#### **Regulations Compliance Report**

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.9 Printed on 28 October 2020 at 14:55:02

Project Information:

Assessed By: Zahid Ashraf (STRO001082) **Building Type:** Flat

Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.54m<sup>2</sup> Plot Reference: Site Reference : Hermitage Lane Plot 12

Address:

Client Details:

Name: Address:

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)

Fuel factor: 1.00 (mains gas (c))

19.8 kg/m<sup>2</sup> Target Carbon Dioxide Emission Rate (TER)

Dwelling Carbon Dioxide Emission Rate (DER) 12.64 kg/m<sup>2</sup> OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 48.7 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 38.6 kWh/m<sup>2</sup>

OK 2 Fabric U-values

**Element Average Highest** 

0.15 (max. 0.70) External wall 0.14 (max. 0.30) OK Floor 0.12 (max. 0.25) 0.12 (max. 0.70) OK

Roof (no roof)

**Openings** 1.40 (max. 2.00) 1.40 (max. 3.30) OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 3.00 (design value)

OK Maximum 10.0

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

Space heating controls Charging system linked to use of community heating,

programmer and at least two room thermostats

Hot water controls: No cylinder thermostat

No cylinder

OK

# **Regulations Compliance Report**

400.007	
75.0%	OK
0.91	
1.5	OK
93%	
70%	ок
Medium	ок
Average or unknown	
8.65m <sup>2</sup>	
4.00	
3.0 m <sup>3</sup> /m <sup>2</sup> h	
0.12 W/m²K	
	1.5 93% 70% Medium Average or unknown 8.65m <sup>2</sup> 4.00

