After renewables are added (see SAP calculations) Note 2 : Calculations are based on current SAP version/software	

REGISTERED ADDRESS : 5 TUSCAN AVENUE, MIDDLETON-ON-SEA, WEST SUSSEX PO22 7TE COMPANY NO : 05193292 VAT NO : 838 0185 23

Table 4 : Solar PV

Note 1 : 3kW of solar pv (eg 10 x 300W panels) to be located on flat roof, angled at minimum 15º towards south.

Note 2 : A specialist solar pv supplier/installer will carry out a full design.

Note 3 : Solar panels are to be permanently retained for their lifetime and maintained in good working order.

Summary/Conclusion

The most suitable form of renewable or low carbon energy for the property is solar pv panels, achieving a reduction in CO2 emissions of at least 10%.

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

REGISTERED ADDRESS : 5 TUSCAN AVENUE, MIDDLETON-ON-SEA, WEST SUSSEX PO22 7TE COMPANY NO : 05193292 VAT NO : 838 0185 23

SAP Input

Property Details: As Built

Address: C02 (No LZcs), The Old Barn, 42 Felpham Road, Felpham, PO22 7DF
Located in: England
Region: South East England
UPRN:
Date of assessment: 24 May 2022
Date of certificate: 24 May 2022
Assessment type: New dwelling design stage
Transaction type: New dwelling
Tenure type: Unknown
Related party disclosure: No related party
Thermal Mass Parameter: Indicative Value Medium
Water use <= 125 litres/person/day: True
PCDF Version: 494

Property description:

Dwelling type: House
Detachment: Detached
Year Completed: 2022

Floor Location:	Floor area:	Storey height:
Floor 0	166 m²	2.3 m
Floor 1	133 m²	2.4 m

Living area: 114 m² (fraction 0.381)
Front of dwelling faces: West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Doors (S)	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	Yes	PVC-U
Doors (E)	Manufacturer	Solid	low-E, En = 0.05, soft coat	Yes	PVC-U
Doors (W)	Manufacturer	Solid	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (N)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (S)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (E)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (W)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	Gap:	Frame Factor:	g-value:	U-value:	Area:	No. of Openings:
Doors (S)	16mm or more mm	0.7	0.63	1.8	4	1
Doors (E)	16mm or more mm	0.7	0.63	1.8	4.5	1
Doors (W)	16mm or more mm	0.7	0.63	1.8	2.5	1
Windows (N)	16mm or more	0.7	0.63	1.6	5	1
Windows (S)	16mm or more	0.7	0.63	1.6	16	1
Windows (E)	16mm or more	0.7	0.63	1.6	1	1
Windows (W)	16mm or more	0.7	0.63	1.6	2	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Doors (S)		Wall	South	0	0
Doors (E)		Wall	East	0	0
Doors (W)		Wall	West	0	0
Windows (N)		Wall	North	0	0
Windows (S)		Wall	South	0	0
Windows (E)		Wall	East	0	0
Windows (W)		Wall	West	0	0

Overshading: Average or unknown

Opaque Elements:

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

SAP Input

External Elements

Wall	298	35	263	1.3	0	False	N/A
Roof (main)	133	0	133	0.25	0		N/A
Roof (flat)	30	0	30	0.18	0		N/A
Ground Floor	166			0.7			N/A

Internal Elements

Party Elements

Thermal Bridges

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Ventilation

Pressure test: No (Assumed)
Ventilation: Natural ventilation (extract fans)
Number of chimneys: 0
Number of open flues: 0
Number of fans: 7
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 15

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)
Regular condensing 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: Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary Heating System

Secondary heating system: None

Water Heating

Water heating: From main heating system
Water code: 901
Fuel :mains gas
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

SAP Input

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: 1.0.5.51

Property Address: A02/003

Address : C02 (No LZcs), The Old Barn, 42 Felpham Road, Felpham, PO22 7DF

1. Overall dwelling dimensions

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	166 (1a)	x	2.3 (2a)	=	381.8	(3a)
First floor	133 (1b)	x	2.4 (2b)	=	319.2	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	299 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+....(3n)	=	701	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							7	x 10 =	70	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	70	÷ (5) =	0.1 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.85 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.66 (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

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

0.84	0.82	0.81	0.72	0.71	0.63	0.63	0.61	0.66	0.71	0.74	0.77

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	0.85	0.84	0.83	0.76	0.75	0.7	0.7	0.69	0.72	0.75	0.77	0.8	(24d)

