Predicted Energy Assessment

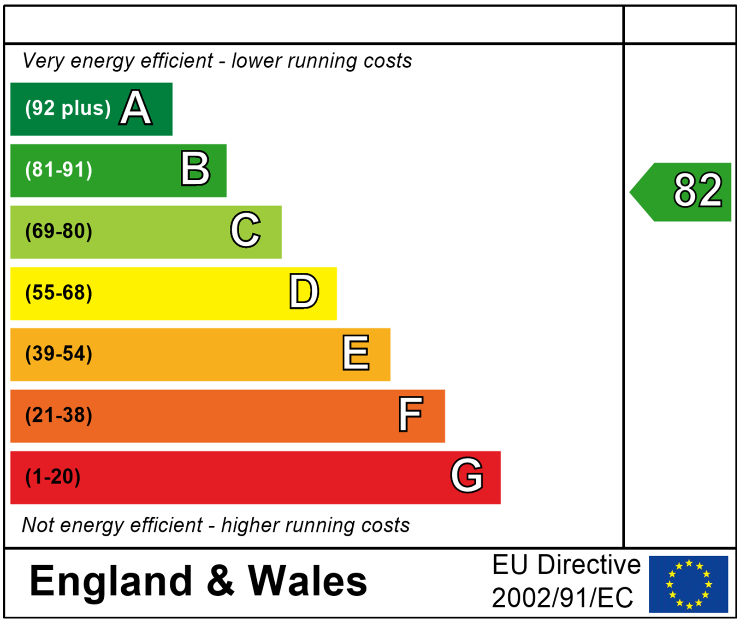
Flat 2
222 Otley Road
Leeds
LS16 5AB

Dwelling type:	Mid floor Flat
Date of assessment:	16 January 2017
Produced by:	Mark Heptonstall
Total floor area:	98.28 m²

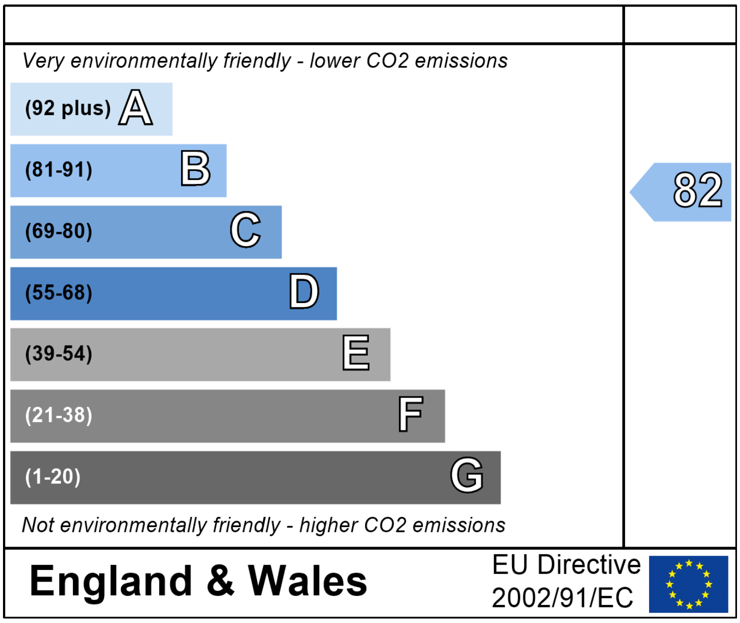
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

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

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



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

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

SAP Input

Property Details: Flat 2

Address:	Flat 2, 222 Otley Road, Leeds, LS16 5AB
Located in:	England
Region:	East Pennines
UPRN:	
Date of assessment:	16 January 2017
Date of certificate:	16 January 2017
Assessment type:	New dwelling created by change of use
Transaction type:	New dwelling
Tenure type:	Owner-occupied
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	False
PCDF Version:	404

Property description:

Dwelling type:	Flat	
Detachment:		
Year Completed:	2017	
Floor Location:	Floor area:	Storey height:
Floor 0	98.28 m²	2.4 m
Living area:	21.77 m² (fraction 0.222)	
Front of dwelling faces:	North East	

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Rear	SAP 2012	Windows	double-glazed	Yes	PVC-U
Side	SAP 2012	Windows	double-glazed	Yes	PVC-U
Side	SAP 2012	Windows	double-glazed	Yes	PVC-U
Side	SAP 2012	Windows	double-glazed	Yes	PVC-U
Front	SAP 2012	Windows	double-glazed	Yes	PVC-U