Assessor Name:			Llear	Details:										
Software Name:   Stroma FSAP 2012   Software Version:   Version: 1.0.5.9	Accessor Name:	Zahid Ashraf	0361		a Nium	hor		STDO	001082					
## Area(m²)   Av. Height(m)   Volume(m²)														
Area(m²)			Property	/ Address:	Plot 12									
Area(m/*)														
Second floor   So.54   (1a) x   2.5   (2a)   = 126.36   (3a)	Overall dwelling dime	ensions:	<b>A</b>	( 2)		A 11-	tall ((as)		)/ - l (2					
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)	Ground floor		Ar		(1a) x			] <sub>(2a)</sub> =	· ·	<u>-</u>				
Dwelling volume		a)+(1b)+(1c)+(1d)+(1e)-	- (1n) -					]`` ''	120.00					
2. Ventilation rate:    main   heating   heating   heating   heating	·	۵, ۱(۱۵,۱(۱۵,۱(۱۵,۱		50.54		)+(3c)+(3c	d)+(3e)+	.(3n) =	126.26	7(5)				
Number of chimneys					(54) (55)	,	.,, (33)	.(6)	120.30	(5)				
Number of chimneys	2. Ventilation rate:			other		total			m³ per hou	r				
Number of open flues  0 + 0 + 0 = 0 x20 = 0 (6b)  Number of intermittent fans  0 x10 = 0 (7a)  Number of passive vents  0 x40 = 0 (7c)  Number of flueless gas fires  0 x40 = 0 (7c)  Air changes per hour  Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 (5) = 0 (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)  Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  if both types of wall are present, use the value corresponding to the greater well area (after deducting areas of openings); if equal use 0.35  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  120  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0 25 - [0.2 × (14) + 100] = (15)  Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (15)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)  If based on air permeability value, then (18) = ((17) + 20)+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Q0 112  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m 5.1 5 4.9 4.4 4.3 3.8 3.8 3.8 3.7 4 4.3 4.5 4.7	Number of chimnevs		<del></del>	0	1 = [	0	x 4	40 =	0	(6a)				
Number of intermittent fans	•				]		x	20 =		=				
Number of passive vents	·				J		x	10 =		<b></b>				
Number of flueless gas fires					L					=				
Air changes per hour  Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	·				L				<u> </u>	Ⅎ				
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	Number of flueless gas fi	163				0			U	(70)				
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)								Air ch	anges per ho	our				
Number of storeys in the dwelling (ns)   Additional infiltration   (g)-1)x0.1 =   0 (10) (10)	Infiltration due to chimne	ys, flues and fans = (6a)	+(6b)+(7a)+(7b)	+(7c) =	Γ	0		÷ (5) =	0	(8)				
Additional infiltration			, proceed to (17)	, otherwise o	ontinue fr	om (9) to	(16)	•						
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  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  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 × (14) ÷ 100] =  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) =  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 × (19)] =  0.12  (21)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4	•	ne dwelling (ns)					[(9)]	-1]v0 1 =		<b></b> 1				
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  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 x (14) ÷ 100] = 0  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) = 0  If based on air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 x (19)] = 0.78  (20)  Infiltration rate incorporating shelter factor  (21) = (18) x (20) = 0.12  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4		.25 for steel or timber fra	ame or 0.35 f	or masonr	v constr	uction	[(0)	1]XO.1 =		= ' '				
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If no draught lobby, enter 0.05, else enter 0	•	• /	d) or 0.1 (sea	led) else	enter ()			i	0	7(12)				
Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 x (14) ÷ 100] = 0 (15)  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  3 (17)  If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 x (19)] = 0.78 (20)  Infiltration rate incorporating shelter factor  (21) = (18) x (20) = 0.12 (21)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4	•	•	a) or o.1 (30a	iica), cisc	CITICI O					=				
Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0.015$ Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0.016$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area $3.017$ If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered $(20) = 1 - [0.075 \times (19)] = 0.78$ Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.12$ Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= $5.1$ $5$ $4.9$ $4.4$ $4.3$ $3.8$ $3.8$ $3.7$ $4$ $4.3$ $4.5$ $4.7$ Wind Factor $(22a)m = (22)m \div 4$	• •		pped					-		= ' '				
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If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] =$ $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ $(21) = (18) \times (20) =$ Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7 $(22)m = 5.1  5  4.9  4.4  4.3  3.8  3.8  3.7  4  4.3  4.5  4.7$ Wind Factor $(22a)m = (22)m \div 4$	Infiltration rate			(8) + (10)	+ (11) + (1	2) + (13)	+ (15) =		0	(16)				
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Number of sides sheltered	•	-							0.15	(18)				
Shelter factor $ (20) = 1 - [0.075 \times (19)] = 0.78                                   $			oeen done or a d	legree air pei	meability	is being u	sed		2	7(10)				
Infiltration rate incorporating shelter factor $ (21) = (18) \times (20) =                                   $		,u		(20) = 1 - [	0.075 x (1	9)] =				<b>⊣</b>				
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           Monthly average wind speed from Table 7           (22)m=         5.1         5         4.9         4.4         4.3         3.8         3.7         4         4.3         4.5         4.7           Wind Factor (22a)m = (22)m ÷ 4	Infiltration rate incorporat	ting shelter factor		(21) = (18)	x (20) =				0.12	=				
Monthly average wind speed from Table 7 (22)m= $\begin{bmatrix} 5.1 & 5 & 4.9 & 4.4 & 4.3 & 3.8 & 3.8 & 3.7 & 4 & 4.3 & 4.5 & 4.7 \end{bmatrix}$ Wind Factor (22a)m = (22)m $\div$ 4	Infiltration rate modified f	or monthly wind speed												
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec						
Wind Factor (22a)m = (22)m ÷ 4	Monthly average wind sp	eed from Table 7												
	(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7						
	Wind Factor (22a)m = (2	2)m ÷ 4												
(22a)m= 1.27   1.25   1.23   1.1   1.08   0.95   0.95   0.92   1   1.08   1.12   1.18		<del></del>	0.95	0.92	1	1.08	1.12	1.18						