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

(25)m=	0.85	0.84	0.83	0.76	0.75	0.7	0.7	0.69	0.72	0.75	0.77	0.8	(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 Type 1			4	x	1.8	=	7.2			(26)
Doors Type 2			4.5	x	1.8	=	8.099999			(26)
Doors Type 3			2.5	x	1.8	=	4.5			(26)
Windows Type 1			5	x1/[1/(1.6)+ 0.04]		=	7.52			(27)
Windows Type 2			16	x1/[1/(1.6)+ 0.04]		=	24.06			(27)
Windows Type 3			1	x1/[1/(1.6)+ 0.04]		=	1.5			(27)
Windows Type 4			2	x1/[1/(1.6)+ 0.04]		=	3.01			(27)
Floor			166	x	0.7	=	116.2			(28)
Walls	298	35	263	x	1.3	=	341.9			(29)
Roof Type1	133	0	133	x	0.25	=	33.25			(30)
Roof Type2	30	0	30	x	0.18	=	5.4			(30)
Total area of elements, m²			627							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 552.64 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 38137 (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

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 94.05 (36)

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

Total fabric heat loss — (33) + (36) = — 646.69 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	197.23	194.07	190.96	176.38	173.65	160.95	160.95	158.6	165.84	173.65	179.17	184.94	(38)

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

(39)m=	843.92	840.76	837.65	823.07	820.34	807.64	807.64	805.29	812.53	820.34	825.86	831.63	

Average = Sum(39)$_{1...12}$ /12= 823.06 (39)

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

(40)m=	2.82	2.81	2.8	2.75	2.74	2.7	2.7	2.69	2.72	2.74	2.76	2.78	

Average = Sum(40)$_{1...12}$ /12= 2.75 (40)

Number of days in month (Table 1a)

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

4 Water heating energy requirement (DM/SC/SH)

Assumed occupancy, N — 3.13 (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 — 108.55 (43)

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

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

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

(44)m=	119.41	115.07	110.72	106.38	102.04	97.7	97.7	102.04	106.38	110.72	115.07	119.41	

Total = Sum(44)$_{1...12}$ = 1302.63 (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=	177.08	154.87	159.82	139.33	133.69	115.37	106.9	122.67	124.14	144.67	157.92	171.49	

Total = Sum(45)$_{1...12}$ = 1707.95 (45)

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

(46)m=	26.56	23.23	23.97	20.9	20.05	17.3	16.04	18.4	18.62	21.7	23.69	25.72	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 2.8 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.51	(55)

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

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)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

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

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

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

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

(62)m=	247.21	218.22	229.95	207.2	203.83	183.24	177.04	192.81	192.01	214.81	225.79	241.63	(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=	247.21	218.22	229.95	207.2	203.83	183.24	177.04	192.81	192.01	214.81	225.79	241.63	

Output from water heater (annual)... 2533.73 (64)

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

(65)m=	114.99	102.17	109.25	100.63	100.56	92.66	91.65	96.9	95.57	104.21	106.81	113.13	(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=	187.84	187.84	187.84	187.84	187.84	187.84	187.84	187.84	187.84	187.84	187.84	187.84	(66)

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

(67)m=	119.34	106	86.2	65.26	48.78	41.19	44.5	57.85	77.64	98.58	115.06	122.66	(67)

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

(68)m=	682.77	689.85	672	633.99	586.01	540.92	510.79	503.71	521.56	559.57	607.55	652.64	(68)

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

(69)m=	56.91	56.91	56.91	56.91	56.91	56.91	56.91	56.91	56.91	56.91	56.91	56.91	(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=	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	(71)

Water heating gains (Table 5)

(72)m=	154.55	152.04	146.84	139.76	135.16	128.69	123.19	130.24	132.74	140.07	148.34	152.05	(72)