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
Rear	16mm or more	0.7	0.76	1.6	6.55	1
Side	16mm or more	0.7	0.76	1.6	1	1
Side	16mm or more	0.7	0.76	1.6	1.1	1
Side	16mm or more	0.7	0.76	1.6	0.55	1
Front	16mm or more	0.7	0.76	1.6	5.95	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Rear		Proposed EW	South West	0	0
Side		Proposed EW	North West	0	0
Side		Existing EW	North West	0	0
Side		Existing EW	South East	0	0
Front		Existing EW	North East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
Existing EW	64.32	7.6	56.72	0.3	0	False	N/A
Proposed EW	35.49	7.55	27.94	0.28	0	False	N/A
Roof	20.5	0	20.5	0.16	0		N/A
Internal Elements							

SAP Input

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:	3
Number of passive stacks:	0
Number of sides sheltered:	2
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: Boiler Database Database: (rev 404, product index 017985) Efficiency: Winter 87.3 % Summer: 90.5 Brand name: Ideal Model: LOGIC + COMBI C24 Model qualifier: (Combi boiler) Systems with radiators Central heating pump : 2013 or later Design flow temperature: Design flow temperature<=35°C Boiler interlock: Yes

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

Secondary heating system:	
Secondary heating system:	None

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

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

SAP WorkSheet: New dwelling created by change of use

User Details:

Assessor Name:	Mark Heptonstall	**Stroma Number:**	STRO004925
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.5

Property Address: Flat 2

Address : Flat 2, 222 Otley Road, Leeds, LS16 5AB

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	98.28	(1a) x	2.4	(2a) =	235.87	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	98.28	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		235.87	(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							3	x 10 =	30	(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) =	30	÷ (5) =	0.13	(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)	0.88	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.75	(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
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

0.95	0.93	0.91	0.82	0.8	0.71	0.71	0.69	0.75	0.8	0.84	0.88

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=	0.95	0.93	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.88	(24d)

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

(25)m=	0.95	0.93	0.92	0.84	0.82	0.75	0.75	0.74	0.78	0.82	0.85	0.88	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Windows Type 1			6.55	x1/[1/(1.6)+ 0.04]		=	9.85			(27)
Windows Type 2			1	x1/[1/(1.6)+ 0.04]		=	1.5			(27)
Windows Type 3			1.1	x1/[1/(1.6)+ 0.04]		=	1.65			(27)
Windows Type 4			0.55	x1/[1/(1.6)+ 0.04]		=	0.83			(27)
Windows Type 5			5.95	x1/[1/(1.6)+ 0.04]		=	8.95			(27)
Walls Type1	64.32	7.6	56.72	x	0.3	=	17.02			(29)
Walls Type2	35.49	7.55	27.94	x	0.28	=	7.82			(29)
Roof	20.5	0	20.5	x	0.16	=	3.28			(30)
Total area of elements, m²			120.31							(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) = 50.9 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (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 18.05 (36)

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

Total fabric heat loss (33) + (36) = 68.95 (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=	74.09	72.73	71.39	65.1	63.92	58.45	58.45	57.43	60.56	63.92	66.3	68.79	(38)

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

(39)m=	143.04	141.67	140.33	134.05	132.87	127.39	127.39	126.38	129.5	132.87	135.25	137.74	

Average = Sum(39)$_{1…12}$ /12= 134.04 (39)

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

(40)m=	1.46	1.44	1.43	1.36	1.35	1.3	1.3	1.29	1.32	1.35	1.38	1.4	

Average = Sum(40)$_{1…12}$ /12= 1.36 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.72 (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) + 36 104.08 (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=	114.48	110.32	106.16	101.99	97.83	93.67	93.67	97.83	101.99	106.16	110.32	114.48	

Total = Sum(44)$_{1…12}$ = 1248.91 (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=	169.78	148.49	153.22	133.59	128.18	110.61	102.49	117.61	119.02	138.7	151.41	164.42	

Total = Sum(45)$_{1…12}$ = 1637.51 (45)

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

(46)m=	25.47	22.27	22.98	20.04	19.23	16.59	15.37	17.64	17.85	20.81	22.71	24.66	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

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

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

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

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

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

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

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

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

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

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

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

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

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

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

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

(61)m=	45.62	41.19	45.58	44.07	45.51	43.99	45.43	45.48	44.03	45.54	44.12	45.61	(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=	215.4	189.68	198.8	177.66	173.68	154.6	147.93	163.09	163.05	184.25	195.52	210.03	(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=	215.4	189.68	198.8	177.66	173.68	154.6	147.93	163.09	163.05	184.25	195.52	210.03	