Adjusted infiltra	ation rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14	]	
Calculate effect		•	rate for t	he appli	cable ca	se	•		•	•	•	,	
If mechanica			andiv N. (2	2h) _ (22c	) Em. (	auation (	VEVV otho	auioo (22h	\ _ (22a\			0.5	(23a
If balanced with		•		, ,		•		,	) = (23a)			0.5	(23b
		-	-	_					DL \ (	001.)	4 (00 -)	79.05	(230
a) If balance						<del>-                                    </del>	<del>- ^ ` </del>	<del>``</del>	<del>- ` `</del>	<del></del>	<del>- `                                   </del>	) ÷ 100] ]	(24a
(24a)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24	]	(24a
b) If balance						<del>-                                    </del>	<del>, ``</del>	<u> </u>	<del> </del>	<del></del>	Ι ,	1	(24b
(24b)m= 0	0	0	0	0		0	0	0	0	0	0		(24)
c) If whole ho if (22b)m				•	•				5 v (22h	.)			
(24c)m = 0	0.5 x	0	0	0	0	0	$\frac{C) = (221)}{0}$	0	0 × (231	0	0	1	(240
` ' '						<u> </u>						J	(= .5
d) If natural v if (22b)m				•	•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(240
Effective air	change	rate - er	nter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)				•	
(25)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24	]	(25)
2 Heat leases	مط امدید	ot loop i	2 2 2 2 2 2 4	~ # ·									
3. Heat losses		·			Not Ar	•••	اميرال	10	AXU		le volue		ΑΧk
ELEMENT	Gros area	_	Openin m		Net Ar A ,r		U-valı W/m2		(W/I	K)	k-value kJ/m²-		kJ/K
Doors					2	X	1.4	_ =	2.8				(26)
Windows					8.651	x1	/[1/( 1.4 )+	0.04] =	11.47	=			(27)
Floor					33.58	6 x	0.12	[	4.03032				(28)
Walls Type1	19.7	7	8.65		11.05		0.15	<u> </u>	1.66	=		<b>-</b>	(29)
Walls Type2	19.7		2	=	17.7	=	0.14		2.5	<b>=</b>		<b>=</b>  =	(29)
Total area of el						=	0.14		2.0				(31)
* for windows and		,	effective wi	ndow H-va	72.98		n formula 1	/[(1/Ll-valu	ıe)±0 041 a	as aiven in	naragrani	132	(31)
** include the area						atou uomg	, rommaia i	n no vara	0,10.0-1, 0	io givori iii	paragrapi	7 0.2	
Fabric heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				22.46	(33)
Heat capacity (	Cm = S(	Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	2921.41	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For design assess	ments wh	ere the de	tails of the	construct	ion are no	t known pi	ecisely the	indicative	values of	TMP in Ta	able 1f		
can be used instea						_							
Thermal bridge	`	,		٠.	•	<						6.06	(36)
if details of therma  Total fabric hea		are not kn	iown (36) =	= 0.05 x (3	11)			(33) +	(36) =			20.52	(27)
Ventilation hea		alculated	l monthly	,					(30) = = 0.33 × (	25\m v (5)	1	28.52	(37)
					lun	1,.1	۸۰۰۰				i e	1	
(38)m= 10.55	Feb 10.43	Mar 10.31	Apr 9.7	9.58	Jun 8.97	Jul 8.97	Aug 8.85	Sep 9.22	Oct 9.58	9.82	10.06	1	(38)
` '			J.,	0.00	0.31	0.91	1 0.00			<u> </u>	10.00	J	(30)
Heat transfer c			00.5		l	c= =			= (37) + (3		00.55	1	
(39)m= 39.07	38.95	38.83	38.22	38.1	37.5	37.5	37.38	37.74	38.1	38.34	38.59	20.40	(20)
								,	Average =	Sum(39)₁	12 /12=	38.19	(39)

