Client – Mr Vince Barber

SAP Rating and AD Part L1A 2010 Compliancy Assessment Report

3no New Flats – 170-175 High Street, Teddington, London.

24 May 2012

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Section

* Section 1 of this report details the design specification required in achieving building regulation compliancy.
This specification incorporates the U-values, low energy lighting, DHW provision, heating type & controls, ventilation strategy, and low zero carbon technologies that **must** be achieved to demonstrate PartL1A 2010 compliancy.

Section 1: AD PartL1A 2010 Compliancy Specification

Construction Specification

U-Values (W/m2K)	
Windows	**1.5**
Doors	**N/A**
Ground floor	**N/A**
Walls excluding windows and doors	**0.25**
Roof excluding roof lights	**0.16**
Other	

Air Pressure Test	
Design Air Permeability ($m^3/(hm^2)$ @ 50Pa)	**5**

Mechanical & Electrical Specification

Lighting	
Percentage Lighting Low Energy fixed fittings:	**100%**

Hot Water Cylinder	
Cylinder Size (l)	**N/A**
Insulation thickness (mm)	**N/A**

Heating	
Boiler Fuel	**Gas**
Boiler Efficiency	**90%**
Secondary Heating	**None**

Primary Heating Controls
Time & Temperature Zone Control

Ventilation Strategy
Natural Ventilation

Low Zero Carbon Technologies
3.2KWp PV

SAP Input

Property Details: Flat 8 20%

Address:	172 High St, Teddington, TW11 8HU
Located in:	England
Region:	Thames valley
UPRN:	TBC
RRN:	0000-0000-0000-0000-0000
Date of assessment:	22 May 2012
Date of certificate:	25 May 2012
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Related party disclosure:	Employed by the professional dealing with the property transaction
Thermal Mass Parameter:	Indicative Value
Dwelling designed to use less: than 125 litres per day	True

Property description:

Dwelling type:	Flat
Detachment:	End-terrace
Year Completed:	2012

Floor Location:	Floor area:	Storey height:
Floor 0	63.2 m²	2.67 m

Living area:	24 m² (fraction 0.38)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Door	Manufacturer	Solid			
Window	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
Door	mm	0	0	1.5	2.08	1
Window	16mm or more	0.7	0.63	1.5	4.8	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Door		Coridoor Walls		0	0
Window		Dormers	South	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
Mansard Walls	53	0	53	0.25	0	False	N/A
Coridoor Walls	24	2.08	21.92	0.25	0.43	False	N/A
Dormers	9.6	4.8	4.8	0.25	0	False	N/A
Flat Roof	50	0	50	0.16	0		N/A
Dormer Roofs	2.3	0	2.3	0.16	0		N/A
Internal Elements							
Party Elements							
Party Walls	28						N/A
Flat Below	63.2						N/A

Thermal bridges:

Thermal bridges: User-defined y-value
y =0.04
Reference: EACD

SAP Input

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 sides sheltered:	3
Design q50:	5

Main heating system:	
Main heating system:	Central heating systems with radiators or underfloor heating Gas boilers and oil boilers Fuel: mains gas Info Source: Manufacturer Declaration Manufacturer's data Efficiency: 90.0% (SEDBUK2009) Combi Fuel Burning Type: Modulation Systems with radiators Pump in heat space: Yes

Main heating Control:	
Main heating Control:	Time and temperature zone control Control code: 2110 Boiler interlock: Yes

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:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 1.2 Tilt of collector: 45° Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Dan Watt	**Stroma Number:**	STRO000002
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.79

Property Address: Flat 8 20%

Address : 172 High St, Teddington, TW11 8HU

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	63.2	(1a) x	2.67	(2a) =	168.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.2	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		168.74	(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							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.37	(18)

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

Number of sides on which sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.29	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.39	0.36	0.36	0.32	0.29	0.28	0.26	0.26	0.3	0.32	0.34	0.36

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=	0.57	0.57	0.57	0.55	0.54	0.54	0.53	0.53	0.54	0.55	0.56	0.57	(24d)

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

(25)m=	0.57	0.57	0.57	0.55	0.54	0.54	0.53	0.53	0.54	0.55	0.56	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			2.08	x	1.5	=	3.12			(26)
Windows			4.8	x1/[1/(1.5)+ 0.04]		=	6.79			(27)
Walls Type1	53	0	53	x	0.25	=	13.25			(29)
Walls Type2	24	2.08	21.92	x	0.23	=	4.95			(29)
Walls Type3	9.6	4.8	4.8	x	0.25	=	1.2			(29)
Roof Type1	50	0	50	x	0.16	=	8			(30)
Roof Type2	2.3	0	2.3	x	0.16	=	0.37			(30)
Total area of elements, m²			138.9							(31)
Party wall			28	x	0	=	0			(32)
Party floor			63.2							(32a)

** 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) = 37.68 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3841.46 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.56 (36)

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

Total fabric heat loss (33) + (36) = 43.23 (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=	31.98	31.53	31.53	30.72	30.23	30	29.79	29.79	30.35	30.72	31.11	31.53	(38)

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

(39)m=	75.22	74.77	74.77	73.95	73.46	73.24	73.02	73.02	73.58	73.95	74.35	74.77	

Average = $Sum(39)_{1...12}$ /12= 74.01 (39)

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

(40)m=	1.19	1.18	1.18	1.17	1.16	1.16	1.16	1.16	1.16	1.17	1.18	1.18	

Average = $Sum(40)_{1...12}$ /12= 1.17 (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 2.07 (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 83.37 (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=	91.71	88.38	85.04	81.71	78.37	75.04	75.04	78.37	81.71	85.04	88.38	91.71	

Total = $Sum(44)_{1...12}$ = 1000.5 (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=	136.33	119.24	123.04	107.27	102.93	88.82	82.3	94.45	95.57	111.38	121.58	132.03	

Total = $Sum(45)_{1...12}$ = 1314.95 (45)

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

(46)m=	20.45	17.89	18.46	16.09	15.44	13.32	12.35	14.17	14.34	16.71	18.24	19.8	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 0 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 0 (54)

Enter (49) or (54) in (55) 0 (55)

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

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

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

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

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

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

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

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

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

(61)m=	46.74	40.68	43.34	40.29	39.94	37	38.24	39.94	40.29	43.34	43.58	46.74	(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=	183.07	159.91	166.38	147.56	142.87	125.82	120.54	134.38	135.87	154.72	165.17	178.77	(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=	183.07	159.91	166.38	147.56	142.87	125.82	120.54	134.38	135.87	154.72	165.17	178.77	

Output from water heater (annual)$_{1...12}$	1815.06	(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=	57.01	49.82	51.75	45.74	44.21	38.78	36.93	41.39	41.85	47.87	51.32	55.58	(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=	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	124.23	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	49.14	43.65	35.5	26.87	20.09	16.96	18.33	23.82	31.97	40.6	47.38	50.51	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	270.06	272.86	265.8	250.77	231.79	213.95	202.04	199.23	206.3	221.33	240.31	258.14	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	49.49	(69)
Pumps and fans gains (Table 5a)													
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	(71)
Water heating gains (Table 5)													
(72)m=	76.63	74.13	69.55	63.53	59.42	53.87	49.63	55.63	58.13	64.34	71.28	74.71	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	496.74	491.54	471.75	442.07	412.2	385.68	370.9	379.59	397.3	427.17	459.87	484.27	(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)	
South	0.9x	0.77	x	4.8	x	47.32	x	0.63	x	0.7	=	69.42	(78)
South	0.9x	0.77	x	4.8	x	77.18	x	0.63	x	0.7	=	113.22	(78)

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South	0.9x	0.77	x	4.8	x	94.25	x	0.63	x	0.7	=	138.25	(78)
South	0.9x	0.77	x	4.8	x	105.11	x	0.63	x	0.7	=	154.2	(78)
South	0.9x	0.77	x	4.8	x	108.55	x	0.63	x	0.7	=	159.24	(78)
South	0.9x	0.77	x	4.8	x	108.9	x	0.63	x	0.7	=	159.75	(78)
South	0.9x	0.77	x	4.8	x	107.14	x	0.63	x	0.7	=	157.16	(78)
South	0.9x	0.77	x	4.8	x	103.88	x	0.63	x	0.7	=	152.39	(78)
South	0.9x	0.77	x	4.8	x	99.99	x	0.63	x	0.7	=	146.68	(78)
South	0.9x	0.77	x	4.8	x	85.29	x	0.63	x	0.7	=	125.12	(78)
South	0.9x	0.77	x	4.8	x	56.07	x	0.63	x	0.7	=	82.25	(78)
South	0.9x	0.77	x	4.8	x	40.89	x	0.63	x	0.7	=	59.98	(78)

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

(83)m=	69.42	113.22	138.25	154.2	159.24	159.75	157.16	152.39	146.68	125.12	82.25	59.98	(83)

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

(84)m=	566.16	604.77	610	596.27	571.44	545.43	528.06	531.98	543.98	552.29	542.12	544.25	(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=	0.92	0.91	0.88	0.85	0.78	0.67	0.5	0.5	0.69	0.82	0.9	0.92	(86)

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

(87)m=	19	19.19	19.53	19.87	20.34	20.7	20.9	20.91	20.66	20.16	19.45	19.04	(87)

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

(88)m=	19.93	19.94	19.94	19.95	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94	(88)

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

(89)m=	0.91	0.89	0.86	0.83	0.74	0.6	0.4	0.39	0.62	0.79	0.89	0.91	(89)

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

(90)m=	17.3	17.58	18.07	18.56	19.2	19.68	19.9	19.9	19.63	18.96	17.96	17.37	(90)

fLA = Living area ÷ (4) = | 0.38 | (91)

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

(92)m=	17.94	18.19	18.63	19.06	19.63	20.07	20.28	20.28	20.02	19.41	18.53	18	(92)

