## 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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<sup>\*</sup> 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 <a href="must">must</a> 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 <sup>3</sup> /(hm <sup>2</sup> ) @ 50Pa)	5

### **Mechanical & Electrical Specification**

Lighting	
Percentage Lighting Low Energy fixed fittings:	100%

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

Heating	
Boiler Fuel	Gas
Boiler Efficiency	90%
Secondary Heating	None

<b>Primary Heating Controls</b>	
	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

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

#### Property description:

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

Floor Location: Floor area: Storey height: Floor 0 63.2 m<sup>2</sup> 2.67 m

True

Living area: 24 m<sup>2</sup> (fraction 0.38)

Front of dwelling faces: North

#### Opening types:

Name: Source: Type: Glazing: Argon: Frame:

Door Manufacturer Solid

 $\label{eq:windows} Windows \qquad \qquad \text{low-E, En} = 0.05, \, \text{soft coat} \quad \text{No} \qquad \qquad \text{PVC-U}$ 

Frame Factor: g-value: U-value: Name: Gap: Area: No. of Openings: Door mm 0 0 1.5 2.08 Window 0.7 0.63 4.8 16mm or more 1.5 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:	Карра:
External Element	<u>is</u>						
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 Element	<u>S</u>						
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: <u>Photovoltaic 1</u>

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 Stroma FSAP 2009 **Software Version: Software Name:** Version: 1.4.0.79 Property Address: Flat 8 20% 172 High St, Teddington, TW11 8HU Address: 1. Overall dwelling dimensions: Ave Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 63.2 (1a) x (3a) 2.67 (2a) =168.74 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)63.2 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =168.74 (5) total main Secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 O O 0 0 (6b) Number of intermittent fans x 10 =(7a) 2 20 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $\div$  (5) = (8) 0.12 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) (9)O Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 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 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =O (16)Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , 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 (19)3  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.78  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.29 Infiltration rate modified for monthly wind speed Feb Sep Jan Mar Apr Mav Jun Jul Aug Oct Nov Dec

1.27

4.5

1.12

4.1

1.02

3.9

0.98

3.7

0.92

3.7

0.92

4.2

1.05

4.5

1.12

4.8

1.2

5.1

1.27

Monthly average wind speed from Table 7

5.1

1.27

Wind Factor  $(22a)m = (22)m \div 4$ 

1.35

(22)m =

(22a)m



Adjusted infiltration rate (allow	ing for shelter ar	nd wind s	peed) =	(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 appl	icable ca	se	Į.	Į.			!	,		
If mechanical ventilation:		-)		IC\\		\ (00=)			0	(23a)	
If exhaust air heat pump using App	0	(23b)									
If balanced with heat recovery: effic						Ola ) (6	201.) [	4 (00)	0	(23c)	
·	a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c)										
( 1)		0 hoot roo	0	0 (246	0	0   2b)m + (0	0	0	J	(24a)	
b) If balanced mechanical vo		neat rec	overy (N	0	0	0	0	0	1	(24b)	
c) If whole house extract vei	<u> </u>	ļ		<u> </u>					J	(= :~)	
if $(22b)m < 0.5 \times (23b)$ ,	•	•				.5 × (23b	)				
(24c)m = 0 0 0	0 0	0	0	0	0	0	0	0	]	(24c)	
d) If natural ventilation or wh	nole house positi	ve input	ventilatio	on from I	oft	!!		!	•		
if (22b)m = 1, then (24d)	m = (22b)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]		•	1		
(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 - e	<del>,                                    </del>	<del></del>	<u> </u>	d) in box	(25)				1		
(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:										
<b>ELEMENT</b> Gross area (m²)	Openings m²	Net Ar A ,r		U-valı W/m2		A X U (W/k	()	k-value kJ/m²-		A X k kJ/K	
Doors		2.08	x	1.5	=	3.12	, T			(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	<u> </u>	0.23		4.95	F i		7 F	(29)	
Walls Type3 9.6	4.8	4.8	X	0.25		1.2	F i		7 F	(29)	
Roof Type1 50	0	50	X	0.16		8	F i		7 F	(30)	
Roof Type2 2.3	0	2.3	X	0.16	<del>-</del>	0.37			<b>-</b>	(30)	
Total area of elements, m <sup>2</sup>		138.9								(31)	
Party wall		28	X	0		0				(32)	
Party floor		63.2								(32a)	
* for windows and roof windows, use of include the areas on both sides of it			ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragrapl	 1 3.2	`	
Fabric heat loss, $W/K = S$ (A x	•	unono		(26)(30)	+ (32) =				37.68	(33)	
Heat capacity Cm = S(A x k)	-,				((28).	(30) + (32	) + (32a).	(32e) =	3841.4	<del></del>	
Thermal mass parameter (TM	P = Cm ÷ TFA) ii	n kJ/m²K			Indica	tive Value:	Low		100	(35)	
For design assessments where the de	•			ecisely the	indicative	values of	TMP in Ta	able 1f		\```	
can be used instead of a detailed calc			_								
Thermal bridges: S (L x Y) ca		•	(						5.56	(36)	
if details of thermal bridging are not kn Total fabric heat loss	10WN (36) = 0.15 x (3	51)			(33) +	(36) =			43.23	(37)	
Ventilation heat loss calculated	d monthly					$= 0.33 \times (2$	25)m x (5)	)	75.25	(0.)	
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]		

(0.0)													l	(00)
(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)
	ansfer o		·						<del></del>	= (37) + (37)	<del></del>		l	
(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	74.01	(39)
Heat lo	oss para	meter (l	HLP), W	/m²K						= (39)m ÷	Sum(39) <sub>1.</sub> · (4)	12 / 12=	74.01	(39)
(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		
Numbe	er of day	s in mo	nth (Tab	le 1a)				-	,	Average =	Sum(40) <sub>1</sub> .	12 /12=	1.17	(40)
	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. Wa	ater heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
Assum	ed occu	ıpancy,	N								2.	.07		(42)
			+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13.			ı	, ,
	A £ 13.9 Laverag	•	ater usad	ne in litre	es per da	av Vd.av	erage =	(25 x N)	+ 36		83	3.37		(43)
Reduce	the annua	al average	hot water	usage by	5% if the $c$	lwelling is	designed i	to achieve		se target o			I	(1.0)
not more	e that 125	litres per	person pei	r day (all w т	ater use, i	hot and co	ld) I						l	
Hot wat	Jan	Feb	Mar r day for ea	Apr	May	Jun	Jul Table 10 x	Aug	Sep	Oct	Nov	Dec		
		,	· ·	1	1	1	1	· <i>'</i>	04.74	05.04		04.74	1	
(44)m=	91.71	88.38	85.04	81.71	78.37	75.04	75.04	78.37	81.71	85.04	88.38 m(44) <sub>112</sub> =	91.71	1000.5	(44)
Energy	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	n x nm x E	OTm / 3600			. ,		1000.3	()
(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 = Su	m(45) <sub>112</sub> =	-	1314.95	(45)
If instan	taneous w	ater heati	ng at point	of use (no	hot water	r 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)
	storage anufactu		clared lo	oss facto	r is knov	vn (kWh	/dav):					0		(47)
,			m Table			(	,, , .					0		(48)
			storage		ear			(47) x (48)	) =			0		(49)
If man	ufacture	r's decla	ared cylir	nder loss	factor is									, ,
-		•	) includii	•		_		!				0		(50)
	-	-	l no tank ir	_				ontor 'O' in	hov (50)					
								enter '0' in	DOX (30)			_	l	(=4)
		_	factor fr	om rab	e z (KVV	n/iitre/da	iy)					0		(51)
	e factor erature fa		bie ∠a m Table	2b							_	0		(52) (53)
-			storage		ear			((50) x (51	) x (52) x	(53) =			 	(54)
٠.	(49) or (		_	, v 11/ y (	<i>-</i> 41			((00) /( (01	, ( <del>02</del> ) X	(30) =		0		(54)
	, , ,	, ,	culated t	for each	month			((56)m = (	55) × (41):	m				. ,
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m		H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
•			L	L	<u> </u>	L	L	L	<u> </u>	L	L	L	I .	

Primary circuit loss (an	nual) fro	m Table	3							0		(58)
Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m												
(modified by factor fr	om Table	e H5 if tl	here is s	solar wa	ter heatii	ng and	a cylinde	r thermo	ostat)			
(59)m = 0 0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss calculated	for each	month (	61)m =	(60) ÷ 3	65 × (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 $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$												
(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 Appe	endix G or	Appendix	H (negat	ve quantity	y) (enter	'0' if no sola	r contribu	tion to wate	er heating)	•	
(add additional lines if	FGHRS a	and/or V	VWHRS	applies	, see Ap	pendix	G)					
(63)m= 0 0	0	0	0	0	0	0	0	0	0	0		(63)
Output from water hea	ter	-		-		-	-	-	-	-	•	
(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		
	•			•	•	Οι	tput from w	ater heate	er (annual)	12	1815.06	(64)
Heat gains from water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	m] + 0.8 x	د [(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 cald	ulation o	of (65)m	only if c	ylinder i	s in the o	dwelling	g or hot w	ater is f	rom com	munity h	i leating	
5. Internal gains (see	Table 5	and 5a)	):								-	
Metabolic gains (Table		· ·										
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	<del>+</del>	124.23	124.23	124.23		(66)
Lighting gains (calculate	ted in Ap	pendix l	equat	ion L9 o	r L9a). a	lso see	Table 5	<u> </u>	<u>ļ</u>	!	ı	
(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 (calc	ulated in	Append	lix L. ea	uation L	13 or L1	3a), als	so see Ta	ble 5			ı	
(68)m= 270.06 272.86	265.8	250.77	231.79	213.95	202.04	199.23		221.33	240.31	258.14		(68)
Cooking gains (calcula	ted in An	nendix	l equat	ion I 15	or I 15a\	) also s	see Table	5	1	ļ		
(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 5	l a)		<u> </u>	<b>!</b>	<u> </u>		ļ	ı	<u> </u>		
(70)m= 10 10	10	10	10	10	10	10	10	10	10	10		(70)
Losses e.g. evaporatio	n (negati	ive valu	es) (Tah	L	<u> </u>	<u> </u>		<u> </u>				, ,
(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 (T	l l	02.02	02.02	02.02	1 02:02	02.02	1 02.02	02.02	1 02.02	02.02	l	` '
(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	1	(72)
Total internal gains =		00.00	00.42		<u> </u>	<u> </u>	+ (69)m +		ļ			()
(73)m= 496.74 491.54	471.75	442.07	412.2	385.68	370.9	379.59	<del></del>	427.17	459.87	484.27	l	(73)
6. Solar gains:	471.73	442.07	412.2	303.00	370.9	379.58	397.3	427.17	459.67	404.27		(70)
Solar gains are calculated	using solar	flux from	Table 6a	and assoc	iated equa	ations to	convert to th	e applica	ble orientat	tion.		
Orientation: Access F	•	Area		Flu			g_		FF		Gains	
Table 6d		m <sup>2</sup>			ble 6a		Table 6b	Т	able 6c		(W)	
South 0.9x 0.77	x	4.8	3	x .		] x [	0.63	x [	0.7		69.42	(78)
South 0.9x 0.77	X	4.8			77.18	] x	0.63	x [	0.7	= =	113.22	] (78)
<b></b>							0.00					J` ′



South	0.9x	0.77		X	4.8	3	X	9	4.25	x		0.63	x	0.7	=	138.25	(78)
South	0.9x	0.77		X	4.8	3	X	10	05.11	х		0.63	x	0.7		154.2	(78)
South	0.9x	0.77		X	4.8	3	X	10	08.55	X		0.63	х	0.7	=	159.24	(78)
South	0.9x	0.77		X	4.8	3	X	1	08.9	X		0.63	х	0.7	=	159.75	(78)
South	0.9x	0.77		X	4.8	3	X	10	07.14	х		0.63	x	0.7	=	157.16	(78)
South	0.9x	0.77		X	4.8	3	X	10	03.88	X		0.63	х	0.7	=	152.39	(78)
South	0.9x	0.77		X	4.8	3	X	9	9.99	X		0.63	x	0.7	=	146.68	(78)
South	0.9x	0.77		X	4.8	3	X	8	5.29	x		0.63	х	0.7	=	125.12	(78)
South	0.9x	0.77		X	4.8	3	X	5	6.07	X		0.63	х	0.7	=	82.25	(78)
South	0.9x	0.77		X	4.8	3	X	4	0.89	x		0.63	x	0.7	=	59.98	(78)
Solar g	ains in	watts, ca	1	-						(83)m	= Su	ım(74)m .				7	
(83)m=	69.42	113.22	138.2		154.2	159.24		59.75	157.16	152.	39	146.68	125.12	82.25	59.98		(83)
Ī		nternal a		_	<u> </u>		<del>`</del>							1	ī	7	(5.4)
(84)m=	566.16	604.77	610		596.27	571.44	5	45.43	528.06	531.	98	543.98	552.29	542.12	544.25		(84)
7. Me	an inter	nal temp	peratu	re (	heating	seasor	า)										_
Temp	erature	during h	neatin	g pe	eriods ir	the liv	ing	area f	from Tab	ole 9,	Th1	I (°C)				21	(85)
Utilisa	ition fac	tor for g	ains fo	or li	ving are	ea, h1,n	n (s	ee Ta	ble 9a)						•	7	
	Jan	Feb	Ma	ır	Apr	May	_	Jun	Jul	Αι	ıg	Sep	Oct	Nov	Dec		
(86)m=	0.92	0.91	0.88		0.85	0.78		0.67	0.5	0.5	5	0.69	0.82	0.9	0.92		(86)
Mean	interna	l temper	ature	in li	iving are	ea T1 (f	ollo	w ste	ps 3 to 7	' in Ta	able	9c)				_	
(87)m=	19	19.19	19.5	3	19.87	20.34		20.7	20.9	20.9	91	20.66	20.16	19.45	19.04		(87)
Temp	erature	during h	neating	g pe	eriods ir	rest of	f dw	elling/	from Ta	ıble 9	, Th	12 (°C)					
(88)m=	19.93	19.94	19.9	4	19.95	19.95	1	19.96	19.96	19.9	96	19.95	19.95	19.94	19.94		(88)
Utilisa	ition fac	tor for g	ains fo	or re	est of d	welling,	h2	,m (se	e Table	9a)							
(89)m=	0.91	0.89	0.86	Т	0.83	0.74		0.6	0.4	0.3	9	0.62	0.79	0.89	0.91		(89)
Mean	interna	l temper	ature	in t	he rest	of dwel	lina	T2 (fc	ollow ste	ns 3	to 7	in Tabl	e 9c)	•	•	_	
(90)m=	17.3	17.58	18.0	-	18.56	19.2	Ť	19.68	19.9	19.	-	19.63	18.96	17.96	17.37		(90)
L		!	•									f	LA = Liv	ing area ÷ (	4) =	0.38	(91)
Mean	interna	l temner	ature	(for	the wh	ole dwa	nillد	a) – fl	LA × T1	<b>_</b>	_ fl .	Δ) <b>v</b> T2					
(92)m=	17.94	18.19	18.6	Ť	19.06	19.63	$\overline{}$	20.07	20.28	20.2		20.02	19.41	18.53	18	1	(92)
	adjustr	nent to t	he me	an	internal	tempe	ratu	ire fro	m Table	4e, v	whe	re appro	priate	_!		_	
(93)m=	17.79	18.04	18.4	-	18.91	19.48	1	19.92	20.13	20.1		19.87	19.26	18.38	17.85		(93)
8. Spa	ace hea	ting requ	uireme	ent											•		
							nec	l at ste	ep 11 of	Table	e 9b	, so tha	t Ti,m=	(76)m an	d re-cal	culate	
the uti		factor fo		$\overline{}$			_							1		7	
Litilion	Jan	Feb	Ma		Apr	May		Jun	Jul	Αι	ng	Sep	Oct	Nov	Dec		
(94)m=	0.88	tor for g	0.83	$\neg$	0.8	0.72	1	0.59	0.41	0.4	1	0.61	0.76	0.86	0.89	1	(94)
		hmGm		_					0.11	JT		0.01	0.70	1 0.00	1 0.00	_	\- ·/
(95)m=	500.01	522.26	508.4	Ť	476.8	412.52	3	23.31	218.94	219.	25	333.77	422.13	464.34	481.92	1	(95)
` ' L		age exte		_						ı				ļ	1	_	
(96)m=	4.5	5	6.8	Ť	8.7	11.7	$\overline{}$	14.6	16.9	16.	9	14.3	10.8	7	4.9		(96)
		_					-							-	-	-	



Heat	loss rate	for me	an intern	al tempe	arature l	lm \//-	-[(39)m :	x [(93)m	_ (96)m	1				
(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)
	e heatin	g require	ement fo	r each n		Vh/mont	th = 0.02	1 <u> </u>	ı )m – (95	)m] x (4	L 1)m			
(98)m=	371.85	304.1	271.27	200.12	118.48	0	0	0	0	151.58	274.79	362.05		
								Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	2054.24	(98)
Spac	e heatin	g require	ement in	kWh/m²	<sup>2</sup> /year								32.5	(99)
9a. En	ergy rec	uiremer	nts – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	CHP)					
•	e heatir	_												_
Fract	ion of sp	ace hea	it from s	econdar	y/supple	mentary	system						0	(201)
Fract	ion of sp	ace hea	it from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fract	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
Effici	ency of r	main spa	ace heat	ing syste	em 1								90	(206)
Effici	ency of s	seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Spac	e heatin	g require	ement (c	alculate	d above)	)		1						
	371.85	304.1	271.27	200.12	118.48	0	0	0	0	151.58	274.79	362.05		
(211)n	$n = \{[(98)]$		4)] + (21	0)m } x	100 ÷ (2	06)								(211)
	413.17	337.89	301.41	222.36	131.64	0	0	0	0	168.43	305.33	402.27		<b>¬</b>
_								lota	ii (kwh/yea	ar) =Sum(2	211) <sub>15,1012</sub>		2282.49	(211)
•		• '	econdar <sub>:</sub> 14) m } x	• •										
= {[(90 (215)m=		0	0	0	0	0	0	0	0	0	0	0		
,			<u> </u>					Tota	I II (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	=	0	(215)
Water	heating	l										L		
	_		ter (calc	ulated a	oove)									
	183.07	159.91	166.38	147.56	142.87	125.82	120.54	134.38	135.87	154.72	165.17	178.77		_
	ncy of w							ı	ı				90	(216)
(217)m=		90	90	90	90	90	90	90	90	90	90	90		(217)
		•	kWh/mo (217) ÷ (											
. ,	203.41	177.68	184.86	163.96	158.74	139.8	133.94	149.31	150.96	171.91	183.52	198.63		
								Tota	I = Sum(2	19a) <sub>112</sub> =			2016.73	(219)
	al totals									k\	Wh/year	,	kWh/year	<u>-</u> -
Space	heating	fuel use	ed, main	system	1								2282.49	
Water	heating	fuel use	d										2016.73	
Electri	city for p	umps, f	ans and	electric	keep-ho	t								
centr	al heatin	g pump	•									130		(230c)
boile	r with a f	an-assis	sted flue									45		(230e)
Total e	electricity	for the	above, ł	kWh/yea	r			sum	of (230a).	(230g) =			175	(231)
Electri	city for li	ghting											347.16	(232)
Electri	city gene	erated b	y PVs									[	-1011.84	(233)



	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.1 x 0.01 =		(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 × 0.01 =	62.52	ے (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) sep Energy for lighting	parately as applicable and app	ly fuel price according to		] (250
Additional standing charges (Table 12)			106	_    (251
	one of (233) to (235) x)	11.46 × 0.01 =	-115.96	] (252
Appendix Q items: repeat lines (253) and (254) a		11.40	-115.90	](202
	47) + (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 system	ms including micro-CHP			
	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	ır
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			470.40	_ ](268
Electricity for lighting	(232) x	0.517	179.48	(
Energy saving/generation technologies Item 1	(232) x	0.517 =	-535.26	(269
Energy saving/generation technologies		0.017		
Energy saving/generation technologies Item 1	sum	0.529 =	-535.26	] [269
Energy saving/generation technologies Item 1 Total CO2, kg/year CO2 emissions per m²	sum	0.529 = of (265)(271) =	-535.26 585.94	](269 ](272
Energy saving/generation technologies Item 1 Total CO2, kg/year	sum	0.529 = of (265)(271) =	-535.26 585.94 9.27	](269 ](272 ](273
Energy saving/generation technologies Item 1 Total CO2, kg/year  CO2 emissions per m² El rating (section 14)	sum	0.529 = of (265)(271) =	-535.26 585.94 9.27	](269 ](272 ](273