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

(73)m=	1079.19	1070.42	1027.57	961.54	892.48	833.32	801.01	814.32	854.47	920.75	993.48	1049.88	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	5	x	10.63	x	0.63	x	0.7	=	16.25	(74)
North	0.9x 0.77	x	5	x	20.32	x	0.63	x	0.7	=	31.05	(74)
North	0.9x 0.77	x	5	x	34.53	x	0.63	x	0.7	=	52.76	(74)
North	0.9x 0.77	x	5	x	55.46	x	0.63	x	0.7	=	84.75	(74)
North	0.9x 0.77	x	5	x	74.72	x	0.63	x	0.7	=	114.17	(74)
North	0.9x 0.77	x	5	x	79.99	x	0.63	x	0.7	=	122.22	(74)
North	0.9x 0.77	x	5	x	74.68	x	0.63	x	0.7	=	114.11	(74)
North	0.9x 0.77	x	5	x	59.25	x	0.63	x	0.7	=	90.53	(74)
North	0.9x 0.77	x	5	x	41.52	x	0.63	x	0.7	=	63.44	(74)
North	0.9x 0.77	x	5	x	24.19	x	0.63	x	0.7	=	36.96	(74)
North	0.9x 0.77	x	5	x	13.12	x	0.63	x	0.7	=	20.04	(74)
North	0.9x 0.77	x	5	x	8.86	x	0.63	x	0.7	=	13.55	(74)
East	0.9x 0.77	x	1	x	19.64	x	0.63	x	0.7	=	6	(76)
East	0.9x 0.77	x	1	x	38.42	x	0.63	x	0.7	=	11.74	(76)
East	0.9x 0.77	x	1	x	63.27	x	0.63	x	0.7	=	19.34	(76)
East	0.9x 0.77	x	1	x	92.28	x	0.63	x	0.7	=	28.2	(76)
East	0.9x 0.77	x	1	x	113.09	x	0.63	x	0.7	=	34.56	(76)
East	0.9x 0.77	x	1	x	115.77	x	0.63	x	0.7	=	35.38	(76)
East	0.9x 0.77	x	1	x	110.22	x	0.63	x	0.7	=	33.68	(76)
East	0.9x 0.77	x	1	x	94.68	x	0.63	x	0.7	=	28.93	(76)
East	0.9x 0.77	x	1	x	73.59	x	0.63	x	0.7	=	22.49	(76)
East	0.9x 0.77	x	1	x	45.59	x	0.63	x	0.7	=	13.93	(76)
East	0.9x 0.77	x	1	x	24.49	x	0.63	x	0.7	=	7.48	(76)
East	0.9x 0.77	x	1	x	16.15	x	0.63	x	0.7	=	4.94	(76)
South	0.9x 0.77	x	16	x	46.75	x	0.63	x	0.7	=	228.61	(78)
South	0.9x 0.77	x	16	x	76.57	x	0.63	x	0.7	=	374.4	(78)
South	0.9x 0.77	x	16	x	97.53	x	0.63	x	0.7	=	476.92	(78)
South	0.9x 0.77	x	16	x	110.23	x	0.63	x	0.7	=	539.03	(78)
South	0.9x 0.77	x	16	x	114.87	x	0.63	x	0.7	=	561.7	(78)
South	0.9x 0.77	x	16	x	110.55	x	0.63	x	0.7	=	540.56	(78)
South	0.9x 0.77	x	16	x	108.01	x	0.63	x	0.7	=	528.16	(78)
South	0.9x 0.77	x	16	x	104.89	x	0.63	x	0.7	=	512.91	(78)
South	0.9x 0.77	x	16	x	101.89	x	0.63	x	0.7	=	498.2	(78)
South	0.9x 0.77	x	16	x	82.59	x	0.63	x	0.7	=	403.83	(78)
South	0.9x 0.77	x	16	x	55.42	x	0.63	x	0.7	=	270.98	(78)
South	0.9x 0.77	x	16	x	40.4	x	0.63	x	0.7	=	197.54	(78)
West	0.9x 0.77	x	2	x	19.64	x	0.63	x	0.7	=	12	(80)
West	0.9x 0.77	x	2	x	38.42	x	0.63	x	0.7	=	23.48	(80)
West	0.9x 0.77	x	2	x	63.27	x	0.63	x	0.7	=	38.67	(80)

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West	0.9x	0.77	x	2	x	92.28	x	0.63	x	0.7	=	56.4	(80)
West	0.9x	0.77	x	2	x	113.09	x	0.63	x	0.7	=	69.13	(80)
West	0.9x	0.77	x	2	x	115.77	x	0.63	x	0.7	=	70.76	(80)
West	0.9x	0.77	x	2	x	110.22	x	0.63	x	0.7	=	67.37	(80)
West	0.9x	0.77	x	2	x	94.68	x	0.63	x	0.7	=	57.87	(80)
West	0.9x	0.77	x	2	x	73.59	x	0.63	x	0.7	=	44.98	(80)
West	0.9x	0.77	x	2	x	45.59	x	0.63	x	0.7	=	27.87	(80)
West	0.9x	0.77	x	2	x	24.49	x	0.63	x	0.7	=	14.97	(80)
West	0.9x	0.77	x	2	x	16.15	x	0.63	x	0.7	=	9.87	(80)