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

(93)m=	17.79	18.04	18.48	18.91	19.48	19.92	20.13	20.13	19.87	19.26	18.38	17.85	(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=	0.88	0.86	0.83	0.8	0.72	0.59	0.41	0.41	0.61	0.76	0.86	0.89	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	500.01	522.26	508.46	476.8	412.52	323.31	218.94	219.25	333.77	422.13	464.34	481.92	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

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

(97)m=	999.81	974.8	873.07	754.75	571.77	389.36	235.89	235.97	409.79	625.87	846	968.54	(97)

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

(98)m=	371.85	304.1	271.27	200.12	118.48	0	0	0	0	151.58	274.79	362.05	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 2054.24 (98)

Space heating requirement in kWh/m²/year 32.5 (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		90	(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)	371.85	304.1	271.27	200.12	118.48	0	0	0	0	151.58	274.79	362.05	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206) (211)	413.17	337.89	301.41	222.36	131.64	0	0	0	0	168.43	305.33	402.27	

Total (kWh/year) =Sum(211)1...5,10...12= 2282.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } 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)

	183.07	159.91	166.38	147.56	142.87	125.82	120.54	134.38	135.87	154.72	165.17	178.77

Efficiency of water heater 90 (216)

(217)m=	90	90	90	90	90	90	90	90	90	90	90	90	(217)

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

(219)m=	203.41	177.68	184.86	163.96	158.74	139.8	133.94	149.31	150.96	171.91	183.52	198.63

Total = Sum(219a)1...12 = 2016.73 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2282.49	
Water heating fuel used			2016.73	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		130		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		175	(231)
Electricity for lighting			347.16	(232)
Electricity generated by PVs			-1011.84	(233)

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10a. Fuel costs - individual heating systems:

		Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x		3.1	x 0.01 =	70.76	(240)
Space heating - main system 2	(213) x		0	x 0.01 =	0	(241)
Space heating - secondary	(215) x		0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		3.1	x 0.01 =	62.52	(247)
Pumps, fans and electric keep-hot	(231)		11.46	x 0.01 =	20.06	(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)	11.46	x 0.01 =	39.78	(250)
Additional standing charges (Table 12)				106	(251)
	one of (233) to (235) x)	11.46	x 0.01 =	-115.96	(252)

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

Total energy cost	(245)...(247) + (250)…(254) =	183.16	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	0.8	(257)
SAP rating (Section 12)		88.9	(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	0.198	=	451.93	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	399.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			851.25	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	179.48	(268)
Energy saving/generation technologies Item 1		0.529	=	-535.26	(269)
Total CO2, kg/year		sum of (265)…(271) =		585.94	(272)
CO2 emissions per m²		(272) ÷ (4) =		9.27	(273)
EI rating (section 14)				93	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.02	=	2328.14	(261)

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Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	2057.07	(264)
Space and water heating	(261) + (262) + (263) + (264) =			4385.21	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	1013.7	(268)
Energy saving/generation technologies					
Item 1		2.92	=	-2954.57	(269)
'Total Primary Energy	sum of (265)…(271) =			2955.34	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			46.76	(273)

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User Details:

Assessor Name:	Dan Watt	**Stroma Number:**	STRO000002
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.79

Property Address: Flat 8 20%

Address : 172 High St, Teddington, TW11 8HU

1. Overall dwelling dimensions:

	Area(m²)			Ave Height(m)			Volume(m³)	
Ground floor	63.2	(1a)	x	2.67	(2a)	=	168.74	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	63.2	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =			168.74	(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							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides on which sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.29	(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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.39	0.36	0.36	0.32	0.29	0.28	0.26	0.26	0.3	0.32	0.34	0.36

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=	0.57	0.57	0.57	0.55	0.54	0.54	0.53	0.53	0.54	0.55	0.56	0.57	(24d)

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

(25)m=	0.57	0.57	0.57	0.55	0.54	0.54	0.53	0.53	0.54	0.55	0.56	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			2.08	x	1.5	=	3.12			(26)
Windows			4.8	x1/[1/(1.5)+ 0.04]		=	6.79			(27)
Walls Type1	53	0	53	x	0.25	=	13.25			(29)
Walls Type2	24	2.08	21.92	x	0.23	=	4.95			(29)
Walls Type3	9.6	4.8	4.8	x	0.25	=	1.2			(29)
Roof Type1	50	0	50	x	0.16	=	8			(30)
Roof Type2	2.3	0	2.3	x	0.16	=	0.37			(30)
Total area of elements, m²			138.9							(31)
Party wall			28	x	0	=	0			(32)
Party floor			63.2							(32a)

** 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) = 37.68 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3841.46 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.56 (36)

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

Total fabric heat loss (33) + (36) = 43.23 (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=	31.98	31.53	31.53	30.72	30.23	30	29.79	29.79	30.35	30.72	31.11	31.53	(38)

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

(39)m=	75.22	74.77	74.77	73.95	73.46	73.24	73.02	73.02	73.58	73.95	74.35	74.77

Average = Sum(39)$_{1…12}$ /12= 74.01 (39)

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

(40)m=	1.19	1.18	1.18	1.17	1.16	1.16	1.16	1.16	1.16	1.17	1.18	1.18

Average = Sum(40)$_{1…12}$ /12= 1.17 (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 2.07 (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 83.37 (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)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	91.71	88.38	85.04	81.71	78.37	75.04	75.04	78.37	81.71	85.04	88.38	91.71

Total = Sum(44)$_{1…12}$ = 1000.5 (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=	136.33	119.24	123.04	107.27	102.93	88.82	82.3	94.45	95.57	111.38	121.58	132.03

Total = Sum(45)$_{1…12}$ = 1314.95 (45)

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

(46)m=	20.45	17.89	18.46	16.09	15.44	13.32	12.35	14.17	14.34	16.71	18.24	19.8	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 0 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 0 (54)

Enter (49) 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)

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

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

(61)m=	46.74	40.68	43.34	40.29	39.94	37	38.24	39.94	40.29	43.34	43.58	46.74	(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=	183.07	159.91	166.38	147.56	142.87	125.82	120.54	134.38	135.87	154.72	165.17	178.77	(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=	183.07	159.91	166.38	147.56	142.87	125.82	120.54	134.38	135.87	154.72	165.17	178.77

Output from water heater (annual)$_{1...12}$ | 1815.06 | (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=	57.01	49.82	51.75	45.74	44.21	38.78	36.93	41.39	41.85	47.87	51.32	55.58	(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=	103.53	103.53	103.53	103.53	103.53	103.53	103.53	103.53	103.53	103.53	103.53	103.53	(66)

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

(67)m=	19.66	17.46	14.2	10.75	8.04	6.78	7.33	9.53	12.79	16.24	18.95	20.2	(67)

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

(68)m=	180.94	182.82	178.09	168.01	155.3	143.35	135.36	133.49	138.22	148.29	161.01	172.96	(68)

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

(69)m=	33.35	33.35	33.35	33.35	33.35	33.35	33.35	33.35	33.35	33.35	33.35	33.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	-82.82	(71)

Water heating gains (Table 5)

(72)m=	76.63	74.13	69.55	63.53	59.42	53.87	49.63	55.63	58.13	64.34	71.28	74.71	(72)

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

(73)m=	341.29	338.46	325.89	306.35	286.81	268.06	256.38	262.7	273.19	292.93	315.3	331.93	(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)	
South	0.9x	0.77	x	4.8	x	47.32	x	0.63	x	0.7	=	69.42	(78)
South	0.9x	0.77	x	4.8	x	77.18	x	0.63	x	0.7	=	113.22	(78)

South	0.9x	0.77	x	4.8	x	94.25	x	0.63	x	0.7	=	138.25	(78)
South	0.9x	0.77	x	4.8	x	105.11	x	0.63	x	0.7	=	154.2	(78)
South	0.9x	0.77	x	4.8	x	108.55	x	0.63	x	0.7	=	159.24	(78)
South	0.9x	0.77	x	4.8	x	108.9	x	0.63	x	0.7	=	159.75	(78)
South	0.9x	0.77	x	4.8	x	107.14	x	0.63	x	0.7	=	157.16	(78)
South	0.9x	0.77	x	4.8	x	103.88	x	0.63	x	0.7	=	152.39	(78)
South	0.9x	0.77	x	4.8	x	99.99	x	0.63	x	0.7	=	146.68	(78)
South	0.9x	0.77	x	4.8	x	85.29	x	0.63	x	0.7	=	125.12	(78)
South	0.9x	0.77	x	4.8	x	56.07	x	0.63	x	0.7	=	82.25	(78)
South	0.9x	0.77	x	4.8	x	40.89	x	0.63	x	0.7	=	59.98	(78)

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

(83)m=	69.42	113.22	138.25	154.2	159.24	159.75	157.16	152.39	146.68	125.12	82.25	59.98	(83)

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

(84)m=	410.71	451.69	464.15	460.55	446.05	427.8	413.55	415.09	419.87	418.04	397.55	391.91	(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=	0.96	0.95	0.93	0.91	0.85	0.75	0.6	0.6	0.78	0.89	0.95	0.96	(86)

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

(87)m=	18.64	18.85	19.24	19.62	20.15	20.59	20.85	20.85	20.53	19.93	19.14	18.69	(87)

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

(88)m=	19.93	19.94	19.94	19.95	19.95	19.96	19.96	19.96	19.95	19.95	19.94	19.94	(88)

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

(89)m=	0.95	0.94	0.92	0.89	0.82	0.69	0.48	0.48	0.72	0.87	0.94	0.96	(89)

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

(90)m=	16.79	17.1	17.66	18.21	18.96	19.55	19.86	19.86	19.48	18.65	17.52	16.87	(90)

fLA = Living area ÷ (4) = | 0.38 | (91)

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

(92)m=	17.49	17.77	18.26	18.75	19.41	19.95	20.24	20.24	19.88	19.14	18.14	17.56	(92)