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 o	of (265)(271) =		2955.34	(272)
Primary energy kWh/m²/year	(272)	÷ (4) =		46.76	(273)

User Details: Dan Watt STRO000002 **Assessor Name:** Stroma Number: Stroma FSAP 2009 **Software Version:** Version: 1.4.0.79 **Software Name:** Property Address: Flat 8 20% 172 High St, Teddington, TW11 8HU Address: 1. Overall dwelling dimensions: Ave Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 63.2 (1a) x 2.67 (2a) = 168.74 (3a) Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)63.2 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =168.74 (5) Secondary other total m³ per hour main heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 O O 0 0 (6b) Number of intermittent fans x 10 =(7a) 2 20 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $\div$  (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) (9) O Additional infiltration (10)[(9)-1]x0.1 =0 Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 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 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =O (16)Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , otherwise (18) = (16)(18)0.37 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 (19)3  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.78  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.29

Infiltrat	Infiltration rate modified for monthly wind speed													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthl	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 F	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 infiltra	ation rate (allo	wina for sh	nelter an	d wind s	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 effec	•	e rate for t	he appli	cable ca	se	ı						<del></del>
	al ventilation: eat pump using Ap	nandiy N. (2	ah) (aa	s) Em. /	accetion (N	JEV otho	muiaa (22h	) (220)			0	(23a)
								) = (23a)			0	(23b)
	n heat recovery: ef	-	_					2h\ /	20h) [/	1 (00.0)	0	(23c)
a) if balance (24a)m= 0	ed mechanical	ventilation 0	with ne	at recove	ery (MV)	1R) (248	$\int_{0}^{\infty} \int_{0}^{\infty} dx dx$	2b)m + (2 0	23b) <b>x</b> [*	0	) ÷ 100] ]	(24a)
` ′	d mechanical									0	J	(244)
(24b)m= 0		0 0	0	0	0	0	0	0	0	0	1	(24b)
( )	ouse extract v			<u> </u>							J	, ,
,	$0 < 0.5 \times (23b)$		•	•				.5 × (23b	)			
(24c)m= 0	0 0	0	0	0	0	0	0	0	0	0	]	(24c)
d) If natural	ventilation or v	hole hous	e positiv	e input	ventilatio	on from I	oft	!		!	•	
if (22b)n	n = 1, then (24	d)m = (22b)	o)m othe	erwise (2	(4d)m =	0.5 + [(2	2b)m² x	0.5]		1	1	
(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)
	change rate -	<del></del>	<u> </u>	<del>_ ``</del>	<del></del>	<del></del>	<del>`</del>	1			1	
(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 losse	s and heat los	s paramete	er:									
ELEMENT	Gross area (m²)	Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²-		A X k kJ/K
Doors				2.08	х	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	<u>x</u>	0.23	<del>-</del>	4.95			<b>i</b> i	(29)
Walls Type3	9.6	4.8		4.8	x	0.25	<del>-</del>	1.2			<b>i</b> i	(29)
Roof Type1	50	0	_	50	x	0.16	Ħ =i	8	T i		7 F	(30)
Roof Type2	2.3	0		2.3	x	0.16	<del>-</del>	0.37	<b>-</b>		7 F	(30)
Total area of e	elements, m <sup>2</sup>			138.9								(31)
Party wall				28	x	0		0				(32)
Party floor				63.2							<b>7</b>	(32a)
* for windows and  ** include the area					ated using	ı formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragrapl	n 3.2	
Fabric heat los						(26)(30)	) + (32) =				37.6	8 (33)
Heat capacity	$Cm = S(A \times k)$	,					((28).	(30) + (32	2) + (32a).	(32e) =	3841.	
Thermal mass	parameter (TN	/IP = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Low		100	(35)
For design assess			construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
can be used inste			icina Ar	nandiy l								(20)
Thermal bridge if details of therma	, ,		• .	•	``						5.56	(36)
Total fabric he			J. 10 X (0	.,			(33) +	(36) =			43.2	3 (37)
Ventilation hea	at loss calculat	ed monthly	y				(38)m	= 0.33 × (2	25)m x (5)	)		
Jan	Feb Ma	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

(0.0)													l	(00)
(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)
	ansfer o		·						<del></del>	= (37) + (37)	<del></del>		l	
(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	74.01	(39)
Heat lo	oss para	meter (l	HLP), W	/m²K						= (39)m ÷	Sum(39) <sub>1.</sub> · (4)	12 / 12=	74.01	(39)
(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		
Numbe	er of day	s in mo	nth (Tab	le 1a)				-	,	Average =	Sum(40) <sub>1</sub> .	12 /12=	1.17	(40)
	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. Wa	ater heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
Assum	ed occu	ıpancy,	N								2.	.07		(42)
			+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13.			ı	, ,
	A £ 13.9 Laverag	•	ater usad	ne in litre	es per da	av Vd.av	erage =	(25 x N)	+ 36		83	3.37		(43)
Reduce	the annua	al average	hot water	usage by	5% if the $c$	lwelling is	designed i	to achieve		se target o			I	(1.0)
not more	e that 125	litres per	person pei	r day (all w т	ater use, i	hot and co	ld) I						l	
Hot wat	Jan	Feb	Mar r day for ea	Apr	May	Jun	Jul Table 10 x	Aug	Sep	Oct	Nov	Dec		
		,	· ·	1	1	1	1	· <i>'</i>	04.74	05.04		04.74	1	
(44)m=	91.71	88.38	85.04	81.71	78.37	75.04	75.04	78.37	81.71	85.04	88.38 m(44) <sub>112</sub> =	91.71	1000.5	(44)
Energy	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	n x nm x E	OTm / 3600			. ,		1000.3	()
(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 = Su	m(45) <sub>112</sub> =	-	1314.95	(45)
If instan	taneous w	ater heati	ng at point	of use (no	hot water	r 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)
	storage anufactu		clared lo	oss facto	r is knov	vn (kWh	/dav):					0		(47)
,			m Table			(	,, , .					0		(48)
			storage		ear			(47) x (48)	) =			0		(49)
If man	ufacture	r's decla	ared cylir	nder loss	factor is									, ,
-		•	) includii	•		_		!				0		(50)
	-	-	l no tank ir	_				ontor 'O' in	hov (50)					
								enter '0' in	DOX (30)			_	l	(=4)
		_	factor fr	om rab	e z (KVV	n/iitre/da	iy)					0		(51)
	e factor erature fa		bie ∠a m Table	2b							_	0		(52) (53)
-			storage		ear			((50) x (51	) x (52) x	(53) =			 	(54)
٠.	(49) or (		_	, v 11/ y (	<i>-</i> 41			((00) /( (01	, ( <del>02</del> ) X	(30) =		0		(54)
	, , ,	, ,	culated t	for each	month			((56)m = (	55) × (41):	m				. ,
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m		H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
•			L	L	<u> </u>	L	L	L	<u> </u>	L	L	L	I .	

Primary ci	rcuit loss (ar	nnual) fr	om Tabl	e 3										0			(58)
•	rcuit loss ca				`	•	` '		` '								
(modifie	ed by factor f	rom Tal	ole H5 if	there is	sol	ar wat	er heatii	ng ar	nd a	cylinde	the	rmo	stat)			•	
(59)m=	0 0	0	0	0		0	0	0	)	0	0	)	0	0		I	(59)
Combi los	s calculated	for eac	h month	(61)m =	: (60	)) ÷ 36	65 × (41)	)m									
(61)m= 46	6.74 40.68	43.34	40.29	39.94		37	38.24	39.	94	40.29	43.	34	43.58	46.7	<b>'</b> 4		(61)
Total heat	required for	water h	neating c	alculate	d fo	r eac	h month	(62)	m =	0.85 × (	45)n	n +	(46)m +	(57)r	— n +	(59)m + (61)m	
	3.07 159.91	166.38	<del></del>	142.87	_	25.82	120.54	134	_	135.87	154		165.17	178.	$\neg$		(62)
	nput calculated	using Ap	pendix G o	r Appendi	x H	(negati	ve quantity	 /) (ent	er '0'	if no sola	r cont	ribut	ion to wate	r heat	ing)		
	ional lines if					_									0,		
(63)m=	0 0	0	0	0	Τ̈́	0	0	0		0	0	)	0	0			(63)
	m water hea	ıter	<u> </u>	ļ				<u> </u>					<u>l</u>	<u> </u>			
	3.07 159.91	166.38	147.56	142.87	T 1	25.82	120.54	134	.38	135.87	154	.72	165.17	178.	77		
(01)	0.07	100.00	1 111.00	1 12.01	<u> </u>		120.01						r (annual) <sub>1</sub>		$\ddot{-}$	1815.06	(64)
Hoot goin	a from water	hooting	ı k\A/b/m	onth 0 1	)	[O 0E	(4E)m								سرر ا		](-,
` <del></del>	s from water 7.01 49.82	51.75	45.74	44.21	_	10.63 88.78	36.93	41.		41.85			<u> </u>	r `	Ó	]	(65)
` ′	Į	ļ.	ļ	<u>l</u>			ļ				47.		51.32	55.5			(00)
include	(57)m in cal	culation	of (65)m	only if	cylii	nder i	s in the o	dwell	ing	or hot w	ater	is tr	om com	muni	ty h	eating	
5. Intern	al gains (see	e Table	5 and 5a	1):													
Metab <u>olic</u>	gains (Table	<u>5), Wa</u>	itts		_											1	
J	an Feb	Mar	Apr	May	╙	Jun	Jul	А	ug	Sep	0	ct	Nov	D€	ЭС		
(66)m= 10	3.53 103.53	103.53	103.53	103.53	1	03.53	103.53	103	.53	103.53	103	.53	103.53	103.	53		(66)
Lighting g	ains (calcula	ted in A	ppendix	L, equa	tion	L9 o	r L9a), a	lso s	ee -	Table 5							
(67)m= 19	9.66 17.46	14.2	10.75	8.04		6.78	7.33	9.5	53	12.79	16.	24	18.95	20.	2		(67)
Appliance	s gains (calc	ulated i	n Appen	dix L, e	qua	tion L	13 or L1	3a),	also	see Tal	ole 5	;					
(68)m= 18	0.94 182.82	178.09	168.01	155.3	1	43.35	135.36	133	.49	138.22	148	.29	161.01	172.	96		(68)
Cooking	ains (calcula	ated in A	Appendix	L, equa	atior	ո L15	or L15a	), als	o se	e Table	5				_		
	3.35 33.35	33.35	33.35	33.35	_	33.35	33.35	33.	_	33.35	33.	35	33.35	33.3	35		(69)
Pumps an	d fans gains	(Table						<u>!</u>									
	10 10	10	10	10	Т	10	10	10	0	10	10	0	10	10	,		(70)
	g. evaporation	l	<u> </u>	<u> </u>	L bla			<u> </u>									` ,
	2.82 -82.82	-82.82	-82.82	-82.82	_	3) 32.82	-82.82	-82	82	-82.82	-82	82	-82.82	-82.8	82		(71)
` ′	ļ	<u> </u>		-02.02		32.02	-02.02	-02	.02	-02.02	-02	.02	-02.02	-02.0	) <u>Z</u>		(, ,)
	ating gains (	<del>-                                    </del>		T 50.40	Τ,		40.00	l	00	50.40	0.1	0.4	74.00		-	l	(72)
` ′	5.63 74.13	69.55	63.53	59.42		3.87	49.63	55.		58.13	64.		71.28	74.7	1	I	(72)
	rnal gains =			1	_		· · ·	·	_				1)m + (72)			1	
` '	1.29 338.46	325.89	306.35	286.81	2	68.06	256.38	262	2.7	273.19	292	.93	315.3	331.	93	l	(73)
6. Solar	_																
_	are calculated	_			and			tions	to co	nvert to th	e app	licat		ion.			
Orientatio	n: Access f Table 6d		Area m²	l		Flu	x ole 6a		т	g_ able 6b		т.	FF able 6c			Gains	
_		·	1112			ıaı	JIE Od	,		avie ov	_	- T	avie oc		1	(W)	,
	0.77	)	4	.8	X	4	7.32	X		0.63	×	· L	0.7		=	69.42	(78)
South	0.77	,	4	.8	X	7	7.18	X		0.63	×	· [	0.7		=	113.22	(78)



South	0.9x	0.77	X	4.	8	x	9	4.25	x		0.63	x	0.7	=	138.25	(78)
South	0.9x	0.77	x	4.	8	x	10	05.11	x		0.63	_ x [	0.7	=	154.2	(78)
South	0.9x	0.77	X	4.	8	X	10	08.55	X		0.63	x	0.7	=	159.24	(78)
South	0.9x	0.77	x	4.	8	x	1	08.9	X		0.63	x	0.7	=	159.75	(78)
South	0.9x	0.77	X	4.	8	x	10	07.14	x		0.63	x	0.7	=	157.16	(78)
South	0.9x	0.77	X	4.	8	x	10	03.88	x		0.63	x	0.7	=	152.39	(78)
South	0.9x	0.77	X	4.	8	x	9	9.99	X		0.63	x	0.7	=	146.68	(78)
South	0.9x	0.77	X	4.	8	x	8	5.29	X		0.63	x	0.7	=	125.12	(78)
South	0.9x	0.77	X	4.	8	X	5	6.07	X		0.63	x	0.7	=	82.25	(78)
South	0.9x	0.77	x	4.	8	x	4	0.89	x		0.63	_ x [	0.7	=	59.98	(78)
Solar g	ains in	watts, ca							(83)m	= Su	ım(74)m .	(82)m		1	7	
(83)m=	69.42	113.22	138.25	154.2	159.24	_	59.75	157.16	152.	39	146.68	125.12	82.25	59.98		(83)
Ī		nternal a		<u> </u>	<u> </u>	·									7	
(84)m=	410.71	451.69	464.15	460.55	446.05	4	27.8	413.55	415.	09	419.87	418.04	397.55	391.91		(84)
7. Me	an inter	nal temp	perature	(heating	season	)										
Temp	erature	during h	neating p	eriods ir	n the livi	ng a	area f	from Tab	ole 9,	Th1	I (°C)				21	(85)
Utilisa	ition fac	tor for g	ains for	living are	ea, h1,m	ı (se	ee Ta	ble 9a)							_	
	Jan	Feb	Mar	Apr	May	<u> </u>	Jun	Jul	Αι	ıg	Sep	Oct	Nov	Dec	_	
(86)m=	0.96	0.95	0.93	0.91	0.85		).75	0.6	0.6	5	0.78	0.89	0.95	0.96		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollo	w ste	ps 3 to 7	' in Ta	able	9c)					
(87)m=	18.64	18.85	19.24	19.62	20.15	2	0.59	20.85	20.8	35	20.53	19.93	19.14	18.69		(87)
Temp	erature	during h	neating p	eriods ir	n rest of	dw	elling	from Ta	ble 9	), Th	2 (°C)					
(88)m=	19.93	19.94	19.94	19.95	19.95	1	9.96	19.96	19.9	96	19.95	19.95	19.94	19.94		(88)
- Utilisa	ition fac	tor for g	ains for	rest of d	welling,	h2,	m (se	e Table	9a)		-		-	-	_	
(89)m=	0.95	0.94	0.92	0.89	0.82	ı	0.69	0.48	0.48	8	0.72	0.87	0.94	0.96	7	(89)
Mean	interna	l temper	ature in	the rest	of dwell	ina	T2 (fc	ollow ste	ns 3	to 7	in Tabl	e 9c)			_	
(90)m=	16.79	17.1	17.66	18.21	18.96	T	9.55	19.86	19.8		19.48	18.65	17.52	16.87	7	(90)
L		<u> </u>	<u> </u>	<u> </u>	<u>I</u>	_					f	LA = Livi	ng area ÷ (	4) =	0.38	(91)
Moan	intorna	l temper	aturo (fo	r tha wh	ole dwe	llin	م) _ fl	Λ <b>ν</b> Τ1	<b> /1</b> _	_ fl .	۸) ی T2					
(92)m=	17.49	17.77	18.26	18.75	19.41	_	9.95	20.24	20.2		19.88	19.14	18.14	17.56	7	(92)
		nent to t	l	ļ	<u> </u>	<u> </u>									_	, ,
(93)m=	17.34	17.62	18.11	18.6	19.26	1	19.8	20.09	20.0		19.73	18.99	17.99	17.41	7	(93)
8. Spa	ace hea	ting requ	uirement													
Set Ti	to the	mean int	ernal te	mperatu	re obtair	ned	at ste	ep 11 of	Table	e 9b	, so tha	t Ti,m=	(76)m an	d re-cal	culate	
the uti	ilisation	factor fo		using Ta	ble 9a										7	
,	Jan	Feb	Mar	Apr	May	<u> </u>	Jun	Jul	Αι	ıg	Sep	Oct	Nov	Dec	_	
Г		tor for g	I	ī	0.0	<u> </u>	2.00	0.5	0.5		0.7	0.04	1 004	1 0 00	7	(04)
(94)m=	0.93	0.92	0.89	0.86	0.8	Г.	0.68	0.5	0.5	<u> </u>	0.7	0.84	0.91	0.93	J	(94)
(95)m=	382.85	hmGm 413.31	, VV = (94 413.19	4)m x (8/ 396.79	4)m 354.88	20	90.36	206.74	206.	95	295.29	350.37	362.94	366.31	1	(95)
L		age exte						200.74	200.	<u> </u>	200.20	000.07	002.34	1 000.01	J	(55)
(96)m=	4.5	5	6.8	8.7	11.7	_	14.6	16.9	16.9	9	14.3	10.8	7	4.9	1	(96)
` ′ [		I	I	I	I	1			I		·		<u> </u>	<u> </u>	_	. ,



Heat	loss rate	e for me	an intern	al temp	erature	Im W=	=[(39)m	x [(93)m	– (96)m	1				
(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)
Spac	e heating	g require	ement fo	r each n	nonth, k\	Nh/mont	th = 0.02	24 x [(97	ı )m – (95	)m] x (4	1)m			
(98)m=	433.81	356.15	321.63	241.22	149.37	0	0	0	0	189.76	326.76	423.29		
						•	•	Tota	l per year	(kWh/year	r) = Sum(9	8) <sub>15,912</sub> =	2441.99	(98)
Spac	e heatin	g require	ement in	kWh/m²	<sup>2</sup> /year								38.64	(99)
9a. En	nergy rec	Juiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heatir	_										r		_
Fract	ion of sp	ace hea	at from s	econdar	y/supple	mentary	system					Į	0	(201)
Fract	ion of sp	ace hea	at from m	nain syst	em(s)			(202) = 1	- (201) =			Ĺ	1	(202)
Fract	ion of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
Effici	ency of r	main spa	ace heat	ing syste	em 1								90	(206)
Effici	ency of s	seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Spac	e heatin		<del>- `</del>	r								1		
	433.81	356.15	321.63	241.22	149.37	0	0	0	0	189.76	326.76	423.29		
(211)n	n = {[(98				· ·	06)								(211)
	482.01	395.72	357.36	268.02	165.97	0	0	0	0	210.85	363.07	470.33		_
								Lota	ıl (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	F	2713.33	(211)
	e heatin	•		• •										
= {[(98 (215)m=	3)m x (20 0	0 0	14) m } >	( 100 ÷ (	208) 0	0	0	0	0	0	0	0		
(213)111-	U	0			U	U U		_	_	_	215) <sub>15.1012</sub>		0	(215)
Water	heating									, ,	/15,1012	L		(=:0)
	t from w		ter (calc	ulated a	bove)									
	183.07	159.91	166.38	147.56	142.87	125.82	120.54	134.38	135.87	154.72	165.17	178.77		
Efficie	ncy of w	ater hea	iter	•				•	•		•		90	(216)
(217)m=	90	90	90	90	90	90	90	90	90	90	90	90		(217)
	or water	•												
,	n = (64) 203.41	m x 100 177.68	) ÷ (217) 184.86	m 163.96	158.74	139.8	133.94	149.31	150.96	171.91	183.52	198.63		
(= : 0)				100.00		.00.0			I = Sum(2		100.02	1 100.00	2016.73	(219)
Annua	al totals										Wh/year	. L	kWh/yea	
	heating	fuel use	ed, main	system	1						, cu.	[	2713.33	7
Water	heating	fuel use	d									Ī	2016.73	_
Electri	city for p	umps, f	ans and	electric	keep-ho	t								_
centr	al heatin	g pump	:									130		(230c)
boile	r with a f	an-assis	sted flue									45		(230e)
Total 6	electricity	for the	above, I	kWh/yea	r			sum	of (230a).	(230g) =	:	 	175	(231)
Electri	city for li	ghting										j	347.16	(232)
Electri	city gene	erated b	y PVs									j	-1011.84	(233)
												_		



### 12a. CO2 emissions – Individual heating systems including micro-CHP

	<b>Energy</b> 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)

OK

## **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/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 10.62 kg/m<sup>2</sup>

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
esign air permeability		_	
Design air permeability	y at 50 pascals	5.00	
Maximum		10.0	ОК

4 Heating efficiency

3 D

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**



OK

#### 8 Mechanical ventilation

Not applicable

#### 9 Summertime temperature

Overheating risk (Thames valley):

Based on:

Overshading:

Windows facing: South

Ventilation rate:

Blinds/curtains:

Slight

Average or unknown

4.8m², Overhang twice as wide as window, ratio NaN

4.00

Dark-coloured curtain or roller blind shutter closed 100% of daylight hours

#### 10 Key features

Photovaltaic array

# DRAE

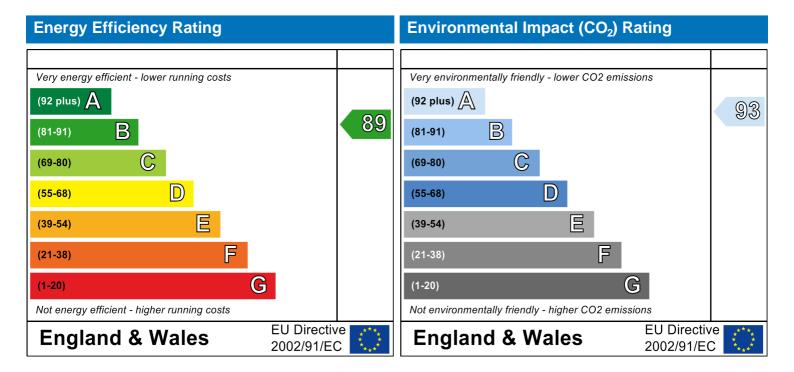
## **Predicted Energy Assessment**

172 High St Teddington TW11 8HU Dwelling type: Date of assessment: Produced by: End-terrace Top floor Flat 22 May 2012 Dan Watt 63.2 m<sup>2</sup>

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.