Heat loss par	ameter (I	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m= 0.77	0.77	0.77	0.76	0.75	0.74	0.74	0.74	0.75	0.75	0.76	0.76		
	-!					l	l		Average =	: Sum(40) <sub>1</sub>	12 /12=	0.76	(40)
Number of da	<del>i                                     </del>	nth (Tab	le 1a)		ı			1	1				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ating ene	rgy requ	irement:								kWh/ye	ar:	
Assumed occ if TFA > 13 if TFA £ 13	s.9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		71		(42)
Annual avera Reduce the annu not more that 12	ual average	hot water	usage by	5% if the $a$	lwelling is	designed t			se target o		3.65		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage								- 1					
(44)m= 86.52	83.37	80.23	77.08	73.93	70.79	70.79	73.93	77.08	80.23	83.37	86.52		
	_ <b>!</b>								Total = Su	ım(44) <sub>112</sub> =	-	943.85	(44)
Energy content of	of hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	n x nm x C	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 128.31	112.22	115.8	100.96	96.87	83.59	77.46	88.89	89.95	104.82	114.42	124.26		_
If instantaneous	water heat	na at naint	of uso (no	hot water	r storago)	ontor O in	havas (16		Total = Su	ım(45) <sub>112</sub> =	= [	1237.53	(45)
			· `	·	· · ·		· · ·	, , , I		1			(40)
(46)m= 19.25 Water storage	16.83 e loss:	17.37	15.14	14.53	12.54	11.62	13.33	13.49	15.72	17.16	18.64		(46)
Storage volur		) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community	heating a	and no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if r	no stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage													
a) If manufac				or is kno	wn (kWł	n/day):					0		(48)
Temperature											0		(49)
Energy lost fr		•			or io not		(48) x (49)	) =		1	10		(50)
<ul><li>b) If manufact</li><li>Hot water sto</li></ul>			-							0	02		(51)
If community	•			_ (	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	-77				0.	.02		(0.7)
Volume facto	r from Ta	ble 2a								1.	.03		(52)
Temperature	factor fro	m Table	2b							0	.6		(53)
Energy lost fr		_	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter (50) or	(54) in (	55)								1.	.03		(55)
Water storage	e loss cal	culated	for each	month			((56)m = (	(55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain	ns 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 Appendi	хH	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circu	it loss (ar	nnual) fro	m Table	 3					_		0		(58)
Primary circu	`	,			59)m = (	(58) ÷ 36	65 × (41)	m					
(modified b	y factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$												
(61)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(61)											
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m + (62)m + (63)m + (64)m + (64)m + (65)m + (65)m$	. ,											
(62)m= 183.58   162.14   171.07   154.45   152.15   137.08   132.74   144.16   143.44   160.1   167.92   179.53	(62)											
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)	(02)											
(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 0 0	(63)											
Output from water heater												
(64)m= 183.58 162.14 171.07 154.45 152.15 137.08 132.74 144.16 143.44 160.1 167.92 179.53												
Output from water heater (annual) <sub>112</sub> 1888.37	(64)											
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]												
(65)m= 86.88 77.25 82.72 76.36 76.43 70.59 69.98 73.78 72.7 79.08 80.84 85.54	(65)											
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating												
5. Internal gains (see Table 5 and 5a):												
Metabolic gains (Table 5), Watts												
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												
(66)m= 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31 85.31	(66)											
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
(67)m= 13.65 12.12 9.86 7.47 5.58 4.71 5.09 6.62 8.88 11.28 13.16 14.03	(67)											
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
(68)m= 148.65 150.19 146.3 138.03 127.58 117.77 111.21 109.66 113.55 121.83 132.27 142.09	(68)											
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
(69)m= 31.53 31.53 31.53 31.53 31.53 31.53 31.53 31.53 31.53 31.53 31.53 31.53	(69)											
Pumps and fans gains (Table 5a)												
(70)m= 0 0 0 0 0 0 0 0 0 0 0 0 0	(70)											
Losses e.g. evaporation (negative values) (Table 5)												
(71)m= -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25 -68.25	(71)											
Water heating gains (Table 5)												
(72)m= 116.78 114.96 111.19 106.06 102.73 98.04 94.05 99.16 100.98 106.28 112.28 114.97	(72)											
Total internal gains = $(66)m + (67)m + (68)m + (70)m + (71)m + (72)m$	, ,											
(73)m= 327.67 325.87 315.95 300.15 284.49 269.11 258.94 264.03 272 287.98 306.31 319.68	(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 m² Table 6a Table 6b Table 6c (W)												
Northeast 0.9x 0.77 x 8.65 x 11.28 x 0.63 x 0.7 = 29.83	(75)											
Northeast 0.9x 0.77 x 8.65 x 22.97 x 0.63 x 0.7 = 60.72	(75)											
Northeast 0.9x 0.77 x 8.65 x 41.38 x 0.63 x 0.7 = 109.4	(75)											
Northeast 0.9x 0.77 x 8.65 x 67.96 x 0.63 x 0.7 = 179.67	(75)											