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

(93)m=	17.34	17.62	18.11	18.6	19.26	19.8	20.09	20.09	19.73	18.99	17.99	17.41	(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=	0.93	0.92	0.89	0.86	0.8	0.68	0.5	0.5	0.7	0.84	0.91	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	382.85	413.31	413.19	396.79	354.88	290.36	206.74	206.95	295.29	350.37	362.94	366.31	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(97)m=	965.92	943.3	845.48	731.82	555.65	380.64	232.85	232.9	399.46	605.43	816.77	935.25	(97)

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

(98)m=	433.81	356.15	321.63	241.22	149.37	0	0	0	0	189.76	326.76	423.29	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 2441.99 (98)

Space heating requirement in kWh/m²/year 38.64 (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		90	(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)	433.81	356.15	321.63	241.22	149.37	0	0	0	0	189.76	326.76	423.29	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)	482.01	395.72	357.36	268.02	165.97	0	0	0	0	210.85	363.07	470.33	(211)

Total (kWh/year) =$Sum(211)_{1...5,10....12}$= 2713.33 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } 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)

	183.07	159.91	166.38	147.56	142.87	125.82	120.54	134.38	135.87	154.72	165.17	178.77

Efficiency of water heater 90 (216)

(217)m=	90	90	90	90	90	90	90	90	90	90	90	90	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	203.41	177.68	184.86	163.96	158.74	139.8	133.94	149.31	150.96	171.91	183.52	198.63

Total = $Sum(219a)_{1...12}$ = 2016.73 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2713.33	
Water heating fuel used			2016.73	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		130		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		175	(231)
Electricity for lighting			347.16	(232)
Electricity generated by PVs			-1011.84	(233)

DER WorkSheet: New dwelling design stage

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	0.198	=	537.24	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	399.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			936.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	179.48	(268)
Energy saving/generation technologies Item 1		0.529	=	-535.26	(269)
Total CO2, kg/year		sum of (265)…(271) =		671.24	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		10.62	(273)
EI rating (section 14)				92	(274)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.79
Printed on 25 May 2012 at 10:04:44

Project Information:

Assessed By: Dan Watt (STRO000002) **Building Type:** End-terrace Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Flat 8 20% **Plot Reference:** 172 High StTeddington

Address : 172 High St, Teddington, TW11 8HU

Client Details:

Name: Alan Ward Architecture

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1 TER and DER

Fuel for main heating system: Natural gas		
Target Carbon Dioxide Emission Rate (TER)	20.46 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	10.62 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	5.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Boiler system with radiators or underfloor - mains gas
Data from manufacturer
Combi boiler
Efficiency 90.0 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls	Time and temperature zone control	OK
Hot water controls:	No cylinder	
Boiler interlock:	Yes	OK

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: South	4.8m², Overhang twice as wide as window, ratio NaN	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind shutter closed 100% of daylight hours	

10 Key features

Photovaltaic array

Predicted Energy Assessment

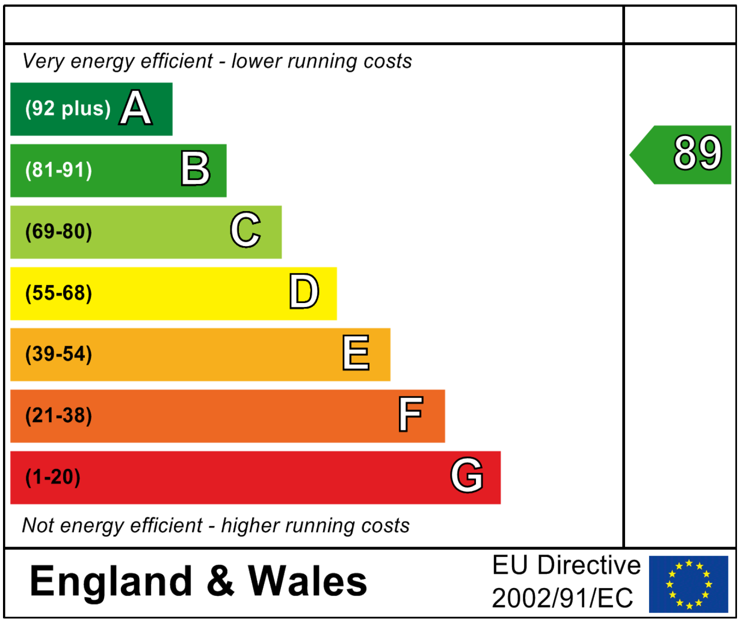
172 High St
Teddington
TW11 8HU

Dwelling type: End-terrace Top floor Flat
Date of assessment: 22 May 2012
Produced by: Dan Watt
Total floor area: 63.2 m²

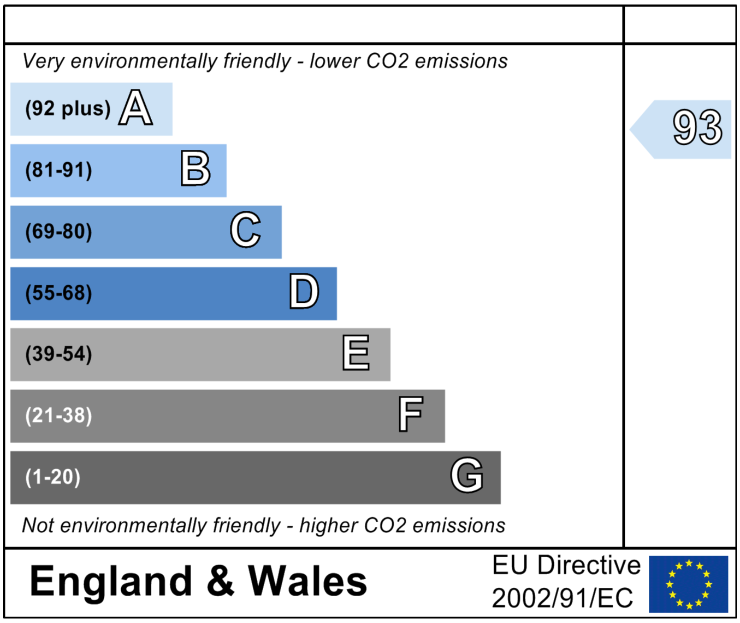
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

Energy performance has been assessed using the SAP 2009 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 9 20%

Address:	172 High St, Teddington, TW11 8HU
Located in:	England
Region:	Thames valley
UPRN:	
RRN:	0000-0000-0000-0000-0000
Date of assessment:	22 May 2012
Date of certificate:	25 May 2012
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Related party disclosure:	Employed by the professional dealing with the property transaction
Thermal Mass Parameter:	Indicative Value
Dwelling designed to use less: than 125 litres per day	True

Property description:

Dwelling type:	Flat	
Detachment:	End-terrace	
Year Completed:	2012	
Floor Location:	Floor area:	Storey height:
Floor 0	55.5 m²	2.67 m
Living area:	30 m² (fraction 1.034)	
Front of dwelling faces:	North	

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Door	Manufacturer	Solid			
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U
E	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
Door	mm	0	0	1.5	2.08	1
N	16mm or more	0.7	0.63	1.5	1.6	1
E	16mm or more	0.7	0.63	1.5	3.2	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Door		Coridoor Walls		0	0
N		Dormers	North	0	0
E		Dormers	East	0	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
Mansard Walls	41	0	41	0.25	0	False	N/A
Coridoor Walls	6	2.08	3.92	0.25	0.43	False	N/A
Dormers	9.6	4.8	4.8	0.25	0	False	N/A
Flat Roof	44	0	44	0.16	0		N/A
Dormer Roofs	2.3	0	2.3	0.16	0		N/A
Internal Elements							
Party Elements							
Party Walls	28						N/A
Flat Below	63.2						N/A

Thermal bridges:

SAP Input

Thermal bridges:	User-defined y-value y =0.04 Reference: EACD

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 sides sheltered:	3
Design q50:	5

Main heating system:

Main heating system:	Central heating systems with radiators or underfloor heating Gas boilers and oil boilers Fuel: mains gas Info Source: Manufacturer Declaration Manufacturer's data Efficiency: 90.0% (SEDBUK2009) Combi Fuel Burning Type: Modulation Systems with radiators Pump in heat space: Yes

Main heating Control:

Main heating Control:	Time and temperature zone control Control code: 2110 Boiler interlock: Yes

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:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 1.2 Tilt of collector: 30° Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name: Dan Watt
Stroma Number: STRO000002
Software Name: Stroma FSAP 2009
Software Version: Version: 1.4.0.79

Property Address: Flat 9 20%

Address : 172 High St, Teddington, TW11 8HU

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	55.5	(1a) x	2.67	(2a) =	148.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	148.19	(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							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(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		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)

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

Number of sides on which sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

SAP WorkSheet: New dwelling design stage

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

0.4	0.38	0.38	0.34	0.31	0.29	0.28	0.28	0.31	0.34	0.36	0.38

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

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

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.56	0.56	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			2.08	x	1.5	=	3.12			(26)
Windows Type 1			1.6	x1/[1/(1.5)+ 0.04]		=	2.26			(27)
Windows Type 2			3.2	x1/[1/(1.5)+ 0.04]		=	4.53			(27)
Walls Type1	41	0	41	x	0.25	=	10.25			(29)
Walls Type2	6	2.08	3.92	x	0.23	=	0.88			(29)
Walls Type3	9.6	4.8	4.8	x	0.25	=	1.2			(29)
Roof Type1	44	0	44	x	0.16	=	7.04			(30)
Roof Type2	2.3	0	2.3	x	0.16	=	0.37			(30)
Total area of elements, m²			102.9							(31)
Party wall			28	x	0	=	0			(32)
Party floor			63.2							(32a)

** 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) = 29.66 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3355.46 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.12 (36)

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

Total fabric heat loss (33) + (36) = 33.77 (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=	28.42	27.99	27.99	27.21	26.74	26.52	26.31	26.31	26.85	27.21	27.58	27.99	(38)

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

(39)m=	62.19	61.76	61.76	60.98	60.51	60.29	60.08	60.08	60.62	60.98	61.36	61.76	

Average = Sum(39)$_{1...12}$ /12= 61.03 (39)