Total floor area:

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.



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

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

#### Property description:

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

Floor Location: Floor area: Storey height:

Type:

Floor 0  $55.5 \text{ m}^2$  2.67 m

True

Living area: 30 m<sup>2</sup> (fraction 1.034)

Front of dwelling faces: North

Source:

#### Opening types:

Name:

DoorManufacturerSolidNManufacturerWindowslow-E, En = 0.05, soft coatNoPVC-UEManufacturerWindowslow-E, En = 0.05, soft coatNoPVC-U

Glazing:

Argon:

Frame:

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

Name: Type-Name: Location: Orient: Width: Height: Door Coridoor Walls North Ν **Dormers** 0 0 Ε 0 0 **Dormers** East

Overshading: Average or unknown

#### Onaque Flements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Element	<u>S</u>						
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 Element	<u>s</u>						
Party Elements							
Party Walls	28						N/A

#### Thermal bridges

Flat Below

63.2

N/A

## **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 Stroma FSAP 2009 **Software Version: Software Name:** Version: 1.4.0.79 Property Address: Flat 9 20% 172 High St, Teddington, TW11 8HU Address: 1. Overall dwelling dimensions: Ave Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor 55.5 (1a) x (3a) 2.67 (2a) =148.19 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)(4)55.5 Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n) =148.19 (5) total main Secondary other m³ per hour heating heating x 40 =Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 O O 0 0 (6b) Number of intermittent fans x 10 =(7a) 2 20 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $\div$  (5) = (8) 0.13 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) (9)O Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 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 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =O (16)Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , 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 (19)3  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.78  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.3 Infiltration rate modified for monthly wind speed Feb Sep Jan Mar Apr Mav Jun Jul Aug Oct Nov Dec Monthly average wind speed from Table 7

1.27

4.5

1.12

4.1

1.02

3.9

0.98

3.7

0.92

3.7

0.92

4.2

1.05

4.5

1.12

4.8

1.2

5.1

1.27

5.1

1.27

Wind Factor  $(22a)m = (22)m \div 4$ 

1.35

(22)m =

(22a)m

Adjusted infiltration rate (allo	owing for shelter a	and wind spee	ed) = (21a) x	(22a)m					
0.4 0.38 0.38		1 1	.28 0.28	0.31	0.34	0.36	0.38		
Calculate effective air change of the change	ge rate for the app	olicable case					•		(00-)
If mechanical ventilation.	nnendix N (23h) = (2	3a) x Emy (equa	tion (N5)) othe	rwise (23h	ı) = (23a)			0	(23a)
If balanced with heat recovery:	., , ,	,	, ,, .	`	) = (23a)			0	(23b)
a) If balanced mechanical					Oh)m ı (	23h) v [	1 (220)	0 . 1001	(23c)
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		<del> </del>	$\frac{(\text{INVIR})(24)}{0}$	$\frac{a)(1) = (2a)}{a}$	0	230) <b>x</b> [	0	+ 100j	(24a)
b) If balanced mechanical				<u> </u>			_		(= .3)
(24b)m =	0 0	1 1	0 0	0	0	0	0		(24b)
c) If whole house extract v	entilation or posit	tive input vent	tilation from	outside		ļ	<u> </u>	l	
if $(22b)m < 0.5 \times (23b)$	•	•			.5 × (23b	)			
(24c)m= 0 0 0	0 0	0	0 0	0	0	0	0		(24c)
d) If natural ventilation or if (22b)m = 1, then (24b)m =	•				0.5]		•	•	
(24d)m= 0.58 0.57 0.57	7 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 (24	4b) or (24c) o	r (24d) in bo	x (25)	•	•	•	•	
(25)m= 0.58 0.57 0.57	7 0.56 0.55	0.54 0	.54 0.54	0.55	0.56	0.56	0.57		(25)
3. Heat losses and heat los	ss parameter:								
ELEMENT Gross area (m²)	Openings m²	Net Area A ,m²	U-val W/m2		A X U (W/I	<b>〈</b> )	k-value		A X k kJ/K
` '					`	,			
Doors		2.08	x 1.5	=	3.12				(26)
Doors Windows Type 1		2.08	X 1.5	!	3.12 2.26				(26) (27)
			! <u>L</u>	+ 0.04] =					. ,
Windows Type 1	0	1.6	x1/[1/( 1.5 )+	+ 0.04] = + 0.04] =	2.26			¬ [	(27)
Windows Type 1 Windows Type 2	2.08	1.6	x1/[1/( 1.5 )+	+ 0.04] = [ + 0.04] = [ = =	2.26 4.53				(27)
Windows Type 1 Windows Type 2 Walls Type1  41		1.6 3.2 41	x1/[1/( 1.5 )- x1/[1/( 1.5 )- x 0.25	+ 0.04] = [ + 0.04] = [ = [	2.26 4.53 10.25				(27) (27) (29)
Windows Type 1 Windows Type 2 Walls Type1  Walls Type2  6	2.08	1.6 3.2 41 3.92	x1/[1/( 1.5 )-1 x1/[1/( 1.5 )-1 x 0.25 x 0.23	+ 0.04] =   + 0.04] =   =   =   =	2.26 4.53 10.25 0.88				(27) (27) (29) (29)
Windows Type 1 Windows Type 2 Walls Type1 Walls Type2 6 Walls Type3 9.6	2.08	1.6 3.2 41 3.92 4.8	x1/[1/(1.5)+ x1/[1/(1.5)+ x 0.25 x 0.23 x 0.25	+ 0.04] =   + 0.04] =   =   =   =   =	2.26 4.53 10.25 0.88 1.2				(27) (27) (29) (29) (29)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44	2.08 4.8	1.6 3.2 41 3.92 4.8 44	x1/[1/(1.5)- x1/[1/(1.5)- x1/[1/(1.5)- x 0.25 x 0.23 x 0.25 x 0.16	+ 0.04] =   + 0.04] =   =   =   =   =	2.26 4.53 10.25 0.88 1.2 7.04				(27) (27) (29) (29) (29) (29) (30)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3	2.08 4.8	1.6 3.2 41 3.92 4.8 44 2.3	x1/[1/(1.5)- x1/[1/(1.5)- x1/[1/(1.5)- x 0.25 x 0.23 x 0.25 x 0.16	+ 0.04] =   + 0.04] =   =   =   =   =	2.26 4.53 10.25 0.88 1.2 7.04				(27) (27) (29) (29) (29) (30) (30)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m²	2.08 4.8	1.6 3.2 41 3.92 4.8 44 2.3 102.9	x1/[1/(1.5)-4 x1/[1/(1.5)-4 x 0.25 x 0.23 x 0.25 x 0.16 x 0.16	+ 0.04] =   + 0.04] =   =   =   =   =	2.26 4.53 10.25 0.88 1.2 7.04 0.37				(27) (27) (29) (29) (29) (30) (30) (31)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall	2.08 4.8 0 0	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 evalue calculated	x1/[1/(1.5)-4 x1/[1/(1.5)-4 x 0.25 x 0.23 x 0.25 x 0.16 x 0.16	+ 0.04] = [ + 0.04] = [ = = [ = = [ = = [	2.26 4.53 10.25 0.88 1.2 7.04 0.37	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	paragraph		(27) (27) (29) (29) (29) (30) (30) (31) (32)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, us	2.08  4.8  0  0  otherwise effective window Uniternal walls and particular to the control of the	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 evalue calculated	x1/[1/(1.5)-4 x1/[1/(1.5)-4 x 0.25 x 0.23 x 0.25 x 0.16 x 0.16 x 0.16	+ 0.04] = [ + 0.04] = [ = = [ = = [ = = [	2.26 4.53 10.25 0.88 1.2 7.04 0.37	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	paragraph	3.2	(27) (27) (29) (29) (29) (30) (30) (31) (32)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, us ** include the areas on both sides	2.08  4.8  0  0  se effective window Uniternal walls and part of internal walls and part of X X U)	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 evalue calculated	x1/[1/(1.5)-4 x1/[1/(1.5)-4 x 0.25 x 0.23 x 0.25 x 0.16 x 0.16 x 0.16	+ 0.04] = [ + 0.04] = [	2.26 4.53 10.25 0.88 1.2 7.04 0.37				(27) (27) (29) (29) (29) (30) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, us ** include the areas on both sides of the sides of	2.08  4.8  0  0  is ee effective window Unit of internal walls and part of X X U)	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 evalue calculated artitions	x1/[1/(1.5)-4 x1/[1/(1.5)-4 x 0.25 x 0.23 x 0.25 x 0.16 x 0.16 x 0.16	+ 0.04] = [ + 0.04] = [ + 0.04] = [ = [ = [ = [ = [ ]	2.26 4.53 10.25 0.88 1.2 7.04 0.37	2) + (32a).		29.66	(27) (27) (29) (29) (29) (30) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, us ** include the areas on both sides of Fabric heat loss, W/K = S (A x k) Heat capacity Cm = S(A x k)	2.08  4.8  0  0  of internal walls and particles (A x U)  MP = Cm ÷ TFA)  details of the constru	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 evalue calculated artitions	x1/[1/(1.5)-4 x1/[1/(1.5)-4 x 0.25 x 0.23 x 0.25 x 0.16 x 0.16 x 0.16 y 0.16 y 0.16	+ 0.04] = [ + 0.04] = [ + 0.04] = [ = [ = [ = [ = [ ]	2.26 4.53 10.25 0.88 1.2 7.04 0.37 0 ue)+0.04] a	2) + (32a). : Low	(32e) =	29.66 3355.46	(27) (27) (29) (29) (29) (30) (30) (31) (32) (32a) (333) (34)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, us ** include the areas on both sides of the party floor The party f	2.08  4.8  0  0  0  xe effective window U- of internal walls and part (x U)  MP = Cm ÷ TFA) (a details of the constru- alculation.	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 -value calculated artitions in kJ/m²K ction are not known a	x1/[1/(1.5)-4 x1/[1/(1.5)-4 x 0.25 x 0.23 x 0.25 x 0.16 x 0.16 x 0.16 y 0.16 y 0.16	+ 0.04] = [ + 0.04] = [ + 0.04] = [ = [ = [ = [ = [ ]	2.26 4.53 10.25 0.88 1.2 7.04 0.37 0 ue)+0.04] a	2) + (32a). : Low	(32e) =	29.66 3355.46	(27) (27) (29) (29) (29) (30) (30) (31) (32) (32a) (333) (34)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, us ** include the areas on both sides of the side of the sid	2.08  4.8  0  0  0  is eeffective window Unit of internal walls and particulation.  In the construction of the construction of the construction.  Calculated using A	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 Evalue calculated artitions Appendix K	x1/[1/(1.5)-4 x1/[1/(1.5)-4 x 0.25 x 0.23 x 0.25 x 0.16 x 0.16 x 0.16 y 0.16 y 0.16	+ 0.04] =	2.26 4.53 10.25 0.88 1.2 7.04 0.37 0 ue)+0.04] a	2) + (32a). : Low	(32e) =	29.66 3355.46 100	(27) (27) (29) (29) (29) (30) (31) (32) (32a) (33) (34) (35)



Ventila	ation hea	at loss ca	alculated	l monthl	V				(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 to	ransfer c	oefficier	nt, 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		
Heat lo	oss para	meter (H	HLP), W/	′m²K			•	•		Average = = (39)m ÷	Sum(39) <sub>1</sub> - (4)	12 /12=	61.03	(39)
(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		
Numbe	er of day	s in moi	nth (Tab	le 1a)				•	,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.1	(40)
	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. Wa	ater heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Accum	ned occu	inancy l	N									0.5	1	(42)
if TF		9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	ΓFA -13.		.85		(42)
Annua	l averag	e hot wa	ater usaç									3.18		(43)
		_	hot water person per			_	-	to achieve	a water us	se target o	f			
not mon					<u> </u>		•	Ι	0			<u> </u>		
Hot wat	Jan er usage ii	Feb	Mar day for ea	Apr ach month	May <i>Vd.m</i> = fa	Jun ctor from	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	86	82.88	79.75	76.62	73.49	70.37	70.37	73.49	76.62	79.75	82.88	86		
(44)111=		02.00	13.13	70.02	70.40	10.01	70.07	70.40	<u> </u>		m(44) <sub>112</sub> =		938.22	(44)
Energy	content of	hot water	used - cal	culated me	onthly $= 4$ .	190 x Vd,r	m x nm x E	OTm / 3600			. ,			
(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		
If incton	<b>4</b> 0000000	otor booti	na ot noint	of upo (no	hot water	r otorogol	antar O in	haves (46		Total = Su	m(45) <sub>112</sub> =	=	1233.1	(45)
			ng at point	,	1	· · ·		, ,	. , ,				I	(40)
(46)m= Water	19.18 storage	16.77 loss:	17.31	15.09	14.48	12.49	11.58	13.28	13.44	15.67	17.1	18.57		(46)
	_		clared lo	ss facto	r is knov	vn (kWh	/day):					0		(47)
Tempe	erature fa	actor fro	m Table	2b								0		(48)
Energy	y lost fro	m water	storage	, kWh/ye	ear			(47) x (48)	) =			0		(49)
			ared cylir										· [	(==)
•		•	) includir I no tank in	•		•						0		(50)
	-	•	t water (th				. ,	enter '0' in	box (50)					
Hot wa	ater stora	age loss	factor fr	om Tab	e 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
٠.			storage	, kWh/y	ear			((50) x (51	) x (52) x	(53) =		0		(54)
	(49) or (	, ,	•						,			0		(55)
	storage	loss cal	culated f	or each	month		1	((56)m = (	55) × (41)ı	m	1	•	•	
(56)m=	0	0	0	0	0 (50)	0	0	0	0 (50)	0	0	0		(56)
-	er contains	dedicate	a solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	u), else (5	/)m = (56)	m where (	H11) is fro	m Append	ıx H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary	/ circuit	loss (an	nual) fro	om Table	e 3									0	7	(58)
Primary	/ circuit	loss cal	culated	for each	month (	(59)r	n = (	(58) ÷ 36	65 × (4	11)m			•		_	
(mod	lified by	factor fi	om Tab	le H5 if t	here is	solar	wat	er heatii	ng an	d a cylind	ler th	nermo	ostat)		_	
(59)m=	0	0	0	0	0		)	0	0	0		0	0	0		(59)
Combi	loss cal	culated	for each	month (	(61)m =	(60)	÷ 36	65 × (41)	)m							
(61)m=	43.83	38.15	40.64	37.79	37.45	34	1.7	35.86	37.4	5 37.79	4	10.64	40.87	43.83	7	(61)
Total he	eat requ	ired for	water h	eating ca	alculated	d for	eacl	n month	(62)n	า = 0.85 >	· (45	5)m +	(46)m +	(57)m ·	- + (59)m + (61)m	
	171.67	149.96	156.02	138.38	133.97	_	7.99	113.04	126.0		ì	45.09	154.88	167.64	¬`´´	(62)
Solar DH	IW input c	alculated	using App	endix G o	r Appendix	<b>т</b> х Н (n	egativ	ve quantity	y) (ente	r '0' if no so	lar co	ontribu	tion to wate	er heating	<b>_</b> 1)	
(add ad	ditional	lines if	FGHRS	and/or \	//WHRS	S app	olies,	, see Ap	pendi	x G)						
(63)m=	0	0	0	0	0		)	0	0	0		0	0	0	7	(63)
Output	from wa	ater hea	ter	!											_	
. г	171.67	149.96	156.02	138.38	133.97	117	7.99	113.04	126.0	2 127.41	1 1	45.09	154.88	167.64	7	
L	<u>l</u>									Output from	water	r heate	- <b>I</b> er (annual)₁	12	1702.08	(64)
Heat ga	ains fron	n water	heating	. kWh/m	onth 0.2	5 ′ [(	0.85	× (45)m	ı + (61	)m] + 0.8	3 x [(	46)m	+ (57)m	+ (59)r	n 1	_
(65)m=	53.47	46.71	48.52	42.89	41.46	<del>-</del>	.37	34.63	38.8	<del></del>	<del></del>	14.89	48.13	52.12	, 1	(65)
L	de (57)n	n in calc	culation	of (65)m	only if a	cvling	der is	s in the o	dwelli	ng or hot	wate	er is f	rom com	nunity	⊒ heating	
	. ,			5 and 5a	•		, o		u 11 0 1111	19 01 110t	···aic	J. 10 .	10111 00111		au.ig	
		•			).											
Metabo T	lic gains Jan	s (Table Feb	(5), Wat		May		un	Jul	Ι	g Sep	$\overline{}$	Oct	Nov	Dec	٦	
(66)m=	111.12	111.12	111.12	Apr 111.12	May 111.12	+	un 1.12	111.12	111.	<del></del>	-	11.12	111.12	111.12	-	(66)
` ' L												11.12	1111.12	111.12	_	(00)
Ť	<del></del>	`	30.92	<del>`</del>	<del></del>	_		<u> </u>		e Table 5		25.20	1 44 00	12.00	٦	(67)
(67)m=	42.8	38.01		23.41	17.5	<u> </u>	.77	15.96	20.7			35.36	41.26	43.99	J	(67)
· · · -	<del></del>	`				_			<del></del>	lso see T	$\neg$		T		7	(00)
(68)m=	241	243.51	237.2	223.79	206.85	<u> </u>	0.93	180.3	177.	!		97.52	214.45	230.37		(68)
F	<del></del>	•		<del>'                                    </del>	<del></del>	_				see Tab	$\overline{}$		T		7	
(69)m=	47.96	47.96	47.96	47.96	47.96	47	.96	47.96	47.9	6 47.96	4	17.96	47.96	47.96	J	(69)
Pumps	and fan	s gains	(Table	5a)									•		_	
(70)m=	10	10	10	10	10	1	0	10	10	10		10	10	10	_	(70)
Losses	e.g. ev	aporatio	n (nega	tive valu	es) (Tab	ole 5	)								_	
(71)m=	-74.08	-74.08	-74.08	-74.08	-74.08	-74	.08	-74.08	-74.0	8 -74.08	3 -7	74.08	-74.08	-74.08		(71)
Water h	neating	gains (T	able 5)													
(72)m=	71.86	69.52	65.22	59.57	55.72	50	.51	46.54	52.1	7 54.51	6	60.33	66.84	70.06		(72)
Total in	nternal	gains =			-		(66)	m + (67)m	า + (68)	m + (69)m -	+ (70)	)m + (7	71)m + (72)	m	_	
(73)m=	450.67	446.04	428.34	401.77	375.07	35′	1.22	337.81	345.7	1 361.46	3	88.21	417.57	439.42	7	(73)
6. Sola	ar gains	:		•										<u> </u>		
Solar ga	ains are c	alculated	using sola	r flux from	Table 6a	and a	ssoci	ated equa	itions to	convert to	the a	pplica	ble orientat	ion.		
Orienta	ition: A		actor	Area			Flu			_ g_			FF		Gains	
	Т	able 6d		m²			Tak	ole 6a		Table 6	b	Т	able 6c		(W)	
North	0.9x	0.77	x	1.	6	x [	1	0.73	] x [	0.63		х	0.7	=	5.25	(74)