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

(83)m=	262.86	440.68	587.7	708.38	779.56	768.92	743.32	690.25	629.11	482.59	313.48	225.89	(83)

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

(84)m=	1342.05	1511.1	1615.26	1669.92	1672.04	1602.24	1544.33	1504.57	1483.58	1403.34	1306.95	1275.78	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.99	0.97	0.94	0.95	0.98	0.99	1	1	(86)

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

(87)m=	17.93	18.1	18.46	18.98	19.54	20.12	20.48	20.44	19.99	19.26	18.53	17.93	(87)

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

(88)m=	18.84	18.85	18.85	18.88	18.88	18.91	18.91	18.91	18.9	18.88	18.87	18.86	(88)

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

(89)m=	1	1	0.99	0.99	0.98	0.93	0.8	0.83	0.95	0.99	1	1	(89)

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

(90)m=	14.99	15.24	15.76	16.54	17.36	18.19	18.68	18.63	18.01	16.96	15.88	14.99	(90)

fLA = Living area ÷ (4) = 0.38 (91)

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

(92)m=	16.11	16.33	16.79	17.47	18.2	18.93	19.37	19.32	18.76	17.84	16.89	16.11	(92)

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

(93)m=	16.11	16.33	16.79	17.47	18.2	18.93	19.37	19.32	18.76	17.84	16.89	16.11	(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=	1	0.99	0.99	0.98	0.97	0.93	0.85	0.87	0.95	0.98	0.99	1	(94)

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

(95)m=	1336.21	1501.57	1599.77	1643.06	1620.39	1491.58	1309.96	1306.14	1409.72	1381	1298.59	1271.05	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	9965.25	9608.8	8618.01	7055.59	5328.4	3494.12	2235.09	2353.1	3788.34	5935.16	8084.56	9903.93	(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=	6420.01	5448.06	5221.57	3897.02	2758.76	0	0	0	0	3388.3	4885.89	6422.86	
									Total per year (kWh/year) = Sum(98)$_{1..5,9..12}$ =				38442.49 (98)
Space heating requirement in kWh/m²/year													128.57 (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		89.9 (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)													
	6420.01	5448.06	5221.57	3897.02	2758.76	0	0	0	0	3388.3	4885.89	6422.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	7141.27	6060.14	5808.2	4334.84	3068.7	0	0	0	0	3768.96	5434.81	7144.45	
									Total (kWh/year) =Sum(211)$_{1..5,10..12}$=				42761.39 (211)

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

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

Water heating

Output from water heater (calculated above)

	247.21	218.22	229.95	207.2	203.83	183.24	177.04	192.81	192.01	214.81	225.79	241.63

Efficiency of water heater 79.8 (216)

(217)m=	89.48	89.46	89.42	89.33	89.12	79.8	79.8	79.8	79.8	89.23	89.4	89.49	(217)

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

(219)m=	276.28	243.92	257.15	231.95	228.7	229.62	221.85	241.61	240.61	240.74	252.56	270	
									Total = Sum(219a)$_{1..12}$ =				2935.01 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		42761.39
Water heating fuel used		2935.01
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		843.06 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		46614.45 (338)

12a. CO2 emissions – Individual heating systems

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	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		3.48	x 0.01 =	1488.1	(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 =	102.14	(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 =	111.2	(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) =				1831.33	(255)

12a SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	2.24	(257)
SAP rating (Section 12)	68.81	(258)

12b 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	=	9236.46	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	633.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				9870.42	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	437.55	(268)
Total CO2, kg/year	sum of (265)...(271) =				10346.89	(272)
CO2 emissions per m²	(272) ÷ (4) =				34.6	(273)
EI rating (section 14)					60	(274)

13a Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		1.22	=	52168.89	(261)
Space heating (secondary)	(215) x		3.07	=	0	(263)
Energy for water heating	(219) x		1.22	=	3580.71	(264)
Space and water heating	(261) + (262) + (263) + (264) =				55749.6	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		3.07	=	230.25	(267)