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

(40)m=	1.12	1.11	1.11	1.1	1.09	1.09	1.08	1.08	1.09	1.1	1.11	1.11

Average = Sum(40)$_{1...12}$ /12= 1.1 (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 1.85 (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 78.18 (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=	86	82.88	79.75	76.62	73.49	70.37	70.37	73.49	76.62	79.75	82.88	86	
											Total = Sum(44)$_{1...12}$ =	938.22	(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=	127.85	111.81	115.38	100.59	96.52	83.29	77.18	88.57	89.62	104.45	114.01	123.81	
											Total = Sum(45)$_{1...12}$ =	1233.1	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	19.18	16.77	17.31	15.09	14.48	12.49	11.58	13.28	13.44	15.67	17.1	18.57	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 0 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 0 (54)

Enter (49) 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)

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

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

(61)m=	43.83	38.15	40.64	37.79	37.45	34.7	35.86	37.45	37.79	40.64	40.87	43.83	(61)

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

(62)m=	171.67	149.96	156.02	138.38	133.97	117.99	113.04	126.02	127.41	145.09	154.88	167.64	(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=	171.67	149.96	156.02	138.38	133.97	117.99	113.04	126.02	127.41	145.09	154.88	167.64

Output from water heater (annual)$_{1...12}$ | 1702.08 | (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=	53.47	46.71	48.52	42.89	41.46	36.37	34.63	38.81	39.25	44.89	48.13	52.12	(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=	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	111.12	(66)

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

(67)m=	42.8	38.01	30.92	23.41	17.5	14.77	15.96	20.75	27.84	35.36	41.26	43.99	(67)

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

(68)m=	241	243.51	237.2	223.79	206.85	190.93	180.3	177.8	184.1	197.52	214.45	230.37	(68)

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

(69)m=	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	47.96	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	(71)

Water heating gains (Table 5)

(72)m=	71.86	69.52	65.22	59.57	55.72	50.51	46.54	52.17	54.51	60.33	66.84	70.06	(72)

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

(73)m=	450.67	446.04	428.34	401.77	375.07	351.22	337.81	345.71	361.46	388.21	417.57	439.42	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.6	x	10.73	x	0.63	x	0.7	=	5.25	(74)
North	0.9x	0.77	x	1.6	x	20.36	x	0.63	x	0.7	=	9.96	(74)

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North	0.9x	0.77	x	1.6	x	33.31	x	0.63	x	0.7	=	16.29	(74)
North	0.9x	0.77	x	1.6	x	54.64	x	0.63	x	0.7	=	26.72	(74)
North	0.9x	0.77	x	1.6	x	75.22	x	0.63	x	0.7	=	36.78	(74)
North	0.9x	0.77	x	1.6	x	84.09	x	0.63	x	0.7	=	41.12	(74)
North	0.9x	0.77	x	1.6	x	79.12	x	0.63	x	0.7	=	38.69	(74)
North	0.9x	0.77	x	1.6	x	61.56	x	0.63	x	0.7	=	30.1	(74)
North	0.9x	0.77	x	1.6	x	41.09	x	0.63	x	0.7	=	20.09	(74)
North	0.9x	0.77	x	1.6	x	24.81	x	0.63	x	0.7	=	12.13	(74)
North	0.9x	0.77	x	1.6	x	13.22	x	0.63	x	0.7	=	6.46	(74)
North	0.9x	0.77	x	1.6	x	8.94	x	0.63	x	0.7	=	4.37	(74)
East	0.9x	1	x	3.2	x	19.87	x	0.63	x	0.7	=	19.43	(76)
East	0.9x	1	x	3.2	x	38.52	x	0.63	x	0.7	=	37.67	(76)
East	0.9x	1	x	3.2	x	61.57	x	0.63	x	0.7	=	60.21	(76)
East	0.9x	1	x	3.2	x	91.41	x	0.63	x	0.7	=	89.4	(76)
East	0.9x	1	x	3.2	x	111.22	x	0.63	x	0.7	=	108.77	(76)
East	0.9x	1	x	3.2	x	116.05	x	0.63	x	0.7	=	113.49	(76)
East	0.9x	1	x	3.2	x	112.64	x	0.63	x	0.7	=	110.16	(76)
East	0.9x	1	x	3.2	x	98.03	x	0.63	x	0.7	=	95.87	(76)
East	0.9x	1	x	3.2	x	73.6	x	0.63	x	0.7	=	71.98	(76)
East	0.9x	1	x	3.2	x	46.91	x	0.63	x	0.7	=	45.87	(76)
East	0.9x	1	x	3.2	x	24.71	x	0.63	x	0.7	=	24.16	(76)
East	0.9x	1	x	3.2	x	16.39	x	0.63	x	0.7	=	16.03	(76)

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

(83)m=	24.68	47.62	76.5	116.11	145.55	154.61	148.85	125.98	92.07	58.01	30.63	20.41	(83)

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

(84)m=	475.35	493.67	504.84	517.88	520.62	505.83	486.65	471.69	453.53	446.22	448.19	459.83	(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=	0.93	0.91	0.89	0.85	0.76	0.63	0.46	0.48	0.69	0.84	0.91	0.93	(86)

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

(87)m=	19.09	19.25	19.6	19.98	20.45	20.77	20.93	20.93	20.69	20.18	19.52	19.15	(87)

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

(88)m=	19.99	19.99	19.99	20	20.01	20.01	20.02	20.02	20.01	20	20	19.99	(88)

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

(89)m=	0.92	0.9	0.87	0.82	0.72	0.56	0.37	0.38	0.63	0.81	0.89	0.92	(89)

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

(90)m=	17.47	17.7	18.2	18.74	19.39	19.8	19.97	19.97	19.71	19.04	18.1	17.55	(90)

fLA = Living area ÷ (4) = 0.54 (91)

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

(92)m=	18.35	18.54	18.96	19.41	19.96	20.33	20.49	20.49	20.24	19.66	18.87	18.41	(92)

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

(93)m=	18.2	18.39	18.81	19.26	19.81	20.18	20.34	20.34	20.09	19.51	18.72	18.26	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.89	0.88	0.85	0.8	0.71	0.57	0.4	0.41	0.63	0.79	0.87	0.89	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	424.63	434.35	428.29	415.56	368.43	288.28	194.58	193.56	286	351.84	390.32	411.28	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	851.92	826.79	741.65	643.89	490.69	336.16	206.77	206.54	350.95	530.9	718.9	825.42	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	317.9	263.72	233.14	164.4	90.96	0	0	0	0	133.22	236.58	308.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1748.05 (98)

Space heating requirement in kWh/m²/year 31.5 (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		90	(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)													
	317.9	263.72	233.14	164.4	90.96	0	0	0	0	133.22	236.58	308.12	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)													(211)
	353.22	293.02	259.05	182.67	101.06	0	0	0	0	148.02	262.87	342.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1942.27 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] + (214) m } 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)													
	171.67	149.96	156.02	138.38	133.97	117.99	113.04	126.02	127.41	145.09	154.88	167.64	
Efficiency of water heater												90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	190.75	166.62	173.36	153.75	148.86	131.1	125.6	140.02	141.57	161.21	172.09	186.26	

Total = Sum(219a)$_{1...12}$ = 1891.2 (219)

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Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			1942.27	
Water heating fuel used			1891.2	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		130		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		175	(231)
Electricity for lighting			302.35	(232)
Electricity generated by PVs			-1030.08	(233)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.1	x 0.01 =	60.21	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.1	x 0.01 =	58.63	(247)
Pumps, fans and electric keep-hot	(231)	11.46	x 0.01 =	20.06	(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)	11.46	x 0.01 =	34.65	(250)
Additional standing charges (Table 12)				106	(251)
	one of (233) to (235) x)	11.46	x 0.01 =	-118.05	(252)

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

Total energy cost	(245)...(247) + (250)…(254) =	161.49	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	0.76	(257)
SAP rating (Section 12)		89.46	(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	0.198	=	384.57	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Water heating	(219) x	0.198	=	374.46	(264)
Space and water heating	(261) + (262) + (263) + (264) =			759.03	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.517	=	90.48	(267)
Electricity for lighting	(232) x	0.517	=	156.31	(268)

Energy saving/generation technologies					
Item 1		0.529	=	-544.91	(269)
Total CO2, kg/year		sum of (265)…(271) =		460.9	(272)
CO2 emissions per m²		(272) ÷ (4) =		8.3	(273)
EI rating (section 14)				94	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.02	=	1981.12	(261)
Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	1929.02	(264)
Space and water heating	(261) + (262) + (263) + (264) =			3910.14	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	882.86	(268)
Energy saving/generation technologies					
Item 1		2.92	=	-3007.83	(269)
‘Total Primary Energy		sum of (265)…(271) =		2296.16	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		41.37	(273)

DER WorkSheet: New dwelling design stage

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User Details:

Assessor Name:	Dan Watt	**Stroma Number:**	STRO000002
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.79

Property Address: Flat 9 20%

Address : 172 High St, Teddington, TW11 8HU

1. Overall dwelling dimensions:

	Area(m²)			Ave Height(m)			Volume(m³)	
Ground floor	55.5	(1a)	x	2.67	(2a)	=	148.19	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	55.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	148.19	(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							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.13	(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		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.38	(18)

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

Number of sides on which sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.3	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.4	0.38	0.38	0.34	0.31	0.29	0.28	0.28	0.31	0.34	0.36	0.38

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

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

(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.56	0.56	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			2.08	x	1.5	=	3.12			(26)
Windows Type 1			1.6	x1/[1/(1.5)+ 0.04]		=	2.26			(27)
Windows Type 2			3.2	x1/[1/(1.5)+ 0.04]		=	4.53			(27)
Walls Type1	41	0	41	x	0.25	=	10.25			(29)
Walls Type2	6	2.08	3.92	x	0.23	=	0.88			(29)
Walls Type3	9.6	4.8	4.8	x	0.25	=	1.2			(29)
Roof Type1	44	0	44	x	0.16	=	7.04			(30)
Roof Type2	2.3	0	2.3	x	0.16	=	0.37			(30)
Total area of elements, m²			102.9							(31)
Party wall			28	x	0	=	0			(32)
Party floor			63.2							(32a)