North	0.9x	0.77	,		1.6	6	X	3	33.31	x		0.63	×	0.7		=	16.29	(74)
North	0.9x	0.77	)		1.6	3	X	5	54.64	x		0.63	x	0.7		=	26.72	(74)
North	0.9x	0.77	)		1.6	6	X	7	75.22	x		0.63	x	0.7		=	36.78	(74)
North	0.9x	0.77	•		1.6	6	X	8	34.09	x		0.63	×	0.7		=	41.12	(74)
North	0.9x	0.77	,	,	1.6	5	X	7	79.12	x		0.63	×	0.7		=	38.69	(74)
North	0.9x	0.77	)	, <u> </u>	1.6	3	X	6	61.56	x		0.63	x	0.7		=	30.1	(74)
North	0.9x	0.77	)	┌┌	1.6	3	X	4	11.09	x		0.63	x	0.7		=	20.09	(74)
North	0.9x	0.77	)		1.6	5	X	2	24.81	x		0.63	×	0.7		=	12.13	(74)
North	0.9x	0.77	)		1.6	6	X	1	3.22	X		0.63	x	0.7		=	6.46	(74)
North	0.9x	0.77	)		1.6	3	X		8.94	x		0.63	x	0.7		=	4.37	(74)
East	0.9x	1	)		3.2	2	X	1	19.87	X		0.63	x	0.7		=	19.43	(76)
East	0.9x	1	)		3.2	2	X	3	88.52	x		0.63	x	0.7		=	37.67	(76)
East	0.9x	1	)		3.2	2	X	6	61.57	x		0.63	X	0.7		=	60.21	(76)
East	0.9x	1	)		3.2	2	X	9	91.41	x		0.63	x	0.7		=	89.4	(76)
East	0.9x	1	,		3.2	2	x	1	11.22	x		0.63	X	0.7		=	108.77	(76)
East	0.9x	1	)		3.2	2	X	1	16.05	x		0.63	x	0.7		=	113.49	(76)
East	0.9x	1	)		3.2	2	X	1	12.64	x		0.63	x	0.7		=	110.16	(76)
East	0.9x	1	)		3.2	2	X	9	98.03	x		0.63	X	0.7		=	95.87	(76)
East	0.9x	1	)		3.2	2	X		73.6	x		0.63	x	0.7		=	71.98	(76)
East	0.9x	1	)		3.2	2	X	4	16.91	X		0.63	x	0.7		=	45.87	(76)
East	0.9x	1	)		3.2	2	X	2	24.71	x		0.63	x	0.7		=	24.16	(76)
East	0.9x	1	)		3.2	2	X	1	6.39	x		0.63	x	0.7		=	16.03	(76)
Solar	ains in	watts, ca	alculate	d fo	r each	mont	h_			(83)m	n = Su	ım(74)m	.(82)m					
(83)m=	24.68	47.62	76.5		16.11	145.55		54.61	148.85	125	5.98	92.07	58.01	30.63	20.	41		(83)
_		nternal a		Ť	<u> </u>	` '	_										ı	
(84)m=	475.35	493.67	504.84	5	17.88	520.62	2   5	05.83	486.65	471	.69	453.53	446.22	2 448.19	459	.83		(84)
7. Me	an inter	nal temp	perature	(he	eating	seaso	n)											
Temp	erature	during h	neating	peri	iods in	the liv	/ing	area	from Tab	ole 9	, Th1	l (°C)					21	(85)
Utilisa	ation fac	tor for g	ains for	livii	ng are	a, h1,	m (s	ee Ta	ble 9a)			-					I	
	Jan	Feb	Mar	+	Apr	May	<u>/</u>	Jun	Jul	Α	ug	Sep	Oct	Nov	-	ec		
(86)m=	0.93	0.91	0.89	(	0.85	0.76		0.63	0.46	0.4	48	0.69	0.84	0.91	0.9	93		(86)
Mean	interna	l temper	ature in	livi	ing are	ea T1 (	follo	ow ste	ps 3 to 7	7 in T	Table	9c)		_				
(87)m=	19.09	19.25	19.6	1	19.98	20.45		20.77	20.93	20.	.93	20.69	20.18	19.52	19.	15		(87)
Temp	erature	during h	neating	peri	iods in	rest c	of dv	velling	from Ta	able 9	9, Th	2 (°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)
Utilisa	ation fac	ctor for a	ains for	res	st of dv	vellina	, h2	,m (se	ee Table	9a)								
(89)m=	0.92	0.9	0.87	_	0.82	0.72	$\neg$	0.56	0.37	0.3	38	0.63	0.81	0.89	0.9	92		(89)
Mean	interna	l temner	ature in	the	e rest o	of dwe	llind	1 T2 (f	ollow ste	ine a	1 3 to 7	in Tabl	e 9c)				1	
(90)m=	17.47	17.7	18.2	_	18.74	19.39	$\overline{}$	19.8	19.97	19.		19.71	19.04	18.1	17.	55		(90)
` '		<u> </u>	<u> </u>						<u> </u>					ring area ÷ (4			0.54	(91)
Maar	intorna	l tompo	oturo /£	Or 41	ho wh	مام طب	OII:	رم ( حال	I A T4	. (4	fl	۸۱ ,, Το						
(92)m=	18.35	18.54	18.96	$\overline{}$	ne wno	19.96	$\overline{}$	1 <b>g)</b> = 1 20.33	LA × T1 20.49	+ (1 20.	$\overline{}$	4) × 12 20.24	19.66	18.87	18.	41		(92)
(52)111-	I .0.00	I '0.07	I '5.55	1 '			Ι.	_0.00	I ~070	ı	· · ~ 1	-5.27	. 5.00	1 '0.0'	ι 'ິ.	• •		(0-)

Same   18.2	Apply adju	stment to t	he mear	n interna	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
Set Tir 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:  96/me   0.89   0.88   0.88   0.88   0.80   0.71   0.57   0.4   0.41   0.63   0.79   0.87   0.89   0.89   0.89   0.89   0.88   0.88   0.81   0.71   0.57   0.4   0.41   0.63   0.79   0.87   0.89   0.89   0.89   0.89   0.88   0.88   0.71   0.57   0.4   0.41   0.63   0.79   0.87   0.89   0.89   0.89   0.89   0.80   0.88   0.88   0.71   0.57   0.4   0.41   0.63   0.79   0.87   0.89	· · · · <del>- · ·</del>	-	1	r	· ·	1	1	1		·	18.72	18.26		(93)
the utilisation factor for gains using Table 9a    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	8. Space l	neating requ	uirement											
Utilisation factor for gains, hm:  9/m				•		ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
Secondary   Seco	Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains, hmGm, N = (94)m x (84)m   Softmal (2463) 434.56   428.29   415.66   388.43   288.28   194.58   193.56   286   351.84   390.32   411.28	Utilisation	factor for g	ains, hm	1:										
Secondary   Seco	(94)m = 0.8	9 0.88	0.85	0.8	0.71	0.57	0.4	0.41	0.63	0.79	0.87	0.89		(94)
Monthly average external temperature from Table 8   16.9   16.9   14.3   10.8   7   4.9	Useful gai	ns, hmGm	W = (94)	4)m x (8	4)m									
98/ms 4.5 5 6.8 8.7 11.7 14.8 16.9 16.9 14.3 10.8 7 4.9  Heat loss rate for mean internal temperature, Lm, W = ((39)m x ((93)m - (96)m) = (97)ms ((95) = (98)ms ((95) = (98)ms) = (98)	(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)
Heat loss rate for mean internal temperature, Lm., W = \((39)\text{m.x} \text{[(93)m.x} \((96)\text{m.x}\)]  87)me \(\frac{851.92}{851.92}\) \(\frac{826.79}{266.79}\) \(741.65\) \(\frac{643.89}{264.89}\) \(\frac{490.69}{340.69}\) \(\frac{336.16}{266.77}\) \(\frac{206.54}{206.77}\) \(\frac{206.54}{206.79}\) \(\frac{530.9}{50.9}\) \(\frac{718.9}{718.9}\) \(\frac{825.42}{825.42}\)  88)me \(\frac{317.9}{317.9}\) \(\frac{263.72}{263.72}\) \(\frac{233.14}{233.14}\) \(\frac{164.4}{90.96}\) \(\frac{9}{0}\) \(\frac{0}{0}\) \(\frac{0}{0}\) \(\frac{0}{0}\) \(\frac{133.22}{333.22}\) \(\frac{236.58}{306.58}\) \(\frac{308.12}{308.12}\)  82. Energy requirements — Individual heating systems including micro-CHP)  **Space heating**  **Fraction of space heat from secondary/supplementary system**  **Fraction of space heating from main system(s)  **Fraction of space heating from main system(s)  **Fraction of total heating from main system 1  **Efficiency of secondary/supplementary heating system.}*  **Gracin of total heating from main system 1  **Efficiency of secondary/supplementary heating system.}*  **Space heating requirement (calculated above)  **317.9 \(\frac{263.72}{363.72}\) \(\frac{233.14}{31.4}\) \(\frac{164.4}{369.96}\) \(\frac{0}{0}\) \(\frac{0}{0}\) \(\frac{0}{0}\) \(\frac{1}{0}\) \(\frac{14.98}{30.22}\) \(\frac{236.58}{30.80.12}\)  **Space heating requirement (calculated above)  **317.9 \(\frac{263.72}{363.72}\) \(\frac{233.14}{31.4}\) \(\frac{164.4}{369.96}\) \(\frac{0}{0}\) \(\frac{0}{0}\) \(\frac{0}{0}\) \(\frac{0}{0}\) \(\frac{14.88}{30.22}\) \(\frac{111.99}{30.22}\) \(\frac{14.88}{30.22}\) \(\frac{111.99}{30.22}\) \(\frac{14.88}{30.22}\) \(\frac{111.99}{30.22}\) \(\frac{14.88}{30.22}\) \(\frac{111.99}{30.22}\) \(\frac{14.15.7}{30.22}\) \(\frac{161.21}{363.22}\) \(\frac{13.65.22}{363.32}\) \(\frac{13.88}{30.32}\) \(\frac{13.91.1}{30.92}\) \(\frac{13.90}{30.90}\) \(\frac{90.90}{90.90}\) \(\frac{90.90}{90.90}\) \(\frac{90.90}{90.90}\) \(\frac{90.90}{90.90}\) \(\frac{90.90}{90.90}\) \(\frac{90.90}{90.90}\) \(90	Monthly a	verage exte	rnal tem	perature	from Ta	able 8								
97/ms 851.32 826.78 741.65 643.89 490.68 336.16 206.77 206.54 350.95 530.9 718.9 825.42 (97)  Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m  98/ms 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)	(96)m= 4.5	5 5	6.8	8.7	11.7	14.6	16.9	16.9	14.3	10.8	7	4.9		(96)
Space heating requirement for each month, kWh/month = 0.024 x [(977m - (955m] x (41)m - 986m = 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)s2 = 1748.05   (98)   31.5   (99)   (99)   31.5   (99)   (99)   31.5   (99)   (99)   (99)   31.5   (99)   (99)   (99)   (99)   (99)   (99)   (99)   (99)   (99)   (99)   (99)   (99)   (99	Heat loss	rate for me	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m	]				
Same   Saling   Sal	(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 in kWh/m²/year   Sum(98), t.e2   1748.05   (98)	Space hea	ating require	ement fo	r each n	nonth, k\	/Vh/mon	th = 0.02	24 x [(97)	)m – (95	)m] x (4	1)m			
Space heating requirement in kWh/m²/year   31.5   (99)	(98)m= 317	.9 263.72	233.14	164.4	90.96	0	0	0	0	133.22	236.58	308.12		
Space heating:   Fraction of space heat from secondary/supplementary system   (202) = 1 - (201) =   1 (202)								Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	1748.05	(98)
Space   Heat   Franction of space   heat   from secondary/supplementary system	Space hea	ating require	ement in	kWh/m²	²/year							Ī	31.5	(99)
Space   Heat   Franction of space   heat   from secondary/supplementary system	oa Energy	requiremen	nte – Indi	ividual h	eating s	veteme i	ncluding	micro-C	,HD/			L		
Fraction of space heat from secondary/supplementary system  Fraction of space heat from main system(s)  Fraction of space heat from main system 1  Fraction of total heating from main system 1  Efficiency of main space heating system 1  Efficiency of secondary/supplementary heating system, %  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 0 133.22 236.58 308.12  211)m = {[(98)m x (204)] + (210)m} x 100 ÷ (206)  Space heating fuel (secondary), kWh/month = {[(98)m x (201)] + (214) m} x 100 ÷ (208)  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 0 0 0 0 0 0 0			its — Iriu	ividuai II	calling 3	y Sterris r	ricidaling	THICIO-C	/I II <i>)</i>					
Fraction of space heat from main system(s)  Fraction of total heating from main system 1  Efficiency of main space heating system 1  Efficiency of secondary/supplementary heating system, %  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)  Space heating fuel (secondary), kWh/month = {[([98)m x (201)]] + (214) m } x 100 ÷ (208)  Space heating fuel (secondary), kWh/month = {[([98)m x (201)]] + (214) m } x 100 ÷ (208)  Dutput 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 heating. kWh/month = {177.67 149.96 156.02 138.38 133.97 117.99 113.04 126.02 127.41 145.09 154.88 167.64 156.02 127.71 12.09 186.26 179.36 156.02 173.36 153.75 148.86 131.1 125.6 140.02 141.57 161.21 172.09 186.26	•	_	at from s	econdar	v/supple	mentarv	svstem					Г	0	(201
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (204) = (202) × [1 – (203)] = 1 (202) × [1 – (203		•				,	-		- (201) <b>=</b>			<u> </u> 		╡゛
Efficiency of main space heating system 1  Efficiency of secondary/supplementary heating system, %  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 0 133.22 236.58 308.12  211)m = {{(98)m x (204)} + (210)m} x 100 ÷ (206)  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) <sub>1502</sub> 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 0 0 0 0 0  Total (kWh/year) = Sum(215) <sub>1502</sub> 0 (215)  Nater heating  Dutput 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 (calculated above)  Fuel for water heating, kWh/month 219)m = (64)m x 100 ÷ (217)m  219)m = (64)m x 100 ÷ (217)m  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		•		•	` '					(202)] _		ļ		╡゛
Efficiency of secondary/supplementary heating system, %  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  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)  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),a.sr 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 0 0 0 0 0  Total (kWh/year) = Sum(215),a.sr = 0 (215)  Nater heating  Dutput 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  217)m = 90 90 90 90 90 90 90 90 90 90 90 90 90			•	-				(204) = (2	02) 🗶 [1 —	(203)] =		ļ		╡゛
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	•	-		•								Į	90	(206)
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)	Efficiency	of seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208
317.9	Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
211)m = {[[(98)m x (204)] + (210)m} x 100 ÷ (206)						)								
353.22 293.02 259.05 182.67 101.06 0 0 0 148.02 262.87 342.35  Total (kWh/year) = Sum(211) <sub>1.5.1012</sub> 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 0 0  Total (kWh/year) = Sum(215) <sub>1.5.1012</sub> 0 (215)  Water heating  Dutput 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  217)m = 90 90 90 90 90 90 90 90 90 90 90 90 90	317	.9 263.72	233.14	164.4	90.96	0	0	0	0	133.22	236.58	308.12		
353.22 293.02 259.05 182.67 101.06 0 0 0 148.02 262.87 342.35  Total (kWh/year) = Sum(211) <sub>1.5.1012</sub> 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 0 0  Total (kWh/year) = Sum(215) <sub>1.5.1012</sub> 0 (215)  Water heating  Dutput 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  217)m = 90 90 90 90 90 90 90 90 90 90 90 90 90	 211)m = {[	(98)m x (20	)4)] + (2 <sup>1</sup>	I0)m } x	100 ÷ (2	:06)	-	-	-	-	-			(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 0  Total (kWh/year) = Sum(215) <sub>1.5.1012</sub> = 0 (215)  Water heating  Dutput from water heater (calculated above)  171.67	` ' <del>- '</del>	<del>`                                    </del>	<del>,                                    </del>	<del></del>	<u>`</u>		0	0	0	148.02	262.87	342.35		
= {[(98)m x (201)] + (214) m} x 100 ÷ (208)  215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0  Total (kWh/year) = Sum(215) <sub>15,1012</sub> = 0  (215)  Water heating  Dutput from water heater (calculated above)  171.67		!	1	!				Tota	I (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>		1942.27	(211)
= {[(98)m x (201)] + (214) m} x 100 ÷ (208)  215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0  Total (kWh/year) = Sum(215) <sub>15,1012</sub> = 0  (215)  Water heating  Dutput from water heater (calculated above)  171.67	Space hea	ating fuel (s	econdar	v) kWh/	month							L		
215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	•	•		- ,										
Water heating         Dutput 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         217)m=       90				1	ı	0	0	0	0	0	0	0		
Water heating         Dutput 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         217)m=       90		!	1	Į.				Tota	I (kWh/yea	ar) =Sum(2	215) <sub>15.1012</sub>	=	0	(215)
Dutput from water heater (calculated above)  171.67	Water heat	tina										L		
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  217)m= 90 90 90 90 90 90 90 90 90 90 90 90 90  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		_	ter (calc	ulated a	bove)									
217)m= 90 90 90 90 90 90 90 90 90 90 90 90 90						117.99	113.04	126.02	127.41	145.09	154.88	167.64		
217)m= 90 90 90 90 90 90 90 90 90 90 90 90 90	Efficiency c	f water hea	ıter		ı	ı				ı			90	(216
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				90	90	90	90	90	90	90	90	00		(217
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	(217)m= 90	)   90	90	1 30	, ,,,							90 1		
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	` ′			<u> </u>						<u> </u>		90		
Total = Sum(219a) <sub>112</sub> = 1891.2 (219)	Fuel for wa	ter heating,	kWh/mo	nth								90		
	Fuel for wa (219)m <u> = (</u>	ter heating, 64)m x 100	kWh/mo ) ÷ (217)	onth m					141.57	161.21				



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 kee	p-hot		
central heating pump:		130	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230	0a)(230g) =	175 (231)
Electricity for lighting			302.35 (232)
Electricity generated by PVs			-1030.08 (233)
10a. Fuel costs - individual heating system	ms:		
	<b>Fuel</b> 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 × 0.01 =	58.63 (247)
Pumps, fans and electric keep-hot	(231)	11.46 × 0.01 =	20.06 (249)
(if off-peak tariff, list each of (230a) to (230 Energy for lighting	ng) separately as applicable and ap	oply fuel price according to  11.46 × 0.01 =	
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 (2	45)(247) + (250)(254) =		161.49 (255)
11a. SAP rating - individual heating syste	ms		
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. CO2 emissions – Individual heating	systems including micro-CHP		
	<b>Energy</b> 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 kee	p-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