Output from water heater (annual)1…12 — 2173.69 (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=	67.86	59.67	62.34	55.43	54	47.78	45.44	50.48	50.58	57.5	61.37	66.07	(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=	163.38	163.38	163.38	163.38	163.38	163.38	163.38	163.38	163.38	163.38	163.38	163.38	(66)

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

(67)m=	59.39	52.75	42.9	32.48	24.28	20.5	22.15	28.79	38.64	49.06	57.26	61.04	(67)

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

(68)m=	378.38	382.31	372.42	351.35	324.76	299.77	283.08	279.15	289.04	310.11	336.7	361.69	(68)

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

(69)m=	54.06	54.06	54.06	54.06	54.06	54.06	54.06	54.06	54.06	54.06	54.06	54.06	(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=	-108.92	-108.92	-108.92	-108.92	-108.92	-108.92	-108.92	-108.92	-108.92	-108.92	-108.92	-108.92	(71)

Water heating gains (Table 5)

(72)m=	91.2	88.8	83.79	76.99	72.58	66.35	61.07	67.84	70.25	77.29	85.24	88.81	(72)

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

(73)m=	640.5	635.38	610.63	572.34	533.14	498.14	477.82	487.3	509.46	547.98	590.72	623.06	(73)

6. Solar gains:

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

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.77	x	5.95	x	11.28	x	0.76	x	0.7	=	24.75	(75)
Northeast 0.9x	0.77	x	5.95	x	22.97	x	0.76	x	0.7	=	50.38	(75)
Northeast 0.9x	0.77	x	5.95	x	41.38	x	0.76	x	0.7	=	90.77	(75)
Northeast 0.9x	0.77	x	5.95	x	67.96	x	0.76	x	0.7	=	149.07	(75)
Northeast 0.9x	0.77	x	5.95	x	91.35	x	0.76	x	0.7	=	200.38	(75)

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Northeast 0.9x	0.77	x	5.95	x	97.38	x	0.76	x	0.7	=	213.62	(75)
Northeast 0.9x	0.77	x	5.95	x	91.1	x	0.76	x	0.7	=	199.84	(75)
Northeast 0.9x	0.77	x	5.95	x	72.63	x	0.76	x	0.7	=	159.32	(75)
Northeast 0.9x	0.77	x	5.95	x	50.42	x	0.76	x	0.7	=	110.6	(75)
Northeast 0.9x	0.77	x	5.95	x	28.07	x	0.76	x	0.7	=	61.57	(75)
Northeast 0.9x	0.77	x	5.95	x	14.2	x	0.76	x	0.7	=	31.14	(75)
Northeast 0.9x	0.77	x	5.95	x	9.21	x	0.76	x	0.7	=	20.21	(75)
Southeast 0.9x	0.77	x	0.55	x	36.79	x	0.76	x	0.7	=	7.46	(77)
Southeast 0.9x	0.77	x	0.55	x	62.67	x	0.76	x	0.7	=	12.71	(77)
Southeast 0.9x	0.77	x	0.55	x	85.75	x	0.76	x	0.7	=	17.39	(77)
Southeast 0.9x	0.77	x	0.55	x	106.25	x	0.76	x	0.7	=	21.54	(77)
Southeast 0.9x	0.77	x	0.55	x	119.01	x	0.76	x	0.7	=	24.13	(77)
Southeast 0.9x	0.77	x	0.55	x	118.15	x	0.76	x	0.7	=	23.96	(77)
Southeast 0.9x	0.77	x	0.55	x	113.91	x	0.76	x	0.7	=	23.1	(77)
Southeast 0.9x	0.77	x	0.55	x	104.39	x	0.76	x	0.7	=	21.17	(77)
Southeast 0.9x	0.77	x	0.55	x	92.85	x	0.76	x	0.7	=	18.83	(77)
Southeast 0.9x	0.77	x	0.55	x	69.27	x	0.76	x	0.7	=	14.05	(77)
Southeast 0.9x	0.77	x	0.55	x	44.07	x	0.76	x	0.7	=	8.94	(77)
Southeast 0.9x	0.77	x	0.55	x	31.49	x	0.76	x	0.7	=	6.38	(77)
Southwest 0.9x	0.77	x	6.55	x	36.79		0.76	x	0.7	=	88.85	(79)
Southwest 0.9x	0.77	x	6.55	x	62.67		0.76	x	0.7	=	151.35	(79)
Southwest 0.9x	0.77	x	6.55	x	85.75		0.76	x	0.7	=	207.08	(79)
Southwest 0.9x	0.77	x	6.55	x	106.25		0.76	x	0.7	=	256.58	(79)
Southwest 0.9x	0.77	x	6.55	x	119.01		0.76	x	0.7	=	287.39	(79)
Southwest 0.9x	0.77	x	6.55	x	118.15		0.76	x	0.7	=	285.31	(79)
Southwest 0.9x	0.77	x	6.55	x	113.91		0.76	x	0.7	=	275.07	(79)
Southwest 0.9x	0.77	x	6.55	x	104.39		0.76	x	0.7	=	252.08	(79)
Southwest 0.9x	0.77	x	6.55	x	92.85		0.76	x	0.7	=	224.22	(79)
Southwest 0.9x	0.77	x	6.55	x	69.27		0.76	x	0.7	=	167.27	(79)
Southwest 0.9x	0.77	x	6.55	x	44.07		0.76	x	0.7	=	106.42	(79)
Southwest 0.9x	0.77	x	6.55	x	31.49		0.76	x	0.7	=	76.04	(79)
Northwest 0.9x	0.77	x	1	x	11.28	x	0.76	x	0.7	=	4.16	(81)
Northwest 0.9x	0.77	x	1.1	x	11.28	x	0.76	x	0.7	=	4.58	(81)
Northwest 0.9x	0.77	x	1	x	22.97	x	0.76	x	0.7	=	8.47	(81)
Northwest 0.9x	0.77	x	1.1	x	22.97	x	0.76	x	0.7	=	9.31	(81)
Northwest 0.9x	0.77	x	1	x	41.38	x	0.76	x	0.7	=	15.26	(81)
Northwest 0.9x	0.77	x	1.1	x	41.38	x	0.76	x	0.7	=	16.78	(81)
Northwest 0.9x	0.77	x	1	x	67.96	x	0.76	x	0.7	=	25.05	(81)
Northwest 0.9x	0.77	x	1.1	x	67.96	x	0.76	x	0.7	=	27.56	(81)
Northwest 0.9x	0.77	x	1	x	91.35	x	0.76	x	0.7	=	33.68	(81)
Northwest 0.9x	0.77	x	1.1	x	91.35	x	0.76	x	0.7	=	37.04	(81)