** 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) = 29.66 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3355.46 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.12 (36)

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

Total fabric heat loss (33) + (36) = 33.77 (37)

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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=	28.42	27.99	27.99	27.21	26.74	26.52	26.31	26.31	26.85	27.21	27.58	27.99	(38)

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

(39)m=	62.19	61.76	61.76	60.98	60.51	60.29	60.08	60.08	60.62	60.98	61.36	61.76	

Average = $Sum(39)_{1...12}$ /12= 61.03 (39)

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

(40)m=	1.12	1.11	1.11	1.1	1.09	1.09	1.08	1.08	1.09	1.1	1.11	1.11	

Average = $Sum(40)_{1...12}$ /12= 1.1 (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 1.85 (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 78.18 (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=	86	82.88	79.75	76.62	73.49	70.37	70.37	73.49	76.62	79.75	82.88	86	

Total = $Sum(44)_{1...12}$ = 938.22 (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=	127.85	111.81	115.38	100.59	96.52	83.29	77.18	88.57	89.62	104.45	114.01	123.81	

Total = $Sum(45)_{1...12}$ = 1233.1 (45)

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

(46)m=	19.18	16.77	17.31	15.09	14.48	12.49	11.58	13.28	13.44	15.67	17.1	18.57	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 0 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 0 (54)

Enter (49) or (54) in (55) 0 (55)

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

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

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

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

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

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

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

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

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

(61)m=	43.83	38.15	40.64	37.79	37.45	34.7	35.86	37.45	37.79	40.64	40.87	43.83	(61)

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

(62)m=	171.67	149.96	156.02	138.38	133.97	117.99	113.04	126.02	127.41	145.09	154.88	167.64	(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=	171.67	149.96	156.02	138.38	133.97	117.99	113.04	126.02	127.41	145.09	154.88	167.64

Output from water heater (annual)$_{1...12}$ | 1702.08 | (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=	53.47	46.71	48.52	42.89	41.46	36.37	34.63	38.81	39.25	44.89	48.13	52.12	(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=	92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.6	(66)

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

(67)m=	17.12	15.21	12.37	9.36	7	5.91	6.38	8.3	11.14	14.14	16.51	17.6	(67)

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

(68)m=	161.47	163.15	158.93	149.94	138.59	127.93	120.8	119.13	123.35	132.34	143.68	154.35	(68)

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

(69)m=	32.26	32.26	32.26	32.26	32.26	32.26	32.26	32.26	32.26	32.26	32.26	32.26	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	-74.08	(71)

Water heating gains (Table 5)

(72)m=	71.86	69.52	65.22	59.57	55.72	50.51	46.54	52.17	54.51	60.33	66.84	70.06	(72)

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

(73)m=	311.24	308.65	297.29	279.65	262.09	245.13	234.51	240.37	249.77	267.59	287.81	302.78	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.6	x	10.73	x	0.63	x	0.7	=	5.25	(74)
North	0.9x	0.77	x	1.6	x	20.36	x	0.63	x	0.7	=	9.96	(74)

North	0.9x	0.77	x	1.6	x	33.31	x	0.63	x	0.7	=	16.29	(74)
North	0.9x	0.77	x	1.6	x	54.64	x	0.63	x	0.7	=	26.72	(74)
North	0.9x	0.77	x	1.6	x	75.22	x	0.63	x	0.7	=	36.78	(74)
North	0.9x	0.77	x	1.6	x	84.09	x	0.63	x	0.7	=	41.12	(74)
North	0.9x	0.77	x	1.6	x	79.12	x	0.63	x	0.7	=	38.69	(74)
North	0.9x	0.77	x	1.6	x	61.56	x	0.63	x	0.7	=	30.1	(74)
North	0.9x	0.77	x	1.6	x	41.09	x	0.63	x	0.7	=	20.09	(74)
North	0.9x	0.77	x	1.6	x	24.81	x	0.63	x	0.7	=	12.13	(74)
North	0.9x	0.77	x	1.6	x	13.22	x	0.63	x	0.7	=	6.46	(74)
North	0.9x	0.77	x	1.6	x	8.94	x	0.63	x	0.7	=	4.37	(74)
East	0.9x	1	x	3.2	x	19.87	x	0.63	x	0.7	=	19.43	(76)
East	0.9x	1	x	3.2	x	38.52	x	0.63	x	0.7	=	37.67	(76)
East	0.9x	1	x	3.2	x	61.57	x	0.63	x	0.7	=	60.21	(76)
East	0.9x	1	x	3.2	x	91.41	x	0.63	x	0.7	=	89.4	(76)
East	0.9x	1	x	3.2	x	111.22	x	0.63	x	0.7	=	108.77	(76)
East	0.9x	1	x	3.2	x	116.05	x	0.63	x	0.7	=	113.49	(76)
East	0.9x	1	x	3.2	x	112.64	x	0.63	x	0.7	=	110.16	(76)
East	0.9x	1	x	3.2	x	98.03	x	0.63	x	0.7	=	95.87	(76)
East	0.9x	1	x	3.2	x	73.6	x	0.63	x	0.7	=	71.98	(76)
East	0.9x	1	x	3.2	x	46.91	x	0.63	x	0.7	=	45.87	(76)
East	0.9x	1	x	3.2	x	24.71	x	0.63	x	0.7	=	24.16	(76)
East	0.9x	1	x	3.2	x	16.39	x	0.63	x	0.7	=	16.03	(76)

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

(83)m=	24.68	47.62	76.5	116.11	145.55	154.61	148.85	125.98	92.07	58.01	30.63	20.41	(83)

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

(84)m=	335.91	356.28	373.79	395.77	407.64	399.74	383.35	366.35	341.85	325.6	318.44	323.19	(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=	0.96	0.96	0.94	0.91	0.83	0.72	0.56	0.57	0.79	0.91	0.95	0.97	(86)

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

(87)m=	18.72	18.89	19.28	19.72	20.27	20.67	20.89	20.88	20.55	19.93	19.19	18.78	(87)

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

(88)m=	19.99	19.99	19.99	20	20.01	20.01	20.02	20.02	20.01	20	20	19.99	(88)

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

(89)m=	0.96	0.95	0.93	0.89	0.8	0.65	0.45	0.47	0.73	0.89	0.95	0.96	(89)

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

(90)m=	16.93	17.19	17.76	18.39	19.16	19.7	19.95	19.94	19.55	18.7	17.62	17.02	(90)

fLA = Living area ÷ (4) = | 0.54 | (91)

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

(92)m=	17.9	18.11	18.58	19.11	19.76	20.23	20.46	20.45	20.09	19.36	18.47	17.97	(92)

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

(93)m=	17.75	17.96	18.43	18.96	19.61	20.08	20.31	20.3	19.94	19.21	18.32	17.82	(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=	0.94	0.93	0.91	0.87	0.79	0.66	0.48	0.5	0.73	0.87	0.93	0.94	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	316.78	332.14	339.18	343.57	320.08	262.64	185.4	183.28	249.4	282.44	295.72	305.23	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	823.84	800.22	718.42	625.35	478.61	330.1	204.7	204.21	342.02	513.04	694.39	797.94	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	377.25	314.55	282.15	202.88	117.94	0	0	0	0	171.57	287.04	366.58	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2119.97 (98)

Space heating requirement in kWh/m²/year 38.2 (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		90	(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)														
	377.25	314.55	282.15	202.88	117.94	0	0	0	0	171.57	287.04	366.58		
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)														(211)
	419.17	349.5	313.5	225.42	131.05	0	0	0	0	190.63	318.94	407.31		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													2355.52	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] + (214) m } 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)														
	171.67	149.96	156.02	138.38	133.97	117.99	113.04	126.02	127.41	145.09	154.88	167.64		
Efficiency of water heater													90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	190.75	166.62	173.36	153.75	148.86	131.1	125.6	140.02	141.57	161.21	172.09	186.26		
Total = Sum(219a)$_{1...12}$ =													1891.2	(219)

DER WorkSheet: New dwelling design stage

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2355.52	
Water heating fuel used			1891.2	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		130		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		175	(231)
Electricity for lighting			302.35	(232)
Electricity generated by PVs			-1030.08	(233)

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	0.198	=	466.39	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Water heating	(219)	x	0.198	=	374.46	(264)
Space and water heating	(261) + (262) + (263) + (264) =				840.85	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.517	=	90.48	(267)
Electricity for lighting	(232)	x	0.517	=	156.31	(268)
Energy saving/generation technologies Item 1			0.529	=	-544.91	(269)
Total CO2, kg/year			sum of (265)…(271) =		542.73	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		9.78	(273)
EI rating (section 14)					93	(274)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.79
Printed on 25 May 2012 at 10:04:35

Project Information:

Assessed By: Dan Watt (STRO000002)
Building Type: End-terrace Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Flat 9 20%
Plot Reference: 172 High StTeddington

Address : 172 High St, Teddington, TW11 8HU

Client Details:

Name: Alan Ward Architecture
Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1 TER and DER

Fuel for main heating system: Natural gas		
Target Carbon Dioxide Emission Rate (TER)	20.08 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.78 kg/m²	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK

3 Design air permeability

Design air permeability at 50 pascals	5.00	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Boiler system with radiators or underfloor - mains gas Data from manufacturer Combi boiler Efficiency 90.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder

6 Controls

Space heating controls	Time and temperature zone control	OK
Hot water controls:	No cylinder	
Boiler interlock:	Yes	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North	1.6m², Overhang twice as wide as window, ratio NaN	
Windows facing: East	3.2m², Overhang twice as wide as window, ratio NaN	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind shutter closed 100% of daylight hours	