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Electricity for lighting	(232) x	0	=	2588.19	(268)
'Total Primary Energy		sum of (265)...(271) =		58568.04	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		195.88	(273)

SAP Input

Property Details: As Built

Address:	C02 (Solar PV), The Old Barn, 42 Felpham Road, Felpham, PO22 7DF
Located in:	England
Region:	South East England
UPRN:	
Date of assessment:	24 May 2022
Date of certificate:	24 May 2022
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	494

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2022

Floor Location:	**Floor area:**	**Storey height:**
Floor 0	166 m²	2.3 m
Floor 1	133 m²	2.4 m

Living area:	114 m² (fraction 0.381)
Front of dwelling faces:	West

Opening types:

Name:	**Source:**	**Type:**	**Glazing:**	**Argon:**	**Frame:**
Doors (S)	Manufacturer	Half glazed	low-E, En = 0.05, soft coat	Yes	PVC-U
Doors (E)	Manufacturer	Solid	low-E, En = 0.05, soft coat	Yes	PVC-U
Doors (W)	Manufacturer	Solid	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (N)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (S)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (E)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U
Windows (W)	SAP 2012	Windows	low-E, En = 0.05, soft coat	Yes	PVC-U

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
Doors (S)	16mm or more mm	0.7	0.63	1.8	4	1
Doors (E)	16mm or more mm	0.7	0.63	1.8	4.5	1
Doors (W)	16mm or more mm	0.7	0.63	1.8	2.5	1
Windows (N)	16mm or more	0.7	0.63	1.6	5	1
Windows (S)	16mm or more	0.7	0.63	1.6	16	1
Windows (E)	16mm or more	0.7	0.63	1.6	1	1
Windows (W)	16mm or more	0.7	0.63	1.6	2	1

Name:	**Type-Name:**	**Location:**	**Orient:**	**Width:**	**Height:**
Doors (S)		Wall	South	0	0
Doors (E)		Wall	East	0	0
Doors (W)		Wall	West	0	0
Windows (N)		Wall	North	0	0
Windows (S)		Wall	South	0	0
Windows (E)		Wall	East	0	0
Windows (W)		Wall	West	0	0

Overshading: Average or unknown

Opaque Elements:

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

SAP Input

External Elements

Wall	298	35	263	1.3	0	False	N/A
Roof (main)	133	0	133	0.25	0		N/A
Roof (flat)	30	0	30	0.18	0		N/A
Ground Floor	166			0.7			N/A

Internal Elements

Party Elements

Thermal Bridges

Thermal bridges: No information on thermal bridging (y=0.15) (y =0.15)

Ventilation

Pressure test: No (Assumed)
Ventilation: Natural ventilation (extract fans)
Number of chimneys: 0
Number of open flues: 0
Number of fans: 7
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 15

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)
Regular condensing 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: Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary Heating System

Secondary heating system: None

Water Heating

Water heating: From main heating system
Water code: 901
Fuel :mains gas
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

SAP Input

Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 3 Tilt of collector: 30° Overshading: Modest Collector Orientation: South
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: 1.0.5.51

Property Address: A02/002

Address : C02 (Solar PV), The Old Barn, 42 Felpham Road, Felpham, PO22 7DF

1. Overall dwelling dimensions

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	166 (1a)	x	2.3 (2a)	=	381.8	(3a)
First floor	133 (1b)	x	2.4 (2b)	=	319.2	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	299 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+....(3n)	=	701	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							7	x 10 =	70	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	70	÷ (5) =	0.1 (8)

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

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			15 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.85 (18)

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

Number of sides sheltered			3 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.78 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.66 (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

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

0.84	0.82	0.81	0.72	0.71	0.63	0.63	0.61	0.66	0.71	0.74	0.77

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	0.85	0.84	0.83	0.76	0.75	0.7	0.7	0.69	0.72	0.75	0.77	0.8	(24d)

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

(25)m=	0.85	0.84	0.83	0.76	0.75	0.7	0.7	0.69	0.72	0.75	0.77	0.8	(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 Type 1			4	x	1.8	=	7.2			(26)
Doors Type 2			4.5	x	1.8	=	8.099999			(26)
Doors Type 3			2.5	x	1.8	=	4.5			(26)
Windows Type 1			5	x1/[1/(1.6)+ 0.04]		=	7.52			(27)
Windows Type 2			16	x1/[1/(1.6)+ 0.04]		=	24.06			(27)
Windows Type 3			1	x1/[1/(1.6)+ 0.04]		=	1.5			(27)
Windows Type 4			2	x1/[1/(1.6)+ 0.04]		=	3.01			(27)
Floor			166	x	0.7	=	116.2			(28)
Walls	298	35	263	x	1.3	=	341.9			(29)
Roof Type1	133	0	133	x	0.25	=	33.25			(30)
Roof Type2	30	0	30	x	0.18	=	5.4			(30)
Total area of elements, m²			627							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)...(30) + (32) = 552.64 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 38137 (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