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Northwest	0.9x	0.77	x	1	x	97.38	x	0.76	x	0.7	=	35.9	(81)
Northwest	0.9x	0.77	x	1.1	x	97.38	x	0.76	x	0.7	=	39.49	(81)
Northwest	0.9x	0.77	x	1	x	91.1	x	0.76	x	0.7	=	33.59	(81)
Northwest	0.9x	0.77	x	1.1	x	91.1	x	0.76	x	0.7	=	36.95	(81)
Northwest	0.9x	0.77	x	1	x	72.63	x	0.76	x	0.7	=	26.78	(81)
Northwest	0.9x	0.77	x	1.1	x	72.63	x	0.76	x	0.7	=	29.45	(81)
Northwest	0.9x	0.77	x	1	x	50.42	x	0.76	x	0.7	=	18.59	(81)
Northwest	0.9x	0.77	x	1.1	x	50.42	x	0.76	x	0.7	=	20.45	(81)
Northwest	0.9x	0.77	x	1	x	28.07	x	0.76	x	0.7	=	10.35	(81)
Northwest	0.9x	0.77	x	1.1	x	28.07	x	0.76	x	0.7	=	11.38	(81)
Northwest	0.9x	0.77	x	1	x	14.2	x	0.76	x	0.7	=	5.23	(81)
Northwest	0.9x	0.77	x	1.1	x	14.2	x	0.76	x	0.7	=	5.76	(81)
Northwest	0.9x	0.77	x	1	x	9.21	x	0.76	x	0.7	=	3.4	(81)
Northwest	0.9x	0.77	x	1.1	x	9.21	x	0.76	x	0.7	=	3.74	(81)

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

(83)m=	129.8	232.22	347.27	479.81	582.62	598.29	568.54	488.8	392.69	264.61	157.49	109.77	(83)

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

(84)m=	770.3	867.59	957.9	1052.15	1115.76	1096.43	1046.36	976.1	902.15	812.59	748.21	732.83	(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	0.98	0.94	0.85	0.68	0.52	0.57	0.81	0.96	0.99	1	(86)

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

(87)m=	19.53	19.71	20	20.42	20.74	20.94	20.99	20.98	20.85	20.44	19.95	19.55	(87)

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

(88)m=	19.72	19.73	19.74	19.79	19.8	19.84	19.84	19.85	19.83	19.8	19.78	19.76	(88)