10 Key features

Photovaltaic array

Predicted Energy Assessment

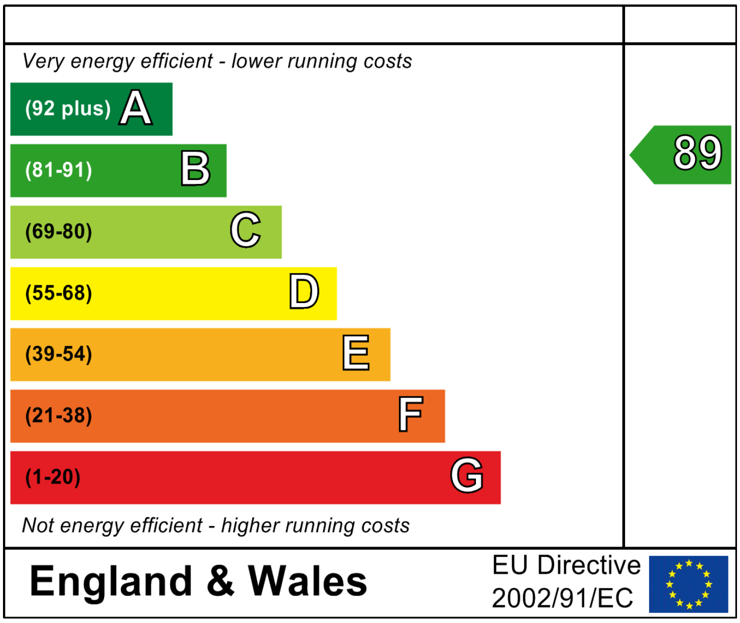
172 High St
Teddington
TW11 8HU

Dwelling type:	End-terrace Top floor Flat
Date of assessment:	22 May 2012
Produced by:	Dan Watt
Total floor area:	55.5 m²

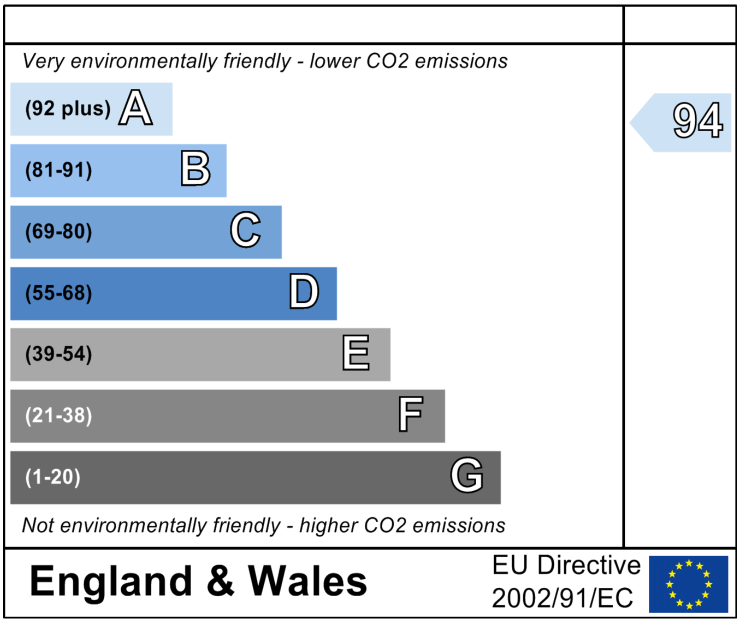
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

Energy performance has been assessed using the SAP 2009 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 10 20%

Address:	172 High St, Teddington, TW11 8HU
Located in:	England
Region:	Thames valley
UPRN:	
RRN:	0000-0000-0000-0000-0000
Date of assessment:	22 May 2012
Date of certificate:	25 May 2012
Assessment type:	New dwelling design stage
Transaction type:	New dwelling
Related party disclosure:	Employed by the professional dealing with the property transaction
Thermal Mass Parameter:	Indicative Value
Dwelling designed to use less: than 125 litres per day	True

Property description:

Dwelling type:	Flat
Detachment:	End-terrace
Year Completed:	2012

Floor Location:	Floor area:	Storey height:
Floor 0	29 m²	2.67 m

Living area:	30 m² (fraction 1.034)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Door	Manufacturer	Solid			
N	Manufacturer	Windows	low-E, En = 0.05, soft coat	No	PVC-U

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
Door	mm	0	0	1.5	2.08	1
N	16mm or more	0.7	0.63	1.5	3.2	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
Door		Coridoor Walls		0	0
N		Dormers	North	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>							
Mansard Walls	38	0	38	0.25	0	False	N/A
Coridoor Walls	22	2.08	19.92	0.25	0.43	False	N/A
Dormers	6.4	3.2	3.2	0.25	0	False	N/A
Flat Roof	25	0	25	0.16	0		N/A
Dormer Roofs	1.5	0	1.5	0.16	0		N/A
<u>Internal Elements</u>							
<u>Party Elements</u>							
Party Walls	28						N/A
Flat Below	63.2						N/A

Thermal bridges:

Thermal bridges:	User-defined y-value y =0.04 Reference: EACD

SAP Input

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 sides sheltered:	3
Design q50:	5

Main heating system:	
Main heating system:	Central heating systems with radiators or underfloor heating Gas boilers and oil boilers Fuel: mains gas Info Source: Manufacturer Declaration Manufacturer's data Efficiency: 90.0% (SEDBUK2009) Combi Fuel Burning Type: Modulation Systems with radiators Pump in heat space: Yes

Main heating Control:	
Main heating Control:	Time and temperature zone control Control code: 2110 Boiler interlock: Yes

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:	Dense urban
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 0.8 Tilt of collector: 30° Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

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User Details:

Assessor Name:	Dan Watt	**Stroma Number:**	STRO000002
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.79

Property Address: Flat 10 20%

Address : 172 High St, Teddington, TW11 8HU

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	29	(1a) x	2.67	(2a) =	77.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	29	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	77.43	(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							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.26	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.51	(18)

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

Number of sides on which sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.39	(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=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

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

0.53	0.5	0.5	0.44	0.4	0.38	0.36	0.36	0.41	0.44	0.47	0.5

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=	0.64	0.63	0.63	0.6	0.58	0.57	0.57	0.57	0.59	0.6	0.61	0.63	(24d)

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

(25)m=	0.64	0.63	0.63	0.6	0.58	0.57	0.57	0.57	0.59	0.6	0.61	0.63	(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			2.08	x	1.5	=	3.12			(26)
Windows			3.2	x1/[1/(1.5)+ 0.04]		=	4.53			(27)
Walls Type1	38	0	38	x	0.25	=	9.5			(29)
Walls Type2	22	2.08	19.92	x	0.23	=	4.5			(29)
Walls Type3	6.4	3.2	3.2	x	0.25	=	0.8			(29)
Roof Type1	25	0	25	x	0.16	=	4			(30)
Roof Type2	1.5	0	1.5	x	0.16	=	0.24			(30)
Total area of elements, m²			92.9							(31)
Party wall			28	x	0	=	0			(32)
Party floor			63.2							(32a)

** 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) = 26.68 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3423.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.72 (36)

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

Total fabric heat loss (33) + (36) = 30.4 (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=	16.39	16	16	15.29	14.86	14.66	14.47	14.47	14.96	15.29	15.63	16	(38)

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

(39)m=	46.79	46.4	46.4	45.69	45.26	45.06	44.87	44.87	45.36	45.69	46.03	46.4	

Average = Sum(39)$_{1…12}$ /12= 45.74 (39)

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

(40)m=	1.61	1.6	1.6	1.58	1.56	1.55	1.55	1.55	1.56	1.58	1.59	1.6	

Average = Sum(40)$_{1…12}$ /12= 1.58 (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 1.15 (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 61.61 (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)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	67.77	65.31	62.85	60.38	57.92	55.45	55.45	57.92	60.38	62.85	65.31	67.77	

Total = Sum(44)$_{1…12}$ = 739.36 (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=	100.75	88.12	90.93	79.27	76.06	65.64	60.82	69.79	70.63	82.31	89.85	97.57	

Total = Sum(45)$_{1…12}$ = 971.74 (45)

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

(46)m=	15.11	13.22	13.64	11.89	11.41	9.85	9.12	10.47	10.59	12.35	13.48	14.64	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 0 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 0 (54)

Enter (49) 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)

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

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

(61)m=	34.54	30.06	32.03	29.78	29.51	27.35	28.26	29.51	29.78	32.03	32.21	34.54	(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=	135.29	118.18	122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11	(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=	135.29	118.18	122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11

Output from water heater (annual)$_{1...12}$	1341.32	(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=	42.13	36.81	38.24	33.8	32.67	28.66	27.29	30.59	30.93	35.37	37.93	41.08	(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=	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	23.98	21.3	17.32	13.11	9.8	8.27	8.94	11.62	15.6	19.81	23.12	24.64	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	142.02	143.49	139.78	131.87	121.89	112.51	106.25	104.77	108.49	116.39	126.37	135.75	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	43.08	(69)
Pumps and fans gains (Table 5a)													
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	(71)
Water heating gains (Table 5)													
(72)m=	56.63	54.78	51.4	46.95	43.91	39.81	36.68	41.11	42.96	47.55	52.68	55.21	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	298.79	295.74	284.66	268.1	251.77	236.76	228.03	233.67	243.21	259.91	278.33	291.77	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.2	x	10.73	x	0.63	x	0.7	=	10.49	(74)
North	0.9x	0.77	x	3.2	x	20.36	x	0.63	x	0.7	=	19.91	(74)