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 94.05 (36)

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

Total fabric heat loss — (33) + (36) = — 646.69 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	197.23	194.07	190.96	176.38	173.65	160.95	160.95	158.6	165.84	173.65	179.17	184.94	(38)

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

(39)m=	843.92	840.76	837.65	823.07	820.34	807.64	807.64	805.29	812.53	820.34	825.86	831.63	

Average = Sum(39)$_{1...12}$ /12= 823.06 (39)

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

(40)m=	2.82	2.81	2.8	2.75	2.74	2.7	2.7	2.69	2.72	2.74	2.76	2.78	

Average = Sum(40)$_{1...12}$ /12= 2.75 (40)

Number of days in month (Table 1a)

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

4 Water heating energy requirement (DM/SC/SH)

Assumed occupancy, N — 3.13 (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 — 108.55 (43)

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

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

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

(44)m=	119.41	115.07	110.72	106.38	102.04	97.7	97.7	102.04	106.38	110.72	115.07	119.41	

Total = Sum(44)$_{1...12}$ = 1302.63 (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=	177.08	154.87	159.82	139.33	133.69	115.37	106.9	122.67	124.14	144.67	157.92	171.49	

Total = Sum(45)$_{1...12}$ = 1707.95 (45)

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

(46)m=	26.56	23.23	23.97	20.9	20.05	17.3	16.04	18.4	18.62	21.7	23.69	25.72	(46)

Water storage loss:

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

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

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

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 2.8 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year — (48) x (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)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.51	(55)

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

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)

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

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

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

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

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

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

(62)m=	247.21	218.22	229.95	207.2	203.83	183.24	177.04	192.81	192.01	214.81	225.79	241.63	(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=	247.21	218.22	229.95	207.2	203.83	183.24	177.04	192.81	192.01	214.81	225.79	241.63	

Output from water heater (annual)... 2533.73 (64)

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

(65)m=	114.99	102.17	109.25	100.63	100.56	92.66	91.65	96.9	95.57	104.21	106.81	113.13	(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=	187.84	187.84	187.84	187.84	187.84	187.84	187.84	187.84	187.84	187.84	187.84	187.84	(66)

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

(67)m=	119.34	106	86.2	65.26	48.78	41.19	44.5	57.85	77.64	98.58	115.06	122.66	(67)

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

(68)m=	682.77	689.85	672	633.99	586.01	540.92	510.79	503.71	521.56	559.57	607.55	652.64	(68)

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

(69)m=	56.91	56.91	56.91	56.91	56.91	56.91	56.91	56.91	56.91	56.91	56.91	56.91	(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=	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	-125.23	(71)

Water heating gains (Table 5)

(72)m=	154.55	152.04	146.84	139.76	135.16	128.69	123.19	130.24	132.74	140.07	148.34	152.05	(72)

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

(73)m=	1079.19	1070.42	1027.57	961.54	892.48	833.32	801.01	814.32	854.47	920.75	993.48	1049.88	(73)