 $(272) \div (4) =$ 

8.3 (273)

El rating (section 14)

94 (274)

13a. Primary	/ Energy
--------------	----------

	Energy	Primary		P. Energy	
	kWh/year	factor		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)

		User [	Details:						
Assessor Name: Software Name:	Dan Watt Stroma FSAP 2009		Stroma Softwar Address: F	e Ver	sion:			000002 n: 1.4.0.79	
Address :	172 High St, Tedding	gton, TW11 8H	U						
1. Overall dwelling dimer	nsions:								
		Are	a(m²)		Ave He	ight(m)	<u>.</u> .	Volume(m³	)_
Ground floor			55.5 (1	a) x	2.	67	(2a) =	148.19	(3a)
Total floor area TFA = (1a	)+(1b)+(1c)+(1d)+(1e)	)+(1n)	55.5 (4	<b>!</b> )					
Dwelling volume			(;	3a)+(3b)-	+(3c)+(3d	)+(3e)+	(3n) =	148.19	(5)
2. Ventilation rate:									
		econdary eating	other		total			m³ per hou	r
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 fan	ıs				2	X	10 =	20	一 (7a)
Number of passive vents				H	0	x	10 = [	0	(7b)
Number of flueless gas fire	98				0	x	40 = [	0	」(7c)
Number of fluciess gas file	63				U		. [	0	(76)
							Air ch	anges per ho	ur
Infiltration due to chimney	s, flues and fans = (6a	n)+(6b)+(7a)+(7b)+	(7c) =		20		÷ (5) =	0.13	(8)
If a pressurisation test has be				ntinue fro			` ′ [	0.10	
Number of storeys in the	e dwelling (ns)							0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2			•		ıction			0	(11)
deducting areas of opening	esent, use the value corresp gs); if equal user 0.35	onaing to the grea	ter wall area (	(aπer					
If suspended wooden flo		ed) or 0.1 (seale	ed), else er	nter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter 0							0	(13)
Percentage of windows	and doors draught str	ripped						0	(14)
Window infiltration			0.25 - [0.2 x	` '	_			0	(15)
Infiltration rate			(8) + (10) + (				ļ	0	(16)
Air permeability value, o	• • •	•			etre of e	nvelope	area	5	(17)
If based on air permeabilit  Air permeability value applies					s heina us	ed:		0.38	(18)
Number of sides on which		boon done or a do	groo an porm	roubinty is	o bomig de	.00	[	3	(19)
Shelter factor			(20) = 1 - [0.	.075 x (19	9)] =		•	0.78	(20)
Infiltration rate incorporation	ng shelter factor		(21) = (18) x	(20) =				0.3	(21)
Infiltration rate modified fo	r monthly wind speed								
Jan Feb I	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed from Table 7								
(22)m= 5.4 5.1 5	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								

1.12

1.02

0.98

0.92

0.92

1.05

1.12

1.2

1.27

1.27

(22a)m=

1.35

1.27

Adjusted infiltration rate (allov	ving for shelter ar	nd wind sp	eed) = (21	a) x (22a)m					
0.4 0.38 0.38	0.34 0.31	0.29	<del></del>	28 0.31	0.34	0.36	0.38		
Calculate effective air change	rate for the appl	icable case	9		_ <b>!</b>	!	!	J	
If mechanical ventilation:	andia N (22b) (22	a)		-th	h) (00-)			0	(23a)
If exhaust air heat pump using Ap		,	, ,, .	,	b) = (23a)			0	(23b)
If balanced with heat recovery: eff					201.)	001 \ [	4 (00.)	0	(23c)
a) If balanced mechanical v	ventilation with he	eat recover	<del>' ' ' '</del>	$\frac{(24a)m = (2)}{0}$	(2b)m + (	23b) × [	1 – (23c)   0	÷ 100] I	(24a)
` '							0		(2 <del>4</del> a)
b) If balanced mechanical v		neat reco	<del>, , , , ,</del>	$\frac{(240)m = (2)}{0}$	20)m + (. 0	230)	0	]	(24b)
c) If whole house extract ve	<u> </u>	<u> </u>	!	ļ					(= .5)
if $(22b)m < 0.5 \times (23b)$ ,	•	•			).5 × (23b	o)			
(24c)m = 0 0 0	0 0	0	<del>`</del> – –	) 0	0	0	0	]	(24c)
d) If natural ventilation or w	hole house positi	ve input ve	entilation fr	om loft	_ <b>I</b>	!	!	J	
if (22b)m = 1, then (24c					( 0.5]			-	
(24d)m= 0.58 0.57 0.57	0.56 0.55	0.54	0.54 0.	0.55	0.56	0.56	0.57		(24d)
Effective air change rate - e	enter (24a) or (24	b) or (24c)	or (24d) ir	box (25)	_			-	
(25)m= 0.58 0.57 0.57	0.56 0.55	0.54	0.54 0.	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		-value /m2K	A X U (W/	K)	k-value kJ/m²-		A X k kJ/K
, ,					`	,			
Doors		2.08	x	1.5 =	3.12				(26)
Doors Windows Type 1		2.08	╡ └─	1.5 = .5 )+ 0.04] =	3.12 2.26				(26) (27)
			x1/[1/( ·						, ,
Windows Type 1	0	1.6	x1/[1/( '	.5 )+ 0.04] =	2.26			<b>-</b>	(27)
Windows Type 1 Windows Type 2	2.08	3.2	x1/[1/( '	.5 )+ 0.04] = .5 )+ 0.04] =	2.26				(27)
Windows Type 1 Windows Type 2 Walls Type1  41		1.6 3.2 41	x1/[1/( '	.5 )+ 0.04] = .5 )+ 0.04] = 0.25 =	2.26 4.53 10.25				(27) (27) (29) (29)
Windows Type 1 Windows Type 2 Walls Type1 Walls Type2 6 Walls Type3 9.6	2.08	1.6 3.2 41 3.92 4.8	x1/[1/( 'x1/[1/( 'x1/[1/[1/( 'x1/[1/[1/[1/( 'x1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1	0.25 = 0.23 = 0.25 = 0.	2.26 4.53 10.25 0.88 1.2				(27) (27) (29) (29) (29)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44	2.08 4.8 0	1.6 3.2 41 3.92 4.8 44	x1/[1/( ' x1/[1/( ' x1/[1/( ' x	0.25 = 0.25 = 0.16 = 0.16 = 0.16 = 0.17 = 0.16 = 0.15   0.04   = 0.15   0.16   = 0.15   0	2.26 4.53 10.25 0.88 1.2 7.04				(27) (27) (29) (29) (29) (29) (30)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3	2.08	1.6 3.2 41 3.92 4.8 44 2.3	x1/[1/( ' x1/[1/( ' x1/[1/( ' x	0.25 = 0.23 = 0.25 = 0.	2.26 4.53 10.25 0.88 1.2				(27) (27) (29) (29) (29) (30) (30)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m²	2.08 4.8 0	1.6 3.2 41 3.92 4.8 44 2.3	x1/[1/( 'x1/[1/( 'x1/[1/[1/( 'x1/[1/[1/( 'x1/[1/[1/( 'x1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1	0.25 = 0.25 = 0.16 = 0.16 = 0.16 = 0.16 = 0.16 = 0.5 ) + 0.04] = 0.5 ) + 0.04] = 0.5 ) + 0.04] = 0.16 = 0.16 = 0.16	2.26 4.53 10.25 0.88 1.2 7.04 0.37				(27) (27) (29) (29) (29) (30) (30) (31)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall	2.08 4.8 0	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28	x1/[1/( ' x1/[1/( ' x1/[1/( ' x	0.25 = 0.25 = 0.16 = 0.16 = 0.16 = 0.17 = 0.16 = 0.15   0.04   = 0.15   0.16   = 0.15   0	2.26 4.53 10.25 0.88 1.2 7.04				(27) (27) (29) (29) (29) (30) (30) (31) (32)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, use	2.08 4.8 0 0 effective window U-v	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 ralue calculate	x1/[1/( 'x1/[1/( 'x1/[1/[1/( 'x1/[1/[1/[1/( 'x1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1/[1	0.5)+0.04] = 0.5)+0.04] = 0.25 = 0.23 = 0.25 = 0.16 = 0.16 =	2.26 4.53 10.25 0.88 1.2 7.04 0.37	as given in	paragraph		(27) (27) (29) (29) (29) (30) (30) (31)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, use ** include the areas on both sides of	2.08 4.8 0 0 effective window U-v internal walls and part	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 ralue calculate	x1/[1/( x x   x   x   x   x   x   x   x   x	0.25 = 0.25 = 0.16 = 0.	2.26 4.53 10.25 0.88 1.2 7.04 0.37	as given in	paragraph	Γ	(27) (27) (29) (29) (29) (30) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, use ** include the areas on both sides of Fabric heat loss, W/K = S (A size)	2.08 4.8 0 0 effective window U-v internal walls and part	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 ralue calculate	x1/[1/( x x   x   x   x   x   x   x   x   x	0.5)+0.04] = 0.5)+0.04] = 0.25 = 0.23 = 0.25 = 0.16 = 0.16 = 0.16 = 0.16 = 0.16 = 0.16 = 0.16 = 0.16 =	2.26 4.53 10.25 0.88 1.2 7.04 0.37			29.66	(27) (27) (29) (29) (29) (30) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, use ** include the areas on both sides of Fabric heat loss, W/K = S (A x k)	2.08 4.8 0 0 vertice of the control	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 ralue calculate rtitions	x1/[1/( x x   x   x   x   x   x   x   x   x	0.25 = 0.25 = 0.16 = 0.	2.26 4.53 10.25 0.88 1.2 7.04 0.37	2) + (32a).		29.66 3355.4	(27) (27) (29) (29) (29) (30) (30) (31) (32) (32a) (32a)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, use ** include the areas on both sides of Fabric heat loss, W/K = S (A x k) Thermal mass parameter (TM	2.08 4.8 0 0 offective window U-vinternal walls and partix U)  1P = Cm ÷ TFA) i	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 ralue calculate ritions	x1/[1/( 'x1/[1/( 'x1/[1/())))))))))))))))))))))))))))))))))	0.25 = 0.25 = 0.16 = 0.	2.26 4.53 10.25 0.88 1.2 7.04 0.37  0  lue)+0.04] a (30) + (3: ative Value	2) + (32a). : Low	(32e) =	29.66	(27) (27) (29) (29) (29) (30) (30) (31) (32) (32a)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, use ** include the areas on both sides of Fabric heat loss, W/K = S (A x k)	2.08  4.8  0  0  offective window U-vinternal walls and particular walls and particular walls and particular walls of the construction of the construction of the construction walls are constructed with the construction of the	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 ralue calculate ritions	x1/[1/( 'x1/[1/( 'x1/[1/())))))))))))))))))))))))))))))))))	0.25 = 0.25 = 0.16 = 0.	2.26 4.53 10.25 0.88 1.2 7.04 0.37  0  lue)+0.04] a (30) + (3: ative Value	2) + (32a). : Low	(32e) =	29.66 3355.4	(27) (27) (29) (29) (29) (30) (30) (31) (32) (32a) (32a)
Windows Type 1  Windows Type 2  Walls Type1 41  Walls Type2 6  Walls Type3 9.6  Roof Type1 44  Roof Type2 2.3  Total area of elements, m²  Party wall  Party floor  * for windows and roof windows, use ** include the areas on both sides of Fabric heat loss, W/K = S (A x k)  Thermal mass parameter (TM  For design assessments where the of	2.08  4.8  0  0  offective window U-vinternal walls and particulation.	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 value calculate rititions	x1/[1/( 'x1/[1/( 'x1/[1/())))))))))))))))))))))))))))))))))	0.25 = 0.25 = 0.16 = 0.	2.26 4.53 10.25 0.88 1.2 7.04 0.37  0  lue)+0.04] a (30) + (3: ative Value	2) + (32a). : Low	(32e) =	29.66 3355.4	(27) (27) (29) (29) (29) (30) (30) (31) (32) (32a) (32a)
Windows Type 1 Windows Type 2 Walls Type1 41 Walls Type2 6 Walls Type3 9.6 Roof Type1 44 Roof Type2 2.3 Total area of elements, m² Party wall Party floor * for windows and roof windows, use ** include the areas on both sides of Fabric heat loss, W/K = S (A x k ) Thermal mass parameter (TM For design assessments where the of can be used instead of a detailed call	2.08  4.8  0  0  offective window U-vinternal walls and particulation.  alculated using A	1.6 3.2 41 3.92 4.8 44 2.3 102.9 28 63.2 ralue calculate rititions	x1/[1/( 'x1/[1/( 'x1/[1/())))))))))))))))))))))))))))))))))	0.5)+0.04] = 0.5)+0.04] = 0.25 = 0.23 = 0.25 = 0.16 = 0.16 = 0.16 = ((28)) Indicative	2.26 4.53 10.25 0.88 1.2 7.04 0.37  0  lue)+0.04] a (30) + (3: ative Value	2) + (32a). : Low	(32e) =	29.66 3355.4 100	(27) (27) (29) (29) (29) (30) (30) (31) (32) (32a) (32a)

Ventila	ation hea	at loss ca	alculated	l monthl	V				(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 to	ransfer c	oefficier	nt, 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		
Heat lo	oss para	meter (H	HLP), W/	′m²K			•	•		Average = = (39)m ÷	Sum(39) <sub>1</sub> - (4)	12 /12=	61.03	(39)
(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		
Numbe	er of day	s in moi	nth (Tab	le 1a)				•	,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.1	(40)
	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. Wa	ater heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Accum	ned occu	inancy l	N									0.5	1	(42)
if TF		9, N = 1	+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	ΓFA -13.		.85		(42)
Annua	l averag	e hot wa	ater usaç									3.18		(43)
		_	hot water person per			_	-	to achieve	a water us	se target o	f			
notmon					<u> </u>		•	Ι	0			<u> </u>		
Hot wat	Jan er usage ii	Feb	Mar day for ea	Apr ach month	May <i>Vd.m</i> = fa	Jun ctor from	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
(44)m=	86	82.88	79.75	76.62	73.49	70.37	70.37	73.49	76.62	79.75	82.88	86		
(44)111=		02.00	13.13	70.02	70.40	10.01	70.07	70.40	<u> </u>		m(44) <sub>112</sub> =		938.22	(44)
Energy	content of	hot water	used - cal	culated me	onthly $= 4$ .	190 x Vd,r	m x nm x E	OTm / 3600			. ,			
(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		
If incton	<b>4</b> 0000000	otor booti	na ot noint	of upo (no	hot water	r otorogol	antar O in	haves (46		Total = Su	m(45) <sub>112</sub> =	=	1233.1	(45)
			ng at point	,	1	· · ·		, ,	. , ,				I	(40)
(46)m= Water	19.18 storage	16.77 loss:	17.31	15.09	14.48	12.49	11.58	13.28	13.44	15.67	17.1	18.57		(46)
	_		clared lo	ss facto	r is knov	vn (kWh	/day):					0		(47)
Tempe	erature fa	actor fro	m Table	2b								0		(48)
Energy	y lost fro	m water	storage	, kWh/ye	ear			(47) x (48)	) =			0		(49)
			ared cylir										· [	(==)
•		•	) includir I no tank in	•		•						0		(50)
	-	•	t water (th				. ,	enter '0' in	box (50)					
Hot wa	ater stora	age loss	factor fr	om Tab	e 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature f	actor fro	m Table	2b								0		(53)
٠.			storage	, kWh/y	ear			((50) x (51	) x (52) x	(53) =		0		(54)
	(49) or (	, ,	•						,			0		(55)
	storage	loss cal	culated f	or each	month		1	((56)m = (	55) × (41)ı	m	1	•	•	
(56)m=	0	0	0	0	0 (50)	0	0	0	0 (50)	0	0	0		(56)
-	er contains	dedicate	a solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	u), else (5	/)m = (56)	m where (	H11) is fro	m Append	ıx H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primary	y circuit le	oss (an	nual) fro	m Table	e 3							0		(58)
Primary	y circuit le	oss cal	culated f	for each	month (	(59)m =	(58) ÷ 36	65 × (41	)m					
(mod	lified by f	actor fr	om Tab	le H5 if t	here is	solar wa	ter heati	ng and a	a cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss calc	ulated	for each	month (	(61)m =	(60) ÷ 3	865 × (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 he	eat requi	red for	water he	eating ca	alculated	d for ea	ch month	(62)m =	= 0.85 × (	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
	<del></del> -	149.96	156.02	138.38	133.97	117.99	1	126.02	127.41	145.09	154.88	167.64		(62)
Solar DH	IW input ca	alculated	using App	endix G oı	· Appendix	ι κ Η (nega	tive quantity	y) (enter '(	)' if no sola	r contribut	ion to wate	er heating)	l	
(add ad	dditional l	lines if	FGHRS	and/or \	WWHRS	applie	s, see Ap	pendix	G)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output	from wat	ter hea	ter			•				ı	!	ı	l	
. г		149.96	156.02	138.38	133.97	117.99	113.04	126.02	127.41	145.09	154.88	167.64		
L					<u> </u>	!		Out	put from wa	ater heate	r (annual)₁	12	1702.08	(64)
Heat ga	ains from	water	heating.	kWh/me	onth 0.2	5 ′ [0.8	5 × (45)m	ı + (61)r	n1 + 0.8 x	ر (46)m	+ (57)m	+ (59)m	1	-
(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	ĺ	(65)
L	 de (57)m	in calc	culation o	of (65)m	only if o	vlinder	is in the	L dwellina	or hot w	ater is f	rom com	nunity h	l eating	
	ernal gai			. ,		y iii idoi		a troilling	01 1101 11	4.01 10 11		mariley i	.cu.i.g	
		,			)•									
Metabo T	olic gains Jan	Feb	5), Wat Mar		May	Jun	Jul	Δυα	Sep	Oct	Nov	Dec		
(66)m=	92.6	92.6	92.6	Apr 92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.6		(66)
` ' L					<u> </u>	<u>.                                    </u>		<u> </u>	<u>.                                    </u>	92.0	92.0	92.0		(00)
Ī	<del>`</del>			<del></del>	· ·		or L9a), a	1	1	1444	10.54	47.0	1	(67)
(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)
· · ·	<del></del> _	<del>`</del>					_13 or L1				1	l	I	(00)
(68)m=		163.15	158.93	149.94	138.59	127.93		119.13	123.35	132.34	143.68	154.35		(68)
F	<del>`                                    </del>	<u> </u>			<del></del>	1	or L15a				T		ı	
(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	s gains	(Table 5	āa)	•		•						•	
(70)m=	10	10	10	10	10	10	10	10	10	10	10	10		(70)
Losses	e.g. eva	poratio	n (negat	tive valu	es) (Tab	ole 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 h	neating g	gains (T	able 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 in	nternal g	gains =			-	(60	6)m + (67)m	n + (68)m	+ (69)m + (	(70)m + (7	'1)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. Sola	ar gains:							•						
Solar ga	oine are ee	lculated i	using sola	r flux from	Table 6a	and asso	ciated equa	ations to c	onvert to th	e applical	ole orientat	ion.		
Colai ge	allis ale ca	ilculated (	aon ig ooia	i iiax iioiii	rabio oa									
•	ition: Ac	ccess F	•	Area		FI	ux	_	g_ -		FF		Gains	
•	ition: Ac		•			FI	ux able 6a	7	g_ Table 6b	Т	FF able 6c		Gains (W)	
•	ition: Ac	ccess F	•	Area		FI		] x [_		T x		=		](74)