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North	0.9x	0.77	x	3.2	x	33.31	x	0.63	x	0.7	=	32.57	(74)
North	0.9x	0.77	x	3.2	x	54.64	x	0.63	x	0.7	=	53.44	(74)
North	0.9x	0.77	x	3.2	x	75.22	x	0.63	x	0.7	=	73.56	(74)
North	0.9x	0.77	x	3.2	x	84.09	x	0.63	x	0.7	=	82.24	(74)
North	0.9x	0.77	x	3.2	x	79.12	x	0.63	x	0.7	=	77.38	(74)
North	0.9x	0.77	x	3.2	x	61.56	x	0.63	x	0.7	=	60.21	(74)
North	0.9x	0.77	x	3.2	x	41.09	x	0.63	x	0.7	=	40.18	(74)
North	0.9x	0.77	x	3.2	x	24.81	x	0.63	x	0.7	=	24.27	(74)
North	0.9x	0.77	x	3.2	x	13.22	x	0.63	x	0.7	=	12.93	(74)
North	0.9x	0.77	x	3.2	x	8.94	x	0.63	x	0.7	=	8.75	(74)

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

(83)m=	10.49	19.91	32.57	53.44	73.56	82.24	77.38	60.21	40.18	24.27	12.93	8.75	(83)

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

(84)m=	309.28	315.65	317.23	321.53	325.33	319	305.41	293.88	283.39	284.18	291.26	300.52	(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=	0.91	0.9	0.88	0.85	0.77	0.65	0.5	0.52	0.71	0.83	0.89	0.91	(86)

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

(87)m=	18.4	18.56	18.98	19.45	20.08	20.56	20.84	20.83	20.45	19.77	18.94	18.48	(87)

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

(88)m=	19.61	19.62	19.62	19.64	19.65	19.65	19.66	19.66	19.64	19.64	19.63	19.62	(88)

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

(89)m=	0.9	0.89	0.86	0.82	0.72	0.57	0.37	0.38	0.63	0.79	0.87	0.9	(89)

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

(90)m=	16.28	16.52	17.11	17.78	18.66	19.28	19.57	19.57	19.14	18.24	17.07	16.4	(90)

fLA = Living area ÷ (4) = 1.03 (91)

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

(92)m=	18.47	18.63	19.04	19.5	20.13	20.61	20.88	20.87	20.49	19.82	19.01	18.55	(92)

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

(93)m=	18.32	18.48	18.89	19.35	19.98	20.46	20.73	20.72	20.34	19.67	18.86	18.4	(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=	0.88	0.87	0.85	0.81	0.73	0.62	0.48	0.49	0.67	0.8	0.86	0.88	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	272.58	275.24	268.97	261.03	238.5	197.69	146.63	144.87	191.1	226.15	250.91	264.96	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

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

(97)m=	646.66	625.57	561.08	486.67	374.68	264.01	171.93	171.51	274.03	405.24	545.88	626.38	(97)

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

(98)m=	278.31	235.43	217.33	162.46	101.31	0	0	0	0	133.25	212.38	268.89	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1609.37 (98)

Space heating requirement in kWh/m²/year 55.5 (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		90	(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)	278.31	235.43	217.33	162.46	101.31	0	0	0	0	133.25	212.38	268.89	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206)	309.24	261.59	241.48	180.52	112.57	0	0	0	0	148.05	235.98	298.77	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1788.19 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } 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)

	135.29	118.18	122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11

Efficiency of water heater 90 (216)

(217)m=	90	90	90	90	90	90	90	90	90	90	90	90	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	150.32	131.31	136.61	121.17	117.31	103.32	98.98	110.34	111.56	127.04	135.62	146.79

Total = Sum(219a)$_{1...12}$ = 1490.36 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1788.19	
Water heating fuel used			1490.36	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		130		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		175	(231)
Electricity for lighting			169.38	(232)
Electricity generated by PVs			-686.72	(233)

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ASHMOUNT CONSULTING ENGINEERS

10a. Fuel costs - individual heating systems:

		Fuel kWh/year		Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211)	x		3.1	x 0.01 =	55.43	(240)
Space heating - main system 2	(213)	x		0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x		0	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)			3.1	x 0.01 =	46.2	(247)
Pumps, fans and electric keep-hot	(231)			11.46	x 0.01 =	20.06	(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)	11.46	x 0.01 =	19.41	(250)
Additional standing charges (Table 12)				106	(251)
	one of (233) to (235) x)	11.46	x 0.01 =	-78.7	(252)

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

Total energy cost	(245)...(247) + (250)…(254) =	168.4	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.47	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.07	(257)
SAP rating (Section 12)		85.08	(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	0.198	=	354.06	(261)
Space heating (secondary)	(215)	x	0	=	0	(263)
Water heating	(219)	x	0.198	=	295.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =				649.15	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.517	=	90.48	(267)
Electricity for lighting	(232)	x	0.517	=	87.57	(268)
Energy saving/generation technologies Item 1			0.529	=	-363.27	(269)
Total CO2, kg/year			sum of (265)…(271) =		463.92	(272)
CO2 emissions per m²			(272) ÷ (4) =		16	(273)
EI rating (section 14)					92	(274)

13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	1.02	=	1823.95	(261)

Space heating (secondary)	(215) x	0	=	0	(263)
Energy for water heating	(219) x	1.02	=	1520.16	(264)
Space and water heating	(261) + (262) + (263) + (264) =			3344.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	2.92	=	511	(267)
Electricity for lighting	(232) x	0	=	494.59	(268)
Energy saving/generation technologies					
Item 1		2.92	=	-2005.22	(269)
‘Total Primary Energy	sum of (265)…(271) =			2344.48	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			80.84	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Dan Watt	**Stroma Number:**	STRO000002
Software Name:	Stroma FSAP 2009	**Software Version:**	Version: 1.4.0.79

Property Address: Flat 10 20%

Address : 172 High St, Teddington, TW11 8HU

1. Overall dwelling dimensions:

	Area(m²)		Ave Height(m)		Volume(m³)	
Ground floor	29	(1a) x	2.67	(2a) =	77.43	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	29	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	77.43	(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							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.26	(8)

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.51	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides on which sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.4	5.1	5.1	4.5	4.1	3.9	3.7	3.7	4.2	4.5	4.8	5.1
(22a)m=	1.35	1.27	1.27	1.12	1.02	0.98	0.92	0.92	1.05	1.12	1.2	1.27

DER WorkSheet: New dwelling design stage

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

0.53	0.5	0.5	0.44	0.4	0.38	0.36	0.36	0.41	0.44	0.47	0.5

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=	0.64	0.63	0.63	0.6	0.58	0.57	0.57	0.57	0.59	0.6	0.61	0.63	(24d)

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

(25)m=	0.64	0.63	0.63	0.6	0.58	0.57	0.57	0.57	0.59	0.6	0.61	0.63	(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			2.08	x	1.5	=	3.12			(26)
Windows			3.2	x1/[1/(1.5)+ 0.04]		=	4.53			(27)
Walls Type1	38	0	38	x	0.25	=	9.5			(29)
Walls Type2	22	2.08	19.92	x	0.23	=	4.5			(29)
Walls Type3	6.4	3.2	3.2	x	0.25	=	0.8			(29)
Roof Type1	25	0	25	x	0.16	=	4			(30)
Roof Type2	1.5	0	1.5	x	0.16	=	0.24			(30)
Total area of elements, m²			92.9							(31)
Party wall			28	x	0	=	0			(32)
Party floor			63.2							(32a)

** 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) = 26.68 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 3423.86 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.72 (36)

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

Total fabric heat loss (33) + (36) = 30.4 (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

DER WorkSheet: New dwelling design stage

(38)m=	16.39	16	16	15.29	14.86	14.66	14.47	14.47	14.96	15.29	15.63	16	(38)

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

(39)m=	46.79	46.4	46.4	45.69	45.26	45.06	44.87	44.87	45.36	45.69	46.03	46.4	

Average = Sum(39)$_{1…12}$ /12= 45.74 (39)

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

(40)m=	1.61	1.6	1.6	1.58	1.56	1.55	1.55	1.55	1.56	1.58	1.59	1.6

Average = Sum(40)$_{1…12}$ /12= 1.58 (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 1.15 (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 61.61 (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=	67.77	65.31	62.85	60.38	57.92	55.45	55.45	57.92	60.38	62.85	65.31	67.77

Total = Sum(44)$_{1…12}$ = 739.36 (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=	100.75	88.12	90.93	79.27	76.06	65.64	60.82	69.79	70.63	82.31	89.85	97.57

Total = Sum(45)$_{1…12}$ = 971.74 (45)

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

(46)m=	15.11	13.22	13.64	11.89	11.41	9.85	9.12	10.47	10.59	12.35	13.48	14.64	(46)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (47)

Temperature factor from Table 2b 0 (48)

Energy lost from water storage, kWh/year (47) x (48) = 0 (49)

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

Cylinder volume (litres) including any solar storage within same 0 (50)

If community heating and no tank in dwelling, enter 110 litres in box (50)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in box (50)

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

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year ((50) x (51) x (52) x (53) = 0 (54)

Enter (49) 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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

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

(61)m=	34.54	30.06	32.03	29.78	29.51	27.35	28.26	29.51	29.78	32.03	32.21	34.54	(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=	135.29	118.18	122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11	(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=	135.29	118.18	122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11	

Output from water heater (annual)$_{1...12}$ 1341.32 (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=	42.13	36.81	38.24	33.8	32.67	28.66	27.29	30.59	30.93	35.37	37.93	41.08	(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=	57.71	57.71	57.71	57.71	57.71	57.71	57.71	57.71	57.71	57.71	57.71	57.71	(66)

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

(67)m=	9.59	8.52	6.93	5.24	3.92	3.31	3.58	4.65	6.24	7.92	9.25	9.86	(67)

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

(68)m=	95.15	96.14	93.65	88.35	81.67	75.38	71.19	70.2	72.69	77.98	84.67	90.95	(68)

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

(69)m=	28.77	28.77	28.77	28.77	28.77	28.77	28.77	28.77	28.77	28.77	28.77	28.77	(69)

Pumps and fans gains (Table 5a)

(70)m=	10	10	10	10	10	10	10	10	10	10	10	10	(70)

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

(71)m=	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	(71)

Water heating gains (Table 5)