6. Solar gains:

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

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	5	x	10.63	x	0.63	x	0.7	=	16.25	(74)
North	0.9x 0.77	x	5	x	20.32	x	0.63	x	0.7	=	31.05	(74)
North	0.9x 0.77	x	5	x	34.53	x	0.63	x	0.7	=	52.76	(74)
North	0.9x 0.77	x	5	x	55.46	x	0.63	x	0.7	=	84.75	(74)
North	0.9x 0.77	x	5	x	74.72	x	0.63	x	0.7	=	114.17	(74)
North	0.9x 0.77	x	5	x	79.99	x	0.63	x	0.7	=	122.22	(74)
North	0.9x 0.77	x	5	x	74.68	x	0.63	x	0.7	=	114.11	(74)
North	0.9x 0.77	x	5	x	59.25	x	0.63	x	0.7	=	90.53	(74)
North	0.9x 0.77	x	5	x	41.52	x	0.63	x	0.7	=	63.44	(74)
North	0.9x 0.77	x	5	x	24.19	x	0.63	x	0.7	=	36.96	(74)
North	0.9x 0.77	x	5	x	13.12	x	0.63	x	0.7	=	20.04	(74)
North	0.9x 0.77	x	5	x	8.86	x	0.63	x	0.7	=	13.55	(74)
East	0.9x 0.77	x	1	x	19.64	x	0.63	x	0.7	=	6	(76)
East	0.9x 0.77	x	1	x	38.42	x	0.63	x	0.7	=	11.74	(76)
East	0.9x 0.77	x	1	x	63.27	x	0.63	x	0.7	=	19.34	(76)
East	0.9x 0.77	x	1	x	92.28	x	0.63	x	0.7	=	28.2	(76)
East	0.9x 0.77	x	1	x	113.09	x	0.63	x	0.7	=	34.56	(76)
East	0.9x 0.77	x	1	x	115.77	x	0.63	x	0.7	=	35.38	(76)
East	0.9x 0.77	x	1	x	110.22	x	0.63	x	0.7	=	33.68	(76)
East	0.9x 0.77	x	1	x	94.68	x	0.63	x	0.7	=	28.93	(76)
East	0.9x 0.77	x	1	x	73.59	x	0.63	x	0.7	=	22.49	(76)
East	0.9x 0.77	x	1	x	45.59	x	0.63	x	0.7	=	13.93	(76)
East	0.9x 0.77	x	1	x	24.49	x	0.63	x	0.7	=	7.48	(76)
East	0.9x 0.77	x	1	x	16.15	x	0.63	x	0.7	=	4.94	(76)
South	0.9x 0.77	x	16	x	46.75	x	0.63	x	0.7	=	228.61	(78)
South	0.9x 0.77	x	16	x	76.57	x	0.63	x	0.7	=	374.4	(78)
South	0.9x 0.77	x	16	x	97.53	x	0.63	x	0.7	=	476.92	(78)
South	0.9x 0.77	x	16	x	110.23	x	0.63	x	0.7	=	539.03	(78)
South	0.9x 0.77	x	16	x	114.87	x	0.63	x	0.7	=	561.7	(78)
South	0.9x 0.77	x	16	x	110.55	x	0.63	x	0.7	=	540.56	(78)
South	0.9x 0.77	x	16	x	108.01	x	0.63	x	0.7	=	528.16	(78)
South	0.9x 0.77	x	16	x	104.89	x	0.63	x	0.7	=	512.91	(78)
South	0.9x 0.77	x	16	x	101.89	x	0.63	x	0.7	=	498.2	(78)
South	0.9x 0.77	x	16	x	82.59	x	0.63	x	0.7	=	403.83	(78)
South	0.9x 0.77	x	16	x	55.42	x	0.63	x	0.7	=	270.98	(78)
South	0.9x 0.77	x	16	x	40.4	x	0.63	x	0.7	=	197.54	(78)
West	0.9x 0.77	x	2	x	19.64	x	0.63	x	0.7	=	12	(80)
West	0.9x 0.77	x	2	x	38.42	x	0.63	x	0.7	=	23.48	(80)
West	0.9x 0.77	x	2	x	63.27	x	0.63	x	0.7	=	38.67	(80)

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West	0.9x	0.77	x	2	x	92.28	x	0.63	x	0.7	=	56.4	(80)
West	0.9x	0.77	x	2	x	113.09	x	0.63	x	0.7	=	69.13	(80)
West	0.9x	0.77	x	2	x	115.77	x	0.63	x	0.7	=	70.76	(80)
West	0.9x	0.77	x	2	x	110.22	x	0.63	x	0.7	=	67.37	(80)
West	0.9x	0.77	x	2	x	94.68	x	0.63	x	0.7	=	57.87	(80)
West	0.9x	0.77	x	2	x	73.59	x	0.63	x	0.7	=	44.98	(80)
West	0.9x	0.77	x	2	x	45.59	x	0.63	x	0.7	=	27.87	(80)
West	0.9x	0.77	x	2	x	24.49	x	0.63	x	0.7	=	14.97	(80)
West	0.9x	0.77	x	2	x	16.15	x	0.63	x	0.7	=	9.87	(80)

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

(83)m=	262.86	440.68	587.7	708.38	779.56	768.92	743.32	690.25	629.11	482.59	313.48	225.89	(83)