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

(89)m=	0.99	0.99	0.97	0.92	0.8	0.58	0.39	0.44	0.73	0.94	0.98	0.99	(89)

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

(90)m=	18.42	18.6	18.9	19.34	19.63	19.82	19.84	19.85	19.75	19.38	18.88	18.47	(90)

fLA = Living area ÷ (4) = 0.22 (91)

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

(92)m=	18.66	18.85	19.14	19.58	19.88	20.07	20.09	20.1	19.99	19.61	19.12	18.71	(92)

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

(93)m=	18.66	18.85	19.14	19.58	19.88	20.07	20.09	20.1	19.99	19.61	19.12	18.71	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.98	0.96	0.92	0.8	0.6	0.42	0.47	0.74	0.93	0.98	0.99	(94)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(95)m=	762.28	852.18	924.31	963.16	897.8	661.6	439.94	458.89	671.57	759.09	734.34	726.61		(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=	2054.46	1975.84	1774.03	1431.38	1086.51	696.23	445.13	467.24	763.38	1197.54	1625.8	1998.41		(97)

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

(98)m=	961.38	755.09	632.19	337.12	140.4	0	0	0	0	326.2	641.85	946.22		

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 4740.47 (98)

Space heating requirement in kWh/m²/year 48.23 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	961.38	755.09	632.19	337.12	140.4	0	0	0	0	326.2	641.85	946.22		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1028.22	807.59	676.14	360.55	150.16	0	0	0	0	348.88	686.47	1012		(211)

Total (kWh/year) =$Sum(211)_{1...5,10....12}$= 5070.02 (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)

	215.4	189.68	198.8	177.66	173.68	154.6	147.93	163.09	163.05	184.25	195.52	210.03		

Efficiency of water heater 87.3 (216)

(217)m=	89.9	89.84	89.71	89.37	88.7	87.3	87.3	87.3	87.3	89.32	89.73	89.9		(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	239.61	211.13	221.6	198.79	195.81	177.09	169.44	186.82	186.77	206.28	217.9	233.62		

Total = $Sum(219a)_{1...12}$ = 2444.86 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		5070.02	
Water heating fuel used		2444.86	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)

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boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			419.55	(232)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	176.44	(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 =	85.08	(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 =	55.34	(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) =	446.75	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.31	(257)
SAP rating (Section 12)		81.73	(258)

12a. CO_2 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	=	1095.12	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	528.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1623.21	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	217.75	(268)
Total CO2, kg/year		sum of (265)…(271) =		1879.89	(272)
CO2 emissions per m²		(272) ÷ (4) =		19.13	(273)
EI rating (section 14)				82	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	6185.42	(261)

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Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2982.73	(264)
Space and water heating	(261) + (262) + (263) + (264) =			9168.15	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1288.03	(268)
'Total Primary Energy		sum of (265)…(271) =		10686.43	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		108.73	(273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 16 January 2017

Property Details: Flat 2

Dwelling type:	Flat
Located in:	England
Region:	East Pennines
Cross ventilation possible:	Yes
Number of storeys:	1
Front of dwelling faces:	North East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	6 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	467.03	**(P1)**
Transmission heat loss coefficient:	68.9	
Summer heat loss coefficient:	535.97	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
South West (Rear)	0	1
North West (Side)	0	1
North West (Side)	0	1
South East (Side)	0	1
North East (Front)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
South West (Rear)	1	0.9	1	0.9	**(P8)**
North West (Side)	1	0.9	1	0.9	**(P8)**
North West (Side)	1	0.9	1	0.9	**(P8)**
South East (Side)	1	0.9	1	0.9	**(P8)**
North East (Front)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (Rear)	0.9 x	6.55	113.91	0.76	0.7	0.9	321.51	
North West (Side)	0.9 x	1	91.1	0.76	0.7	0.9	39.26	
North West (Side)	0.9 x	1.1	91.1	0.76	0.7	0.9	43.18	
South East (Side)	0.9 x	0.55	113.91	0.76	0.7	0.9	27	
North East (Front)	0.9 x	5.95	91.1	0.76	0.7	0.9	233.58	
						Total	664.53	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	495.14	474.82	484.3	
Total summer gains	1194.44	1139.35	1055.62	**(P5)**
Summer gain/loss ratio	2.23	2.13	1.97	**(P6)**
Mean summer external temperature (East Pennines)	14.6	16.6	16.4	

SAP 2012 Overheating Assessment

Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	17.08	18.98	18.62	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Not significant**	**Not significant**	

Assessment of likelihood of high internal temperature: Not significant