(72)m=	56.63	54.78	51.4	46.95	43.91	39.81	36.68	41.11	42.96	47.55	52.68	55.21	(72)

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

(73)m=	211.69	209.75	202.29	190.86	179.81	168.81	161.75	166.27	172.2	183.77	196.91	206.34	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.2	x	10.73	x	0.63	x	0.7	=	10.49	(74)
North	0.9x	0.77	x	3.2	x	20.36	x	0.63	x	0.7	=	19.91	(74)

North	0.9x	0.77	x	3.2	x	33.31	x	0.63	x	0.7	=	32.57	(74)
North	0.9x	0.77	x	3.2	x	54.64	x	0.63	x	0.7	=	53.44	(74)
North	0.9x	0.77	x	3.2	x	75.22	x	0.63	x	0.7	=	73.56	(74)
North	0.9x	0.77	x	3.2	x	84.09	x	0.63	x	0.7	=	82.24	(74)
North	0.9x	0.77	x	3.2	x	79.12	x	0.63	x	0.7	=	77.38	(74)
North	0.9x	0.77	x	3.2	x	61.56	x	0.63	x	0.7	=	60.21	(74)
North	0.9x	0.77	x	3.2	x	41.09	x	0.63	x	0.7	=	40.18	(74)
North	0.9x	0.77	x	3.2	x	24.81	x	0.63	x	0.7	=	24.27	(74)
North	0.9x	0.77	x	3.2	x	13.22	x	0.63	x	0.7	=	12.93	(74)
North	0.9x	0.77	x	3.2	x	8.94	x	0.63	x	0.7	=	8.75	(74)

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

(83)m=	10.49	19.91	32.57	53.44	73.56	82.24	77.38	60.21	40.18	24.27	12.93	8.75	(83)

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

(84)m=	222.18	229.66	234.87	244.3	253.37	251.05	239.13	226.48	212.37	208.03	209.83	215.08	(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=	0.95	0.94	0.93	0.9	0.84	0.73	0.59	0.61	0.8	0.9	0.94	0.95	(86)

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

(87)m=	18.02	18.2	18.65	19.16	19.87	20.44	20.77	20.76	20.28	19.5	18.61	18.11	(87)

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

(88)m=	19.61	19.62	19.62	19.64	19.65	19.65	19.66	19.66	19.64	19.64	19.63	19.62	(88)

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

(89)m=	0.94	0.93	0.91	0.88	0.8	0.65	0.45	0.47	0.73	0.87	0.93	0.94	(89)

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

(90)m=	15.75	16.01	16.66	17.4	18.4	19.15	19.53	19.52	18.96	17.89	16.6	15.88	(90)

fLA = Living area ÷ (4) = | 1.03 | (91)

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

(92)m=	18.1	18.27	18.72	19.22	19.92	20.48	20.82	20.8	20.32	19.55	18.68	18.19	(92)

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

(93)m=	17.95	18.12	18.57	19.07	19.77	20.33	20.67	20.65	20.17	19.4	18.53	18.04	(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=	0.93	0.92	0.9	0.87	0.8	0.7	0.56	0.58	0.76	0.86	0.91	0.93	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	206.22	211.37	211.56	212.42	202.71	174.8	134.49	131.52	161.28	179.75	191.88	199.8	(95)
Monthly average external temperature from Table 8													
(96)m=	4.5	5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9	(96)

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

(97)m=	629.35	608.95	546.05	473.99	365.41	258.21	168.96	168.22	266.31	393.11	530.53	609.46	(97)

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

(98)m=	314.81	267.17	248.86	188.33	121.04	0	0	0	0	158.74	243.83	304.79	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1847.57 (98)

Space heating requirement in kWh/m²/year 63.71 (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		90	(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)	314.81	267.17	248.86	188.33	121.04	0	0	0	0	158.74	243.83	304.79	
(211)m = {[(98)m x (204)] + (210)m } x 100 ÷ (206) (211)	349.79	296.86	276.51	209.26	134.49	0	0	0	0	176.37	270.92	338.65	

Total (kWh/year) =$Sum(211)_{1...5,10....12}$= 2052.86 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] + (214) m } 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)

	135.29	118.18	122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11

Efficiency of water heater 90 (216)

(217)m=	90	90	90	90	90	90	90	90	90	90	90	90	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	150.32	131.31	136.61	121.17	117.31	103.32	98.98	110.34	111.56	127.04	135.62	146.79

Total = $Sum(219a)_{1...12}$ = 1490.36 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2052.86	
Water heating fuel used			1490.36	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		130		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		175	(231)
Electricity for lighting			169.38	(232)
Electricity generated by PVs			-686.72	(233)

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		0.198	=	406.47	(261)
Space heating (secondary)	(215)	x		0	=	0	(263)
Water heating	(219)	x		0.198	=	295.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =					701.56	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x		0.517	=	90.48	(267)
Electricity for lighting	(232)	x		0.517	=	87.57	(268)
Energy saving/generation technologies Item 1				0.529	=	-363.27	(269)
Total CO2, kg/year			sum of (265)…(271) =			516.33	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =			17.8	(273)
EI rating (section 14)						91	(274)

Regulations Compliance Report

Approved Document L1A 2010 edition assessed by Stroma FSAP 2009 program, Version: 1.4.0.79
Printed on 25 May 2012 at 10:04:25

Project Information:

Assessed By: Dan Watt (STRO000002) **Building Type:** End-terrace Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Site Reference : Flat 10 20% **Plot Reference:** 172 High StTeddington

Address : 172 High St, Teddington, TW11 8HU

Client Details:

Name: Alan Ward Architecture

Address :

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1 TER and DER

Fuel for main heating system: Natural gas		
Target Carbon Dioxide Emission Rate (TER)	32.02 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.80 kg/m²	**OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	(no floor)		
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	**OK**
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	**OK**

3 Design air permeability

Design air permeability at 50 pascals	5.00	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Boiler system with radiators or underfloor - mains gas Data from manufacturer Combi boiler Efficiency 90.0 % SEDBUK2009 Minimum 88.0 %	**OK**
Secondary heating system:	None	

5 Cylinder insulation

Hot water Storage:	No cylinder

6 Controls

Space heating controls	Time and temperature zone control	**OK**
Hot water controls:	No cylinder	
Boiler interlock:	Yes	**OK**

7 Low energy lights

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

Regulations Compliance Report

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames valley):	Slight	**OK**
Based on:		
Overshading:	Average or unknown	
Windows facing: North	3.2m², Overhang twice as wide as window, ratio NaN	
Ventilation rate:	4.00	
Blinds/curtains:	Dark-coloured curtain or roller blind shutter closed 100% of daylight hours	

10 Key features

Photovaltaic array

Predicted Energy Assessment

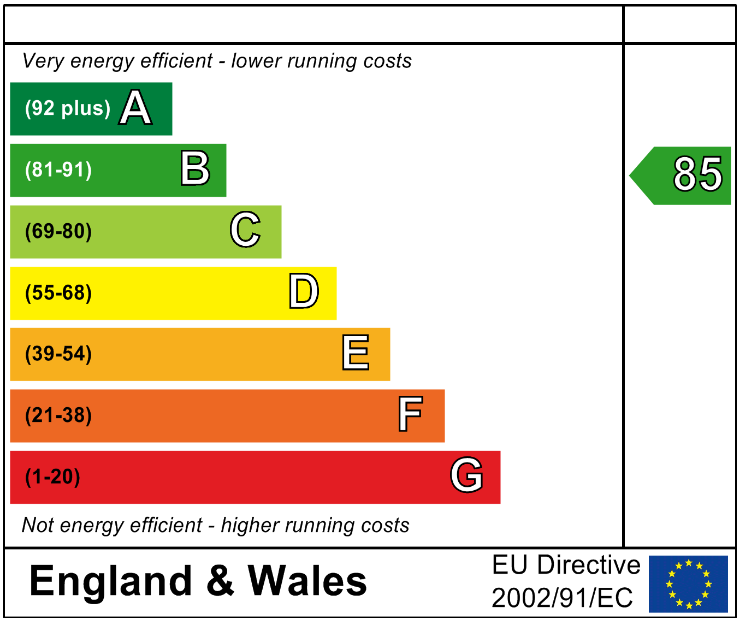
172 High St
Teddington
TW11 8HU

Dwelling type: End-terrace Top floor Flat
Date of assessment: 22 May 2012
Produced by: Dan Watt
Total floor area: 29 m²

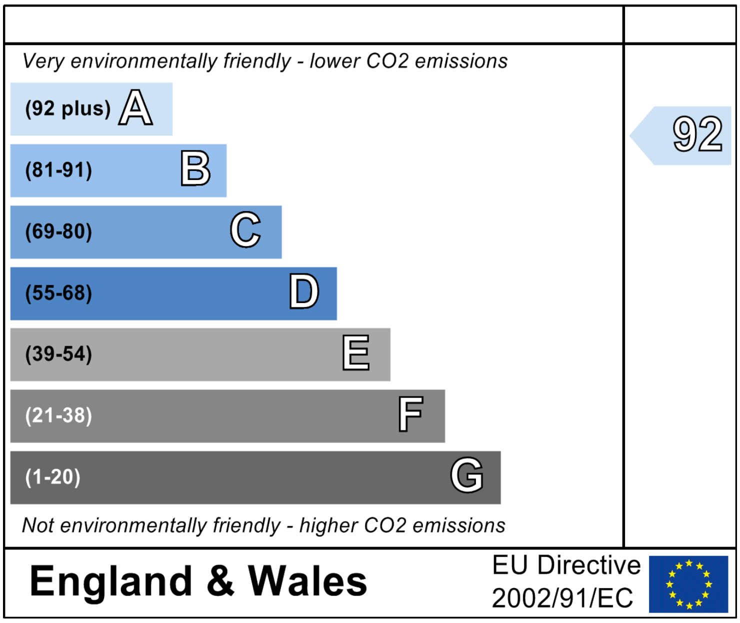
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about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

Energy performance has been assessed using the SAP 2009 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.