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

(84)m=	1342.05	1511.1	1615.26	1669.92	1672.04	1602.24	1544.33	1504.57	1483.58	1403.34	1306.95	1275.78	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.99	0.97	0.94	0.95	0.98	0.99	1	1	(86)

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

(87)m=	17.93	18.1	18.46	18.98	19.54	20.12	20.48	20.44	19.99	19.26	18.53	17.93	(87)

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

(88)m=	18.84	18.85	18.85	18.88	18.88	18.91	18.91	18.91	18.9	18.88	18.87	18.86	(88)

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

(89)m=	1	1	0.99	0.99	0.98	0.93	0.8	0.83	0.95	0.99	1	1	(89)

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

(90)m=	14.99	15.24	15.76	16.54	17.36	18.19	18.68	18.63	18.01	16.96	15.88	14.99	(90)

fLA = Living area ÷ (4) = 0.38 (91)

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

(92)m=	16.11	16.33	16.79	17.47	18.2	18.93	19.37	19.32	18.76	17.84	16.89	16.11	(92)

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

(93)m=	16.11	16.33	16.79	17.47	18.2	18.93	19.37	19.32	18.76	17.84	16.89	16.11	(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=	1	0.99	0.99	0.98	0.97	0.93	0.85	0.87	0.95	0.98	0.99	1	(94)

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

(95)m=	1336.21	1501.57	1599.77	1643.06	1620.39	1491.58	1309.96	1306.14	1409.72	1381	1298.59	1271.05	(95)

Monthly average external temperature from Table 8

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

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

(97)m=	9965.25	9608.8	8618.01	7055.59	5328.4	3494.12	2235.09	2353.1	3788.34	5935.16	8084.56	9903.93	(97)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(98)m=	6420.01	5448.06	5221.57	3897.02	2758.76	0	0	0	0	3388.3	4885.89	6422.86	
Total per year (kWh/year) = Sum(98)$_{1..5,10..12}$ =													38442.49 (98)

Space heating requirement in kWh/m²/year 128.57 (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 89.9 (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)	6420.01	5448.06	5221.57	3897.02	2758.76	0	0	0	0	3388.3	4885.89	6422.86	

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

	7141.27	6060.14	5808.2	4334.84	3068.7	0	0	0	0	3768.96	5434.81	7144.45	
Total (kWh/year) =Sum(211)$_{1..5,10..12}$=													42761.39 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

Water heating

Output from water heater (calculated above)

	247.21	218.22	229.95	207.2	203.83	183.24	177.04	192.81	192.01	214.81	225.79	241.63	

Efficiency of water heater 79.8 (216)

(217)m=	89.48	89.46	89.42	89.33	89.12	79.8	79.8	79.8	79.8	89.23	89.4	89.49	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	276.28	243.92	257.15	231.95	228.7	229.62	221.85	241.61	240.61	240.74	252.56	270	
Total = Sum(219a)$_{1..12}$ =													2935.01 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		42761.39
Water heating fuel used		2935.01
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		843.06 (232)
Electricity generated by PVs		-2072.69 (233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		44541.77 (338)

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12a Fuel costs - individual heating systems

	Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		3.48	x 0.01 =	1488.1	(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 =	102.14	(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 =	111.2	(250)
Additional standing charges (Table 12)					120	(251)
	one of (233) to (235) x		13.19	x 0.01 =	-273.39	(252)
Appendix Q items: repeat lines (253) and (254) as needed						
Total energy cost	(245)...(247) + (250)...(254) =				1557.94	(255)

13a SAP rating - individual heating systems

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF) [(255) x (256)] ÷ [(4) + 45.0] =	1.9	(257)
SAP rating (Section 12)	73.47	(258)

14a 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	=	9236.46	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	633.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =				9870.42	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	437.55	(268)
Energy saving/generation technologies						
Item 1			0.519	=	-1075.72	(269)
Total CO2, kg/year		sum of (265)...(271) =			9271.17	(272)
CO2 emissions per m²		(272) ÷ (4) =			31.01	(273)
EI rating (section 14)					64	(274)

15a Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x		1.22	=	52168.89	(261)

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Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	3580.71	(264)
Space and water heating	(261) + (262) + (263) + (264) =			55749.6	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	2588.19	(268)
Energy saving/generation technologies Item 1		3.07	=	-6363.15	(269)
'Total Primary Energy	sum of (265)...(271) =			52204.89	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			174.6	(273)