	_									_								_
North	0.9x	0.77	<b>)</b>		1.6	3	X	3	3.31	X		0.63	X	0.7		=	16.29	(74)
North	0.9x	0.77	<b>)</b>		1.6	3	X	5	4.64	X		0.63	x	0.7		=	26.72	(74)
North	0.9x	0.77	>		1.6	6	X	7	5.22	X		0.63	x	0.7		=	36.78	(74)
North	0.9x	0.77	>		1.6	6	X	8	4.09	X		0.63	x	0.7		=	41.12	(74)
North	0.9x	0.77	<b>)</b>		1.6	6	X	7	9.12	X		0.63	x	0.7		=	38.69	(74)
North	0.9x	0.77	<b>)</b>		1.6	6	X	6	1.56	X		0.63	x	0.7		=	30.1	(74)
North	0.9x	0.77	<b>)</b>		1.6	6	X	4	1.09	x		0.63	x	0.7		=	20.09	(74)
North	0.9x	0.77	<b>)</b>		1.6	3	X	2	4.81	X		0.63	x	0.7		=	12.13	(74)
North	0.9x	0.77	<b>)</b>		1.6	6	X	1	3.22	X		0.63	x	0.7		=	6.46	(74)
North	0.9x	0.77	<b>)</b>		1.6	3	X		8.94	X		0.63	x	0.7		=	4.37	(74)
East	0.9x	1	>		3.2	2	X	1	9.87	X		0.63	x	0.7		=	19.43	(76)
East	0.9x	1	<u> </u>		3.2	2	X	3	8.52	x		0.63	x	0.7		=	37.67	(76)
East	0.9x	1	<u> </u>	Ē	3.2	2	X	6	1.57	x		0.63	x	0.7		=	60.21	(76)
East	0.9x	1	<u> </u>	Ē	3.2	2	X	9	1.41	x		0.63	x	0.7		=	89.4	(76)
East	0.9x	1	<u> </u>		3.2	2	X	1	11.22	x		0.63	x	0.7		=	108.77	(76)
East	0.9x	1	<b>)</b>		3.2	2	X	1	16.05	X		0.63	x	0.7		=	113.49	(76)
East	0.9x	1	<b>)</b>		3.2	2	X	1	12.64	x		0.63	x	0.7		=	110.16	(76)
East	0.9x	1	>		3.2	2	X	9	8.03	X		0.63	x	0.7		=	95.87	(76)
East	0.9x	1	<b>)</b>		3.2	2	X		73.6	X		0.63	x	0.7		=	71.98	(76)
East	0.9x	1	<u> </u>	Ē	3.2	2	X	4	6.91	x		0.63	x	0.7		=	45.87	(76)
East	0.9x	1	>		3.2	2	X	2	4.71	X		0.63	x	0.7		=	24.16	(76)
East	0.9x	1	<u> </u>	Ē	3.2	2	X	1	6.39	x		0.63	x	0.7		=	16.03	(76)
	_									•						•		
Solar (	gains in	watts, ca	alculate	d fo	r each	n mont	h			(83)m	n = Su	m(74)m	(82)m					
(83)m=	24.68	47.62	76.5	1	16.11	145.55	5 1	54.61	148.85	125	.98	92.07	58.01	30.63	20.	41		(83)
Total (	gains – i	nternal a	and sola	ır (8	84)m =	(73)m	) + (	(83)m	, watts									
(84)m=	335.91	356.28	373.79	39	95.77	407.64	1 3	399.74	383.35	366	.35	341.85	325.6	318.44	323	.19		(84)
7. Me	an inter	nal temp	erature	(he	eating	seaso	n)											
Temp	erature	during h	neating	peri	iods in	the liv	/ing	area	from Tal	ole 9	, Th1	(°C)					21	(85)
Utilis	ation fac	tor for g	ains for	livil	ng are	a, h1,	m (s	see Ta	ble 9a)									
	Jan	Feb	Mar		Apr	May	/	Jun	Jul	А	ug	Sep	Oct	Nov	D	ес		
(86)m=	0.96	0.96	0.94	(	0.91	0.83		0.72	0.56	0.5	57	0.79	0.91	0.95	0.9	97		(86)
Mear	interna	l temper	ature in	livi	ng are	ea T1 (	follo	ow ste	ps 3 to 7	7 in T	able	9c)		-			•	
(87)m=	18.72	18.89	19.28	_	9.72	20.27		20.67	20.89	20.		20.55	19.93	19.19	18.	78		(87)
Temr	erature	during h	eating	neri	inds in	rest c	of dv	velling	from Ta	hle (	a Th	2 (°C)			!		l	
(88)m=	19.99	19.99	19.99	T	20	20.01		20.01	20.02	20.		20.01	20	20	19.	99		(88)
		<u> </u>	<u> </u>		!				<u> </u>		1			1				, ,
	ation fac 0.96	tor for g	0.93	_	o.89	velling 0.8		2, <b>m (se</b> 0.65	e Table 0.45	9a) 0.4	<sub>17</sub> T	0.73	0.89	0.95	0.9	)6 T		(89)
(89)m=		<u> </u>	<u> </u>		!				!			!		0.95		,0		(00)
		l temper	1	_	- 1		$\neg$		i e	·		1		1	Ι.			(00)
(90)m=	16.93	17.19	17.76	1	8.39	19.16	$\perp$	19.7	19.95	19.	94	19.55	18.7	17.62	17.	02		(90)
												ŤI.	LA = LIV	ing area ÷ (4	+) =		0.54	(91)
Mear	interna	l temper	ature (f	or th	he who	ole dw	ellir	ng) = f	LA × T1	+ (1	– fL	A) × T2				_		
(92)m=	17.9	18.11	18.58	1	9.11	19.76		20.23	20.46	20.	45	20.09	19.36	18.47	17.	97		(92)

Apply adjustme	ent to th	e mean	internal	tempera	ature fro	m Table	4e, whe	ere appro	priate				
· · · · · <del>· · · · · · · · · · · · · · </del>	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	ng requ	irement											
Set Ti to the me					ed at ste	ep 11 of	Table 9b	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
the utilisation fa					l	l. d	A	0	0-4	Nan			
Jan Utilisation factor	Feb or for ga	Mar Jine hm	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(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, h					0.00	0.10	0.0	0.10	0.07	0.00	0.01		(- )
	332.14	339.18	343.57	320.08	262.64	185.4	183.28	249.4	282.44	295.72	305.23		(95)
Monthly averag	ge exter	nal tem	perature	from Ta	able 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 t	for mea	n intern	al tempe	erature,	 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	require	ment fo	r each n	nonth, k\	Vh/mont	h = 0.02	24 x [(97)	)m – (95	)m] x (4 <sup>-</sup>	1)m			
(98)m= 377.25	314.55	282.15	202.88	117.94	0	0	0	0	171.57	287.04	366.58		
							Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	2119.97	(98)
Space heating	require	ment in	kWh/m²	/year								38.2	(99)
9a. Energy requ	irement	ts – Indi	vidual h	eating sy	/stems ii	ncluding	micro-C	HP)					
Space heating								,					
Fraction of spa		from se	econdar	y/supple	mentary	system						0	(201)
Fraction of spa	ce heat	from m	nain syst	em(s)			(202) = 1 -	- (201) =			i	1	(202)
							( - /	()				•	(202)
Fraction of tota	ıl heatin	g from i	main sys	. ,			(204) = (20		(203)] =			 1	(204)
		•	-	stem 1			. ,		(203)] =				= ' '
Efficiency of ma	ain spa	ce heati	ing syste	stem 1 em 1	a svstem		. ,		(203)] =			1 90	(204)
Efficiency of ma	ain spa	ce heati	ing syste	stem 1 em 1 y heating		n, %	(204) = (20	02) × [1 –		Nov	Doo	90	(204) (206) (208)
Efficiency of ma	ain spacecondar	ce heati y/supple Mar	ing syste ementar Apr	stem 1 em 1 y heating May	Jun		. ,		(203)] =	Nov	Dec	1 90	(204) (206) (208)
Efficiency of me Efficiency of se Jan Space heating	ain spacecondar Feb require	ce heati y/supple Mar ment (c	ing systeementar Apr alculatee	em 1 y heating May d above	Jun	n, % Jul	(204) = (204) Aug	02) × [1 –	Oct			90	(204) (206) (208)
Efficiency of market Efficiency of set I an I Space heating I 377.25	econdar Feb require	y/supple Mar Ment (c 282.15	ementar Apr alculatee	stem 1 em 1 y heating May d above)	Jun 0	n, %	(204) = (20	02) × [1 –				90	(204) (206) (208)
Efficiency of management of Section Se	econdar Feb require 314.55	Mar ment (c 282.15	Apr alculated 202.88	stem 1 em 1 y heating May d above) 117.94	Jun 0 06)	n, % Jul 0	(204) = (204)	02) × [1 – Sep	Oct 171.57	287.04	366.58	90	(204) (206) (208)
Efficiency of management of Section Se	econdar Feb require	y/supple Mar Ment (c 282.15	ementar Apr alculatee	stem 1 em 1 y heating May d above)	Jun 0	n, % Jul	(204) = (204)	02) × [1 - Sep 0	Oct 171.57 190.63	287.04	366.58 407.31	1 90 0 kWh/ye	(204) (206) (208) ear
Efficiency of ma Efficiency of se Jan Space heating 377.25 (211)m = {[(98)n] 419.17	Feb require 314.55 x (204 349.5	Mar ment (c 282.15 1)] + (21 313.5	Apr alculated 202.88 0)m } x	May dabove; 117.94 100 ÷ (2 131.05	Jun 0 06)	n, % Jul 0	(204) = (204)	02) × [1 - Sep 0	Oct 171.57 190.63	287.04	366.58 407.31	90	(204) (206) (208) ear
Efficiency of market Efficiency of set    Jan   Space heating   377.25   (211)m = {[(98)n   419.17]	require 314.55 m x (204 349.5	Mar ment (c 282.15 4)] + (21 313.5	Apr alculated 202.88 0)m } x 225.42	May dabove) 117.94 100 ÷ (2 131.05	Jun 0 06)	n, % Jul 0	(204) = (204)	02) × [1 - Sep 0	Oct 171.57 190.63	287.04	366.58 407.31	1 90 0 kWh/ye	(204) (206) (208) ear
Efficiency of ma Efficiency of se Jan Space heating 377.25 (211)m = {[(98)n] 419.17	require 314.55 m x (204 349.5	Mar ment (c 282.15 4)] + (21 313.5	Apr alculated 202.88 0)m } x 225.42	May dabove) 117.94 100 ÷ (2 131.05	Jun 0 06)	n, % Jul 0	(204) = (204)	02) × [1 - Sep 0	Oct 171.57 190.63	287.04	366.58 407.31	1 90 0 kWh/ye	(204) (206) (208) ear
Efficiency of market Efficiency of set    Jan   Space heating   377.25   (211)m = {[(98)n   419.17    Space heating   = {[(98)m x (201)]	require 314.55 m x (204 349.5 fuel (se	ment (c 282.15 4)] + (21 313.5 econdary 4) m } x	Apr alculated 202.88 0)m } x 225.42 y), kWh/ 100 ÷ (	May heating May dabove; 117.94 100 ÷ (2 131.05 month 208)	Jun 0 06)	o 0	(204) = (204)	02) × [1 –  Sep  0  1 (kWh/yea	Oct  171.57  190.63  ar) =Sum(2	287.04 318.94 211) <sub>15,1012</sub>	366.58 407.31 =	1 90 0 kWh/ye	(204) (206) (208) ear
Efficiency of management of set of se	require 314.55 m x (204 349.5 fuel (se	ment (c 282.15 4)] + (21 313.5 econdary 4) m } x	Apr alculated 202.88 0)m } x 225.42 y), kWh/ 100 ÷ (	May heating May dabove; 117.94 100 ÷ (2 131.05 month 208)	Jun 0 06)	o 0	(204) = (204)	02) × [1 –  Sep  0  1 (kWh/yea	Oct  171.57  190.63  ar) =Sum(2	287.04 318.94 211) <sub>15,1012</sub>	366.58 407.31 =	1 90 0 kWh/ye	(204) (206) (208) (208) (211) (211)
Efficiency of market Efficiency of set    Jan   Space heating   377.25   (211)m = {[(98)n   419.17    Space heating   = {[(98)m x (201   (215)m= 0	require 314.55 m x (204 349.5 fuel (se	Mar ment (c 282.15 4)] + (21 313.5 econdary 4) m } x	Apr alculated 202.88 0)m } x 225.42 y), kWh/ x 100 ÷ (x	stem 1 em 1 y heating May d above) 117.94 100 ÷ (2 131.05  month 208) 0	Jun 0 06)	o 0	(204) = (204)	02) × [1 –  Sep  0  1 (kWh/yea	Oct  171.57  190.63  ar) =Sum(2	287.04 318.94 211) <sub>15,1012</sub>	366.58 407.31 =	1 90 0 kWh/ye	(204) (206) (208) (208) (211) (211)
Efficiency of management of set of the set of set o	require 314.55 m x (204 349.5 fuel (se	Mar ment (c 282.15 4)] + (21 313.5 econdary 4) m } x	Apr alculated 202.88 0)m } x 225.42 y), kWh/ x 100 ÷ (x	stem 1 em 1 y heating May d above) 117.94 100 ÷ (2 131.05  month 208) 0	Jun 0 06)	o 0	(204) = (204)	02) × [1 –  Sep  0  1 (kWh/yea	Oct  171.57  190.63  ar) =Sum(2	287.04 318.94 211) <sub>15,1012</sub>	366.58 407.31 =	1 90 0 kWh/ye	(204) (206) (208) (208) (211) (211)
Efficiency of management of set of se	ain space condary Feb require 314.55 m x (204 349.5 fuel (se )] + (21 0 ter heat 149.96	Mar ment (c 282.15 1)] + (21 313.5 econdary 4) m } x 0	Apr alculatee 202.88 0)m } x 225.42 y), kWh/ 100 ÷ (100)	month 208)	Jun 0 06) 0	o 0	(204) = (204)	02) × [1 –  Sep  0  0  1 (kWh/yea	Oct  171.57  190.63  ar) = Sum(2	287.04 318.94 211) <sub>15,1012</sub> 0 215) <sub>15,1012</sub>	366.58 407.31 = 0	1 90 0 kWh/ye	(204) (206) (208) (208) (211) (211)
Efficiency of market Efficiency of set    Jan   Space heating   377.25   (211)m = {[(98)n   419.17    Space heating   = {[(98)m x (201   (215)m=  0    Water heating   Output from wate   171.67	ain space condary Feb require 314.55 m x (204 349.5 fuel (se )] + (21 0 ter heat 149.96	Mar ment (c 282.15 1)] + (21 313.5 econdary 4) m } x 0	Apr alculatee 202.88 0)m } x 225.42 y), kWh/ 100 ÷ (100)	month 208)	Jun 0 06) 0	o 0	(204) = (204)	02) × [1 –  Sep  0  0  1 (kWh/yea	Oct  171.57  190.63  ar) = Sum(2	287.04 318.94 211) <sub>15,1012</sub> 0 215) <sub>15,1012</sub>	366.58 407.31 = 0	1 90 0 kWh/ye 2355.52	(204) (206) (208) (208) ear (211) (211)
Efficiency of management of set of se	require 314.55 m x (204 349.5 fuel (se )] + (21 0 ter heat 149.96 ter heat 90 eating,	ment (c 282.15 4)] + (21 313.5 econdary 4) m } x 0 er (calce 156.02 er 90	Apralculatee 202.88  0)m } x 225.42  y), kWh/ 100 ÷ (100) ulated al 138.38	May dabove; 117.94 100 ÷ (2 131.05  month 208) 0	Jun 0 0 06) 0 0	0 0 113.04	(204) = (204)	02) × [1 –  Sep  0  0  I (kWh/yea  127.41	Oct  171.57  190.63  ar) =Sum(2  0  ar) =Sum(2	287.04  318.94  211) <sub>15,1012</sub> 0  215) <sub>15,1012</sub>	366.58 407.31 = 0 =	1 90 0 kWh/ye 2355.52	(204) (206) (208) (208) ear (211) (211)
Efficiency of management of set of se	require 314.55 m x (204 349.5  fuel (se 149.96 ter heat 90 eating, leading,	ment (c 282.15 4)] + (21 313.5 ccondary 4) m } x 0 er (calculus 156.02 er 90 kWh/mo	Apr alculatee 202.88  0)m } x 225.42  y), kWh/ 100 ÷ (1) 0  ulated al 138.38	May dabove) 117.94 100 ÷ (2 131.05  month 208) 0  boove) 133.97	Jun 0 06) 0 117.99	0 0 113.04 90	(204) = (204)	02) × [1 –  Sep  0  0  I (kWh/yea  127.41	Oct  171.57  190.63  ar) =Sum(2  0  ar) =Sum(2  145.09	287.04  318.94  211) <sub>15,1012</sub> 0  215) <sub>15,1012</sub>	366.58 407.31 = 0 = 167.64	1 90 0 kWh/ye 2355.52	(204) (206) (208) (208) ear (211) (211)
Efficiency of management of set of se	require 314.55 m x (204 349.5 fuel (se )] + (21 0 ter heat 149.96 ter heat 90 eating,	ment (c 282.15 4)] + (21 313.5 econdary 4) m } x 0 er (calce 156.02 er 90	Apralculatee 202.88  0)m } x 225.42  y), kWh/ 100 ÷ (100) ulated al 138.38	May dabove; 117.94 100 ÷ (2 131.05  month 208) 0	Jun 0 0 06) 0 0	0 0 113.04	(204) = (204)	02) × [1 –  Sep  0  0  I (kWh/yea  127.41	Oct  171.57  190.63  ar) = Sum(2  0  145.09  90	287.04  318.94  211) <sub>15,1012</sub> 0  215) <sub>15,1012</sub>	366.58 407.31 = 0 =	1 90 0 kWh/ye 2355.52	(204) (206) (208) (208) ear (211) (211)



Annual totals Space heating fuel used, main system 1		kWh/yea	r	2355.52	기
Water heating fuel used				1891.2	╡
Electricity for pumps, fans and electric keep-hot					
central heating pump:			130	1	(230c)
boiler with a fan-assisted flue				] ]	(230e)
poller with a fair-assisted fide			45		(2306)
Total electricity for the above, kWh/year	sum o	of (230a)(230g) =		175	(231)
Electricity for lighting				302.35	(232)
Electricity generated by PVs				-1030.08	(233)
12a. CO2 emissions – Individual heating systems	s including micro-CHP				
	<b>Energy</b> kWh/year	Emission fac kg CO2/kWh	tor	Emissions kg CO2/ye	
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) + (2	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) =			(273)

El rating (section 14)

(274)

OK

### **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:

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

Dwelling Details:

**NEW DWELLING DESIGN STAGE** 

Site Reference: Plot Reference: Flat 9 20% 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/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 9.78 kg/m<sup>2</sup>

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)	ОК
esign air permeability			
Design air permeability a	at 50 pascals	5.00	

3 De

Maximum 10.0

OK

4 Heating efficiency

Boiler system with radiators or underfloor - mains gas Main Heating system:

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 **OK** Time and temperature zone control

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):

Based on:

Overshading:

Windows facing: North Windows facing: East

Ventilation rate: Blinds/curtains:

Slight **OK** 

Average or unknown

1.6m², Overhang twice as wide as window, ratio NaN 3.2m², Overhang twice as wide as window, ratio NaN

4.00

Dark-coloured curtain or roller blind shutter closed 100% of daylight hours

#### 10 Key features

Photovaltaic array

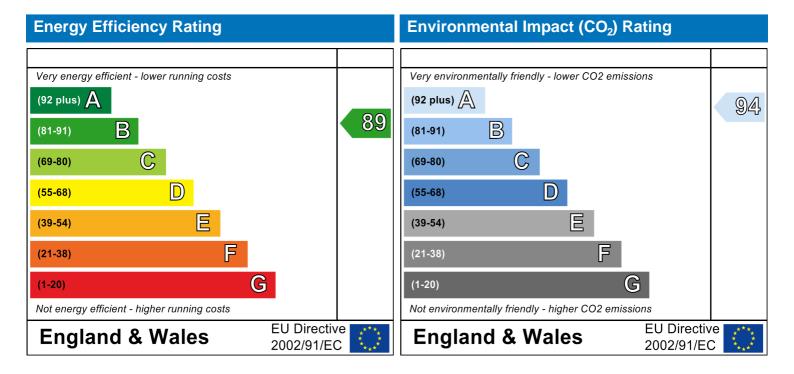
### **Predicted Energy Assessment**

172 High St Teddington TW11 8HU Dwelling type: Date of assessment: Produced by: End-terrace Top floor Flat 22 May 2012 Dan Watt

Produced by: Dan Wa Total floor area: 55.5 m<sup>2</sup>

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.



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**



172 High St, Teddington, TW11 8HU Address:

Located in: England Region: Thames valley

**UPRN:** 

0000-0000-0000-0000-0000 RRN:

Date of assessment: 22 May 2012 25 May 2012 Date of certificate:

New dwelling design stage Assessment type:

New dwelling Transaction type:

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

Flat Dwelling type:

Detachment: **End-terrace** 2012 Year Completed:

Floor Location: Floor area: Storey height: 29 m<sup>2</sup> 2.67 m

Floor 0

True

30 m<sup>2</sup> (fraction 1.034) Living area: North

Front of dwelling faces:

Name: Source: Type: Glazing: Argon: Frame:

Door Manufacturer Solid

Manufacturer Windows low-E, En = 0.05, soft coat PVC-U Ν No

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

Type-Name: Location: Orient: Width: Height: Name:

Coridoor Walls 0 Door 0

0 0 N **Dormers** North

Average or unknown Overshading:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Карра:
External Element	<u>ts</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
Internal Element	<u>S</u>						
Party Elements							
Party Walls	28						N/A
Flat Below	63.2						N/A

User-defined y-value Thermal bridges:

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: <u>Photovoltaic 1</u>

Installed Peak power: 0.8 Tilt of collector: 30°

Overshading: None or very little Collector Orientation: South

Assess Zero Carbon Home: No

User Details: **Assessor Name:** Dan Watt Stroma Number: STRO000002 Stroma FSAP 2009 **Software Version: Software Name:** Version: 1.4.0.79 Property Address: Flat 10 20% 172 High St, Teddington, TW11 8HU Address: 1. Overall dwelling dimensions: Ave Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x (3a) 29 2.67 (2a) 77.43 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)29 (4)Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n)77.43 (5) total main Secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 O O 0 0 (6b) Number of intermittent fans x 10 =(7a) 2 20 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $\div$  (5) = (8) 0.26 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) (9)O Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 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 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =O (16)Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , 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 (19)3  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.78  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.39 Infiltration rate modified for monthly wind speed Feb Sep Jan Mar Apr Mav Jun Jul Aug Oct Nov Dec

1.27

4.5

1.12

4.1

1.02

3.9

0.98

3.7

0.92

3.7

0.92

4.2

1.05

4.5

1.12

4.8

1.2

5.1

1.27

Monthly average wind speed from Table 7

5.1

Wind Factor  $(22a)m = (22)m \div 4$ 1.27

1.35

(22)m =

(22a)m



Adjusted infiltr	ation rate (allo	wing for s	helter an	ıd wind s	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 effec	_	e rate for	he appli	cable ca	se			!				
	al ventilation:	l: <b>.</b>	201 ) (00	/		.15\\	. (00)	\ (00 \			0	(23a)
	eat pump using A							) = (23a)			0	(23b)
	heat recovery: e	•	· ·		`		•				0	(23c)
· ·	d mechanical	1	<u> </u>	i	<del>,                                    </del>	<del>,                                    </del>	<del>í `</del>	<del> </del>		<del>```</del>	) ÷ 100] 1	(5.4.)
(24a)m= 0	0 0	0	0	0	0	0	0	0	0	0	]	(24a)
· -	d mechanical				<del>,                                    </del>	<del>r ´`</del>	<del>í `</del>	<del>r ´ `</del>			1	(0.41-)
(24b)m= 0	0 0	0	0	0	0	0	0	0	0	0	]	(24b)
,	ouse extract v n < 0.5 × (23b		•	•				5 v (22h	١			
$\frac{11 (220)11}{(24c)m} = 0$	0 0.5 x (230)	0, 111611 (24	$C_0 = (23L)$	0	0	$C_{i} = (22i)$	0	0	0	0	1	(24c)
	ventilation or v								0		J	(210)
,	n = 1, then (24)		•	•				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	a) or (24k	o) or (24	c) or (24	d) in box	x (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 losse	s and heat los	s paramet	er:									
ELEMENT	Gross	Openir		Net Ar	ea	U-val	ue	AXU		k-value	9	ΑΧk
	area (m²)		1 <sup>2</sup>	A ,r	m²	W/m2	2K	(W/ł	<u>()</u>	kJ/m²•	K	kJ/K
Doors				2.08	X	1.5	=	3.12				(26)
Windows				3.2	<sub>X</sub> 1	/[1/( 1.5 )+	0.04] =	4.53				(27)
Walls Type1	38	0		38	Х	0.25	=	9.5				(29)
Walls Type2	22	2.08	3	19.92	<u>x</u>	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 e	lements, m <sup>2</sup>			92.9								(31)
Party wall				28	X	0	=	0				(32)
Party floor				63.2							7 F	(32a)
* for windows and ** include the area					lated using	formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragrapl	h 3.2	
Fabric heat los	ss, W/K = S (A	x U)	•			(26)(30)	) + (32) =				26.68	8 (33)
Heat capacity	$Cm = S(A \times k)$	)					((28).	(30) + (32	?) + (32a).	(32e) =	3423.	<del></del> -
Thermal mass	parameter (T	MP = Cm	÷ TFA) ir	n kJ/m²K	,		Indica	tive Value:	Low		100	
For design assess	sments where the	details of the	•			ecisely the	e indicative	e values of	TMP in Ta	able 1f	130	``
Thermal bridge			using Ar	pendix l	K						3.72	(36)
if details of therma	, ,			-								(/
Total fabric he		. ,					(33) +	(36) =			30.4	. (37)
Ventilation hea	at loss calculat	ed monthl	у				(38)m	= 0.33 × (	25)m x (5)	)		_
Jan	Feb Ma	r 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 tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	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		
Heat lo	oss para	meter (H	HLP), W	/m²K						Average = = (39)m ÷		12 /12=	45.74	(39)
(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		
Nicosala		!	/ T - l-	la 4a)	!	!	!		,	Average =	Sum(40) <sub>1</sub> .	12 /12=	1.58	(40)
Numbe			nth (Tab	<u> </u>		1	11	<u> Λ</u>	0	0-4	Mari	D		
(44)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(41)
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ting ene	rgy requi	irement:								kWh/ye	ear:	
		_												
if TF	A > 13.9			[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	ΓFA -13.		15		(42)
	A £ 13.9 Laverag	,	ater usad	ne in litre	s ner da	av Vd av	erane –	(25 x N)	+ 36		61	.61		(43)
								to achieve		se target o		.01		(43)
not more	e that 125	litres per p	person pei	day (all w	ater use, l	hot and co	ld)	_						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water	er usage ii	n litres per	day for ea	ach month	Vd,m = fa	ctor 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		_
Energy (	content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	m x nm x [	OTm / 3600		Total = Sui oth (see Ta	. ,	<u> </u>	739.36	(44)
(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		
` '								1	-	Γotal = Su			971.74	(45)
If instan	taneous w	ater heatii	ng 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)
	storage					(1.1.4.1)		•						
,			clared lo		r is knov	vn (kVVh	/day):					0		(47)
•			m Table									0		(48)
٠.			storage ared cylir			not kn		(47) x (48)	) =			0		(49)
			) includir					<b>:</b>				0		(50)
•		•	no tank ir			J						<u> </u>		(00)
	-	_		_				enter '0' in	box (50)					
Hot wa	ater stora	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
Volum	e factor	from Ta	ble 2a		,		• /					0		(52)
			m Table	2b								0		(53)
Energy	/ lost fro	m water	· storage	, kWh/ye	ear			((50) x (51	) x (52) x	(53) =		0		(54)
		54) in (5	_	,				., , ,	, , ,	,	-	0		(55)
Water	storage	loss cal	culated t	for each	month			((56)m = (	55) × (41):	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	_			ļ	<u> </u>	<u> </u>		ļ		-	_	m Appendi	хН	• •
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
( )			<u>_</u> _	L	L	L	<u> </u>				Ĭ			` '

Primary circuit loss (annual) from Table 3	)
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 =	)
Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$	
(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 $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$	
(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) <sub>112</sub> 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]	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	)
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 (69)	)
Pumps and fans gains (Table 5a)	
(70)m= 10 10 10 10 10 10 10 10 10 10 10 10 10	)
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 Area Flux g_ FF Gains	
Table 6d m <sup>2</sup> Table 6a Table 6b Table 6c (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		ĸ	3.2	2	X	3	33.31	X		0.63	x	0.7	=	32.57	(74)
North	0.9x	0.77		ĸ	3.2	2	X	5	54.64	x		0.63	x	0.7	=	53.44	(74)
North	0.9x	0.77		ĸ	3.2	2	X	7	75.22	X		0.63	X	0.7	=	73.56	(74)
North	0.9x	0.77		ĸ	3.2	2	X	8	34.09	X		0.63	x	0.7	=	82.24	(74)
North	0.9x	0.77		ĸ [	3.2	2	X	7	79.12	X		0.63	x	0.7	=	77.38	(74)
North	0.9x	0.77		ĸ	3.2	2	X	6	31.56	X		0.63	x	0.7	=	60.21	(74)
North	0.9x	0.77	:	× [	3.2	2	X	4	1.09	X		0.63	x	0.7	=	40.18	(74)
North	0.9x	0.77	:	×	3.2	2	X	2	24.81	X		0.63	x	0.7	=	24.27	(74)
North	0.9x	0.77	:	ĸ [	3.2	2	X	1	3.22	X		0.63	X	0.7	=	12.93	(74)
North	0.9x	0.77		K	3.2	2	X	8	8.94	X		0.63	Х	0.7	=	8.75	(74)
Ĩ		watts, ca		d 1			_		i	r <del>`</del>		um(74)m .	· ,			1	(00)
(83)m=	10.49	19.91 nternal a	32.57	<u></u>	53.44	73.56		32.24 83\m	77.38	60.	21	40.18	24.27	12.93	8.75	]	(83)
(84)m=	309.28	315.65	317.23	_	321.53	325.33	<del> </del>	319	305.41	293	88	283.39	284.18	291.26	300.52	1	(84)
L			<u> </u>	_				010	000.41	200	.00	200.00	204.10	201.20	000.02	J	(0.)
		nal temp			· ·				( <b>T</b>	1. 0		4 (00)					7(05)
•		_	•	•			_		from Tab	oie 9,	, Ih	1 (°C)				21	(85)
Utilisa		tor for g	ı —	. II/			Ť			_	_	0	0.1	NI.		1	
(00)	Jan	Feb	Mar	+	Apr	May	+	Jun	Jul	<b>-</b>	ug	Sep	Oct	Nov	Dec	-	(96)
(86)m=	0.91	0.9	0.88		0.85	0.77		0.65	0.5	0.5	02	0.71	0.83	0.89	0.91	]	(86)
Ī		· ·	r	ı li					ps 3 to 7	T				1		7	
(87)m=	18.4	18.56	18.98		19.45	20.08	2	20.56	20.84	20.	83	20.45	19.77	18.94	18.48		(87)
Temp	erature	during h	eating	ре	riods ir	rest o	f dw	elling	from Ta	ble 9	9, Tr	n2 (°C)				-	
(88)m=	19.61	19.62	19.62		19.64	19.65	1	19.65	19.66	19.	66	19.64	19.64	19.63	19.62		(88)
Utilisa	ition fac	tor for g	ains fo	re	est of d	welling	, h2	,m (se	ee Table	9a)						_	
(89)m=	0.9	0.89	0.86		0.82	0.72		0.57	0.37	0.3	88	0.63	0.79	0.87	0.9		(89)
Mean	interna	l temper	ature ir	n th	ne rest	of dwe	lling	T2 (f	ollow ste	ps 3	to 7	7 in Tabl	e 9c)				
(90)m=	16.28	16.52	17.11		17.78	18.66	1	19.28	19.57	19.	57	19.14	18.24	17.07	16.4	]	(90)
•			•				•		•		•	f	LA = Livin	g area ÷ (	4) =	1.03	(91)
Mean	interna	l temper	ature (1	or	the wh	ole dw	ellin	a) = fl	LA × T1	+ (1	– fL	A) × T2					<del></del>
(92)m=	18.47	18.63	19.04	Ť	19.5	20.13	$\overline{}$	20.61	20.88	20.		20.49	19.82	19.01	18.55	1	(92)
ا Apply	adjustr	nent to t	he mea	n i	internal	tempe	ratu	ıre fro	m Table	4e,	whe	re appro	priate			_	
(93)m=	18.32	18.48	18.89		19.35	19.98	2	20.46	20.73	20.	72	20.34	19.67	18.86	18.4		(93)
8. Spa	ace hea	ting requ	uiremer	nt													
							inec	l at ste	ep 11 of	Tabl	e 9b	o, so tha	t Ti,m=(	76)m an	d re-cal	culate	
tne ut		factor fo		$\neg$			.	مديا	11	Ι		Con	Oct	Nav	Dag	1	
l Itilica	Jan	Feb tor for g	Mar	_	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec	]	
(94)m=	0.88	0.87	0.85	T	0.81	0.73		0.62	0.48	0.4	19	0.67	0.8	0.86	0.88	1	(94)
	I gains.	hmGm	. W = (9	 94)		1)m			<u> </u>	<u> </u>				<u> </u>	<u> </u>	J	
(95)m=	272.58	275.24	268.97	Ť	261.03	238.5	1	97.69	146.63	144	.87	191.1	226.15	250.91	264.96	]	(95)
ا Month	ly aver	age exte	rnal te	np	erature	from	Гabl	e 8			!		<u> </u>	!	!	_	
(96)m=	4.5	5	6.8	T	8.7	11.7		14.6	16.9	16.	.9	14.3	10.8	7	4.9	]	(96)
•																_	



Heat	loss rate	o for me	an intern	al temno	arature	Im \//-	-[(39)m :	x [(93)m·	_ (96)m	1				
(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)
								24 x [(97)						` '
(98)m=	278.31	235.43	217.33	162.46	101.31	0	0	0	0	133.25	212.38	268.89		
								Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	1609.37	(98)
Spac	e heatin	g require	ement in	kWh/m²	?/year								55.5	(99)
9a. En	ergy red	quiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	HP)					
•	e heatir	•			, .							Г		<b>-</b>
	-					mentary	-					ļ	0	(201)
			t from m	-	` ,			(202) = 1 -				ļ	1	(202)
			ng from I	-				(204) = (204)	02) × [1 –	(203)] =		ļ	1	(204)
Efficie	ency of ı	main spa	ace heat	ing syste	em 1							ļ	90	(206)
Efficie	ency of s	seconda	ry/supple	ementar	y heating	g system	1, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Spac		<del></del>	ement (c											
	278.31	235.43	217.33	162.46	101.31	0	0	0	0	133.25	212.38	268.89		
(211)m			4)] + (21							440.05	225.00	200 77		(211)
	309.24	261.59	241.48	180.52	112.57	0	0	0 Tota	0 L(kWh/vea	148.05 ar) =Sum(2	235.98 211) <sub>15,1012</sub>	298.77	1788.19	(211)
Snac	a haatin	a fuel (s	econdar	ν) k\//h/	month			. 0.0	. (	, ••••••	- 15,1012		1700.19	
•		• ,	14) m } x											
(215)m=		0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215),,,,5,10,12	F	0	(215)
Water	heating	3										_		_
Output		ater hea	ter (calc 122.95			02.00	90.00	00.24	100 44	111 21	122.06	122.44		
Efficie	135.29	ater hea		109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11	90	(216)
(217)m=		90	90	90	90	90	90	90	90	90	90	90		(217)
			kWh/mo			- 00					- 00			,
			) ÷ (217)							1				
(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		_
								rota	I = Sum(2				1490.36	(219)
	al totals heating		ed, main	svstem	1					K	Wh/year	[	kWh/year 1788.19	٦
•	•	fuel use		.,								[ [		<del>-</del>
	·		ans and	oloctric	kaan ha	<b>+</b>						Į	1490.36	J
		•		CICCLIC	кеер-по	ı								(222.)
		g pump:										130		(230c)
boiler	r with a f	an-assis	sted flue									45		(230e)
Total e	electricity	y for the	above, k	(Wh/yea	r			sum	of (230a).	(230g) =			175	(231)
Electri	city for li	ighting											169.38	(232)
Electri	city gen	erated by	y PVs										-686.72	(233)



	<b>Fuel</b> kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating - main system 1	(211) x	3.1 x 0.01 =		(240
Space heating - main system 2	(213) x	0 x 0.01 =	0	    (241
Space heating - secondary	(215) x	0 x 0.01 =	0	
Water heating cost (other fuel)	(219)	3.1 × 0.01 =	46.2	    (247
Pumps, fans and electric keep-hot	(231)	11.46 x 0.01 =	20.06	
(if off-peak tariff, list each of (230a) to (230g) se Energy for lighting	parately as applicable and app	ly fuel price according to  11.46 × 0.01 =		
Additional standing charges (Table 12)			106	    (251
	one of (233) to (235) x)	11.46 × 0.01 =	-78.7	ー □(252
Appendix Q items: repeat lines (253) and (254)		11.40	-70.7	(202
	(47) + (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 system	ms including micro-CHP			
	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/yea	
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
			97.57	_    (268
Electricity for lighting	(232) x	0.517	87.57	(=00
Electricity for lighting  Energy saving/generation technologies  Item 1	(232) x	0.517 =	-363.27	(269
Energy saving/generation technologies Item 1		0.017		_
Energy saving/generation technologies	sum	0.529 =	-363.27	(269
Energy saving/generation technologies Item 1 Total CO2, kg/year CO2 emissions per m²	sum	0.529 = of (265)(271) =	-363.27 463.92	](269 ](272
Energy saving/generation technologies Item 1 Total CO2, kg/year	sum	0.529 = of (265)(271) =	-363.27 463.92	(269 (272 (273
Energy saving/generation technologies Item 1 Total CO2, kg/year  CO2 emissions per m² El rating (section 14)	sum	0.529 = of (265)(271) =	-363.27 463.92	(269 (272 (273



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 o	of (265)(271) =		2344.48	(272)
Primary energy kWh/m²/year	(272)	÷ (4) =		80.84	(273)

User Details: **Assessor Name:** Dan Watt Stroma Number: STRO000002 Stroma FSAP 2009 **Software Version: Software Name:** Version: 1.4.0.79 Property Address: Flat 10 20% 172 High St, Teddington, TW11 8HU Address: 1. Overall dwelling dimensions: Ave Height(m) Volume(m³) Area(m<sup>2</sup>) Ground floor (1a) x (3a) 29 2.67 (2a) 77.43 Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+....(1n)29 (4)Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)+....(3n)77.43 (5) total main Secondary other m³ per hour heating heating x 40 = Number of chimneys (6a) 0 0 x 20 =Number of open flues 0 O O 0 0 (6b) Number of intermittent fans x 10 =(7a) 2 20 x 10 =Number of passive vents (7b) 0 0 x 40 =Number of flueless gas fires (7c)Air changes per hour Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = $\div$  (5) = (8) 0.26 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) (9)O Additional infiltration [(9)-1]x0.1 =0 (10)Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction (11)0 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 (13)0 Percentage of windows and doors draught stripped (14)0 Window infiltration  $0.25 - [0.2 \times (14) \div 100] =$ 0 (15)Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) =O (16)Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)5 If based on air permeability value, then  $(18) = [(17) \div 20] + (8)$ , 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 (19)3  $(20) = 1 - [0.075 \times (19)] =$ Shelter factor (20)0.78  $(21) = (18) \times (20) =$ Infiltration rate incorporating shelter factor (21)0.39 Infiltration rate modified for monthly wind speed Feb Sep Jan Mar Apr Mav Jun Jul Aug Oct Nov Dec

1.12

4.5

4.1

1.02

3.9

0.98

3.7

0.92

3.7

0.92

4.2

1.05

4.5

1.12

4.8

1.2

5.1

1.27

Monthly average wind speed from Table 7

1.27

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5.1

Wind Factor  $(22a)m = (22)m \div 4$ 1.27

1.35

(22)m =

(22a)m



Adjusted infilt	ration rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	(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 effe		•	rate for t	he appli	cable ca	se	<u> </u>						
If mechanic			andiv NL (O	ah) (aa	s) Fm. / (	auatian (N	JEV otho	nuina (22h	) (220)			0	(23a)
If exhaust air I									) = (23a)			0	(23b)
If balanced wi		-	-	_					2h\ /	20h) [/	1 (00.0)	0	(23c)
a) If balanc (24a)m= 0		anicai ve	ntilation	with ne	at recove	ery (IVIVI	1R) (24a 0	0 = (2x)	2b)m + (2 0	23b) <b>x</b> [*	0	) ÷ 100] ]	(24a)
b) If balance						<u> </u>						]	(244)
(24b)m= 0		0	0	0 Williout	0	0	0	0	0	0	0	1	(24b)
c) If whole			<u> </u>		<u> </u>	<u> </u>						J	( -7
,	m < 0.5 ×			•	•				.5 × (23b	)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24c)
d) If natura	l ventilatio	n or wh	ole hous	e positiv	ve input	ventilatio	on from I	oft	!		!	•	
if (22b)	m = 1, the	en (24d)	m = (221)	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]		1	1	
(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 ai	<del></del>		<u> </u>		ŕ	<del>´ `</del>	<del></del>	<del>`</del>	1			1	
(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 loss	es and he	at loss p	oaramete	er:									
ELEMENT	Gros area	-	Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²-l		A X k kJ/K
Doors					2.08	x	1.5	_ =	3.12	Ť			(26)
Windows					3.2	x1.	/[1/( 1.5 )+	0.04] =	4.53				(27)
Walls Type1	38		0		38	x	0.25	□ = i	9.5				(29)
Walls Type2	22		2.08		19.92	<u>x</u>	0.23	<del>-</del>	4.5			i i	(29)
Walls Type3	6.4		3.2		3.2	x	0.25	<del>-</del>	0.8			i i	(29)
Roof Type1	25		0		25	x	0.16	<del>-</del>	4			i i	(30)
Roof Type2	1.5		0	=	1.5	x	0.16	<b>=</b> = i	0.24	T i			(30)
Total area of	elements,	m²			92.9								(31)
Party wall					28	x	0		0				(32)
Party floor					63.2							7 F	(32a)
* for windows an						ated using	ı formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	n 3.2	
Fabric heat lo							(26)(30)	+ (32) =				26.68	(33)
Heat capacity	/ Cm = S(	Axk)	,					((28).	(30) + (32	2) + (32a).	(32e) =	3423.8	
Thermal mass	s parame	ter (TMF	c = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Low		100	(35)
For design asses				construct	ion are no	t known pr	ecisely the	indicative	e values of	TMP in Ta	able 1f		
Thermal bridg	ges : S (L	x Y) cal	culated (	using Ap	pendix l	<						3.72	(36)
if details of them Total fabric he		are not kn	own (36) =	= 0.15 x (3	11)			(33) +	(36) =			20.4	(37)
Ventilation he		doulatoo	والطاهرة معمال	_						05) (5)		30.4	(31)
		uculaici	HODITHI	/				(38)m	$= 0.33 \times (200)$	25)m x (5)			

			T				l	· · · · -	l		l	l	l	(0.0)
(38)m=	16.39	16	16	15.29	14.86	14.66	14.47	14.47	14.96	15.29	15.63	16	I	(38)
	ransfer c		<del></del>						<del>- `                                   </del>	= (37) + (37)	<del>_</del>		1	
(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	45.74	(30)
Heat lo	oss para	meter (H	HLP), W	/m²K						Average = = (39)m ÷	Sum(39) <sub>1</sub> - (4)	12 /12=	45.74	(39)
(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		
Numbe	er of day	s in mo	nth (Tab	le 1a)					,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.58	(40)
	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. Wa	ater heat	ing ene	rgy requi	irement:								kWh/ye	ear:	
Assum	ned occu	pancy,	N								1	.15		(42)
if TF	A > 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13.				` '
	A £ 13.9 Laverag	•	ater usad	ne in litre	es ner da	av Vd av	erage =	(25 x N)	+ 36		61	.61		(43)
Reduce	the annua	ıl average	hot water	usage by	5% if the $c$	lwelling is	designed t	to achieve		se target o		.01		(40)
not more	e that 125	litres per	person pei	r day (all w	ater use, i	hot and co	ld)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage ir	n litres pei	day for ea	ach month T	Vd,m = fa T	ctor from 1	l able 1c x	(43) T				1	1	
(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		<b>—</b> ,
Energy	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	n x nm x E	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1		739.36	(44)
(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		
(12)			1	I		1					m(45) <sub>112</sub> =	1	971.74	(45)
If instan	taneous w	ater heati	ng at point	of use (no	o hot water	r 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)
	storage		ما معما ام		رم ما ما	(Id\A/la	/do. ().		-	-			l	\
,	anufactu				or is knov	wn (Kvvn	/day):					0		(47)
•	erature fa							(47) (40)				0		(48)
٠.	y lost fro ufacture		•			s not kno		(47) x (48)	) =			0	ı	(49)
	er volum		-					!				0		(50)
If con	nmunity he	eating and	l no tank in	dwelling,	enter 110	litres in bo	ox (50)							
Othe	rwise if no	stored ho	t water (th	is includes	s instantan	eous coml	bi boilers)	enter '0' in	box (50)					
Hot wa	ater stora	age loss	factor fr	om Tab	le 2 (kW	h/litre/da	ay)					0		(51)
	e factor											0		(52)
Tempe	erature fa	actor fro	m Table	2b								0	ļ	(53)
	y lost fro		_	, kWh/ye	ear			((50) x (51	l) x (52) x	(53) =		0		(54)
	(49) or (5	, ,	,					//=c				0	I	(55)
	storage		culated f					((56)m = (					1	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	1	(56)
	$\overline{}$		<u>.                                    </u>			L/= 2'	114.435	0)	<u></u>	<u> </u>	1144) 1 1		,	
If cylinde	er contains	dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	(57)

Primary cir	cuit loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary cir	cuit loss ca	culated f	or each	month (	(59)m =	(58) ÷ 36	65 × (4	1)m				•	
(modified	by factor f	rom Tabl	le H5 if t	here is s	solar wa	ter heati	ng and	a cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi loss	calculated	for each	month (	(61)m =	(60) ÷ 3	65 × (41	)m						
(61)m= 34.		32.03	29.78	29.51	27.35	28.26	29.51	29.78	32.03	32.21	34.54		(61)
Total heat	reauired for	water he	eating ca	alculated	for eac	h month	(62)m	= 0.85 × (	'45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 135		122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11		(62)
Solar DHW in	I put calculated	using App	endix G o	r Appendix	ι κ Η (negat	ve quantity	y) (enter	'0' if no sola	r contribu	tion to wate	r heating)		
(add addition											σ,		
(63)m=	0	0	0	0	0	0	0	0	0	0	0		(63)
Output fror	n water hea	ter		l .							l .	l	
(64)m= 135		122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11		
	<b>i</b>			ļ.	!		Oı	utput from wa	ater heate	r (annual)₁	12	1341.32	(64)
Heat gains	from water	heating,	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	ı + (61)	m] + 0.8 x	c [(46)m	+ (57)m	+ (59)m	1	
(65)m= 42.		38.24	33.8	32.67	28.66	27.29	30.59		35.37	37.93	41.08	_	(65)
include (	 57)m in cal	culation of	of (65)m	only if c	vlinder i	s in the	dwellin	g or hot w	ater is f	rom com	munity h	eating	
,	ıl gains (se		` '	-	•						•		
Metabolic o				/									
Ja		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 57.		57.71	57.71	57.71	57.71	57.71	57.71	57.71	57.71	57.71	57.71		(66)
Lighting ga	ins (calcula	ted in Ar	pendix	L. eguat	ion L9 o	r L9a). a	lso see	e Table 5				l	
(67)m= 9.5	<del>``</del>	6.93	5.24	3.92	3.31	3.58	4.65	6.24	7.92	9.25	9.86		(67)
Appliances	gains (calc	ulated in	Append	dix L. ea	uation L	13 or L1	3a), al	so see Tal	ble 5			l	
(68)m= 95.		93.65	88.35	81.67	75.38	71.19	70.2	72.69	77.98	84.67	90.95		(68)
Cooking ga	ins (calcula	ited in Ai	opendix	L. eguat	tion L15	or L15a	ı ). also	see Table	5	ı	<u> </u>	l	
(69)m= 28.		28.77	28.77	28.77	28.77	28.77	28.77	28.77	28.77	28.77	28.77		(69)
Pumps and	I fans gains	(Table 5	i	<u>l</u>		!		_!		Ţ	l		
(70)m= 1	<u> </u>	10	10	10	10	10	10	10	10	10	10		(70)
Losses e.g	evaporatio	n (negat	ive valu	es) (Tab	le 5)			Į.			<u> </u>		
(71)m= -46	<del>- i</del>	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17	-46.17		(71)
Water heat	ing gains (	rable 5)		<u> </u>	<u> </u>		<u> </u>			!	<u> </u>	l	
(72)m= 56.	<del></del>	51.4	46.95	43.91	39.81	36.68	41.11	42.96	47.55	52.68	55.21		(72)
Total inter	nal gains =	!		<u> </u>	(66	)m + (67)m	1 + (68)n	n + (69)m + (	 (70)m + (7	/1)m + (72)	m	l	
(73)m= 211	<del>-</del>	202.29	190.86	179.81	168.81	161.75	166.27	7 172.2	183.77	196.91	206.34		(73)
6. Solar g	ains:												
Solar gains	are calculated	using sola	r flux from	Table 6a	and assoc	iated equa	itions to	convert to th	e applical	ole orientat	ion.		
Orientation	: Access F	actor	Area		Flu	ıx		g_		FF		Gains	
	Table 6d		m²		Ta	ble 6a		Table 6b	Т	able 6c		(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	3	3.31	x [		0.63	x	0.7	=	32.57	(74)
North	0.9x	0.77	X	3.	2	x	5	4.64	x		0.63	_ x [	0.7	=	53.44	(74)
North	0.9x	0.77	X	3.	2	x	7	5.22	х		0.63	x	0.7	=	73.56	(74)
North	0.9x	0.77	X	3.	2	x	8	4.09	x		0.63	x	0.7	=	82.24	(74)
North	0.9x	0.77	X	3.	2	x	7	9.12	х		0.63	x	0.7	=	77.38	(74)
North	0.9x	0.77	X	3.	2	x	6	1.56	x		0.63	x	0.7	=	60.21	(74)
North	0.9x	0.77	X	3.	2	x	4	1.09	x		0.63	x	0.7	=	40.18	(74)
North	0.9x	0.77	X	3.	2	x	2	4.81	х		0.63	x	0.7	=	24.27	(74)
North	0.9x	0.77	X	3.	2	x	1	3.22	x		0.63	x	0.7	=	12.93	(74)
North	0.9x	0.77	X	3.	2	x	8	3.94	x [		0.63	x	0.7	=	8.75	(74)
Solar g	ains in		alculated	1	h month				(83)m	= Su	um(74)m .	(82)m			1	
(83)m=	10.49	19.91	32.57	53.44	73.56	Ь_	2.24	77.38	60.2	21	40.18	24.27	12.93	8.75		(83)
Ĭ			and solar	<del>`</del>	<del>`</del>	·							1		1	(0.4)
(84)m=	222.18	229.66	234.87	244.3	253.37	2	51.05	239.13	226.	.48	212.37	208.03	209.83	215.08		(84)
7. Me	an inter	nal temp	perature	(heating	season	)										
Temp	erature	during h	neating p	eriods ir	n the livi	ng	area f	from Tab	ole 9,	Th1	1 (°C)				21	(85)
Utilisa	tion fac		ains for	living are	ea, h1,m	ı (s	ee Ta	ble 9a)							1	
	Jan	Feb	Mar	Apr	May	L	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(86)m=	0.95	0.94	0.93	0.9	0.84	(	0.73	0.59	0.6	1	0.8	0.9	0.94	0.95		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (f	ollo	w ste	ps 3 to 7	in T	able	9c)				_	
(87)m=	18.02	18.2	18.65	19.16	19.87	2	0.44	20.77	20.7	76	20.28	19.5	18.61	18.11		(87)
Temp	erature	during h	neating p	eriods ir	n rest of	dw	elling	from Ta	able 9	), Th	n2 (°C)					
(88)m=	19.61	19.62	19.62	19.64	19.65	1	9.65	19.66	19.6	66	19.64	19.64	19.63	19.62		(88)
Utilisa	ation fac	tor for a	ains for	rest of d	welling,	h2,	m (se	e Table	9a)		-		-	-	-	
(89)m=	0.94	0.93	0.91	0.88	0.8	Т	0.65	0.45	0.4	7	0.73	0.87	0.93	0.94	]	(89)
Mean	interna	l temper	ature in	the rest	of dwell	ina	T2 (fd	ollow ste	ens 3	to 7	' in Tabl	e 9c)			4	
(90)m=	15.75	16.01	16.66	17.4	18.4	τŬ	9.15	19.53	19.5		18.96	17.89	16.6	15.88	]	(90)
		<u> </u>	<u> </u>	<u> </u>	<u>I</u>				!		f	LA = Livir	ng area ÷ (4	4) =	1.03	(91)
Mean	intorna	l tompor	ature (fo	r tha wh	ole dwe	llin	a) – fl	Λ <b>~</b> T1	<b>⊥</b> /1 .	_ fl	۸) ی T2					
(92)m=	18.1	18.27	18.72	19.22	19.92	_	0.48	20.82	20.		20.32	19.55	18.68	18.19	1	(92)
		<u> </u>	he mear	!	<u> </u>	_							1		J	` ,
(93)m=	17.95	18.12	18.57	19.07	19.77	1	0.33	20.67	20.6		20.17	19.4	18.53	18.04	]	(93)
8. Spa	ace hea	ting requ	uirement													
Set Ti	to the i	mean int	ernal ter	mperatu	re obtair	ned	at ste	ep 11 of	Table	e 9b	, so tha	t Ti,m=(	76)m an	d re-cal	culate	
the ut	ilisation	i	or gains	using Ta	ble 9a										1	
	Jan	Feb	Mar	Apr	May		Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
I			ains, hm	ī	0.0	1	0.7	0.50		, 1	0.70	0.00	0.04	0.00	1	(04)
(94)m=	0.93	0.92	0.9	0.87	0.8	<u> </u>	0.7	0.56	0.5	o	0.76	0.86	0.91	0.93	J	(94)
(95)m=	206.22	211.37	, W = (94 211.56	4)M X (8 212.42	4)m 202.71	1	74.8	134.49	131.	52	161.28	179.75	191.88	199.8	1	(95)
			rnal tem			_		107.40	L 131.		101.20	175.75	1 101.00	1 100.0	J	(00)
(96)m=	4.5	5	6.8	8.7	11.7	_	14.6	16.9	16.	9	14.3	10.8	7	4.9	1	(96)
` ′		I	I	I	I					1	•		<u>I</u>	<u> </u>	J	



Heat loss ra	te for me	an intern	al tempe	erature	Im W=	=[(39)m	x [(93)m	– (96)m	1				
(97)m= 629.35	1	546.05	473.99	365.41	258.21	168.96	168.22	266.31	393.11	530.53	609.46		(97)
Space heati	ng requir	ement fo	r each n	nonth, k\	Mh/mont	th = 0.02	24 x [(97	)m – (95	i (4) (4)	1)m			
(98)m= 314.81	267.17	248.86	188.33	121.04	0	0	0	0	158.74	243.83	304.79		
		•					Tota	l per year	(kWh/year	) = Sum(9	8)15,912 =	1847.57	(98)
Space heating	ng requir	ement in	kWh/m²	<sup>2</sup> /year								63.71	(99)
9a. Energy re	quiremer	nts – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space heat	_												_
Fraction of s	pace hea	at from s	econdar	y/supple	mentary	system						0	(201)
Fraction of s	pace hea	at from m	nain syst	em(s)			(202) = 1	- (201) =				1	(202)
Fraction of to	otal heati	ng from	main sys	stem 1			(204) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
Efficiency of	main spa	ace heat	ing syste	em 1								90	(206)
Efficiency of	seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heati	ng requir	ement (c	alculate	d above)									
314.81	267.17	248.86	188.33	121.04	0	0	0	0	158.74	243.83	304.79		
$(211)m = \{[(98)]$	8)m x (20	(21	0)m } x	100 ÷ (2	06)								(211)
349.79	296.86	276.51	209.26	134.49	0	0	0	0	176.37	270.92	338.65		_
							Tota	ıl (kWh/yea	ar) =Sum(2	211)	=	2052.86	(211)
Space heating	•		• •										
$= \{[(98)m \times (2000) + (2000)m \times (2000)m $	(01)] + (2	14) m } >   0	( 100 ÷ (	208) 0	0	0	0	0	0	0	0		
(213)111-	<u> </u>				0				ar) =Sum(2	_		0	(215)
Water heatin	a								(	715,1012			(210)
Output from v	_	iter (calc	ulated a	bove)									
135.29		122.95	109.05	105.58	92.98	89.08	99.31	100.41	114.34	122.06	132.11		
Efficiency of v	water hea	ater										90	(216)
(217)m= 90	90	90	90	90	90	90	90	90	90	90	90		(217)
Fuel for water	-												
(219)m = (64) (219)m = 150.32		) ÷ (217) 136.61	m 121.17	117.31	103.32	98.98	110.34	111.56	127.04	135.62	146.79		
(210)	1	1.00.01	.=		.00.02	00.00	ļ	I = Sum(2		.00.02		1490.36	(219)
Annual totals	S									Wh/year	. I	kWh/yea	
Space heating	g fuel use	ed, main	system	1						,		2052.86	
Water heating	g fuel use	ed										1490.36	j
Electricity for	pumps, f	ans and	electric	keep-ho	t								
central heati	ng pump	:									130		(230c)
boiler with a	fan-assis	sted flue									45		(230e)
Total electrici	ty for the	above, I	kWh/yea	r			sum	of (230a).	(230g) =			175	(231)
Electricity for	lighting											169.38	(232)
Electricity ger	nerated b	y PVs										-686.72	(233)



#### 12a. CO2 emissions – Individual heating systems including micro-CHP

	<b>Energy</b> 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)

OK

**OK** 

### **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:

3 D

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/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 17.80 kg/m<sup>2</sup>

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)	ОК
Openings	1.50 (max. 2.00)	1.50 (max. 3.30)	OK
esign air permeability			
Design air permeability	at 50 pascals	5.00	

Boiler system with radiators or underfloor - mains gas

Maximum

Main Heating system:

4 Heating efficiency

Data from manufacturer

Combi boiler

Efficiency 90.0 % SEDBUK2009

Minimum 88.0 % OK

10.0

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):

Based on:

Overshading:

Windows facing: North

Ventilation rate:

Blinds/curtains:

Slight

OK

Average or unknown

3.2m², Overhang twice as wide as window, ratio NaN

4.00

Dark-coloured curtain or roller blind shutter closed 100% of daylight hours

#### 10 Key features

Photovaltaic array



### **Predicted Energy Assessment**

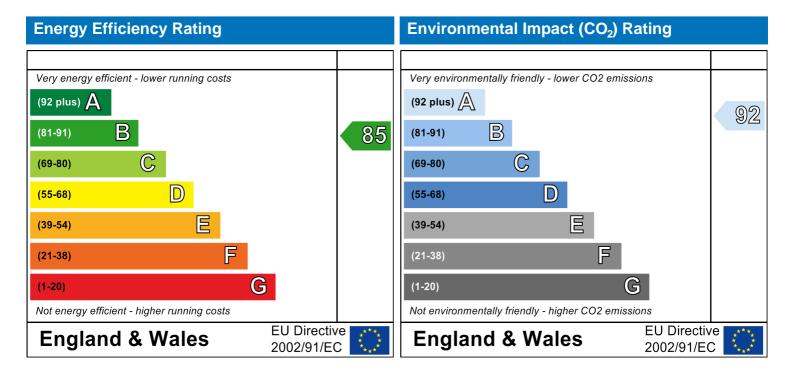
172 High St Teddington TW11 8HU Dwelling type: Date of assessment: Produced by: End-terrace Top floor Flat 22 May 2012 Dan Watt

29 m<sup>2</sup>

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.

Total floor area:

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.



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.