Northeast <sub>0.9x</sub>	0.77	X	8.6	65	x	97.38	x[		0.63	x	0.7	=	257.47	(75)
Northeast <sub>0.9x</sub>	0.77	x	8.6	65	x	91.1	_ x [		0.63	x	0.7	=	240.86	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	65	x	72.63	X		0.63	x	0.7	=	192.02	(75)
Northeast <sub>0.9x</sub>	0.77	Х	8.6	65	x	50.42	<b>x</b> [		0.63	x	0.7	=	133.31	(75)
Northeast <sub>0.9x</sub>	0.77	Х	8.6	55	x	28.07	x		0.63	x	0.7	=	74.21	(75)
Northeast <sub>0.9x</sub>	0.77	x	8.6	55	x	14.2	x		0.63	x	0.7		37.53	(75)
Northeast 0.9x	0.77	х	8.6	65	х	9.21	x		0.63	_ x [	0.7	=	24.36	(75)
•							•							
Solar gains in	watts, ca	alculated	for eacl	h month			(83)m	= St	um(74)m .	(82)m				
(83)m= 29.83	60.72	109.4	179.67	241.51	257.47	240.86	192.	.02	133.31	74.21	37.53	24.36		(83)
Total gains –	internal a	nd solar	(84)m =	= (73)m	+ (83)m	, watts							•	
(84)m= 357.5	386.59	425.35	479.81	525.99	526.58	499.8	456.	.05	405.31	362.19	343.84	344.04		(84)
7. Mean inte	rnal temp	erature	(heating	season	)									
Temperature	during h	eating p	eriods ir	the livi	ng area	from Tal	ble 9,	Th	1 (°C)				21	(85)
Utilisation fa	ctor for g	ains for I	iving are	ea, h1,m	(see T	able 9a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(86)m= 0.94	0.92	0.87	0.76	0.61	0.44	0.33	0.3	7	0.59	0.81	0.91	0.94		(86)
Mean interna	el temper	atura in	living ar	22 T1 (f	ollow et	one 3 to -	7 in T	ahle.	2 9c)					
(87)m= 19.71	19.89	20.21	20.6	20.85	20.96	20.99	20.9		20.9	20.58	20.1	19.68		(87)
` '	ļ				<u> </u>	ļ		!						, ,
Temperature (88)m= 20.28	20.28	eating p				Ť	Т		` ,	20.29	1 20 20	20.20	Ī	(88)
(88)m= 20.28	20.28	20.28	20.29	20.29	20.3	20.3	20.3	31	20.3	20.29	20.29	20.29		(00)
Utilisation fa	<del> </del>	ains for i		welling,	h2,m (s	ee Table	9a)					1	Ī	
(89)m= 0.93	0.91	0.85	0.74	0.57	0.4	0.28	0.3	32	0.54	0.78	0.9	0.94		(89)
Mean_interna	al temper	ature in	the rest	of dwell	ing T2 (	follow ste	eps 3	to 7	in Tabl	e 9c)				
(90)m= 18.54	18.8	19.25	19.8	20.13	20.27	20.3	20.2	29	20.2	19.78	19.11	18.5		(90)
									f	LA = Livir	ng area ÷ (	4) =	0.43	(91)
Mean interna	al temper	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1 -	– fL	A) × T2					
(92)m= 19.04	19.27	19.67	20.15	20.44	20.57	20.6	20.5		20.51	20.12	19.53	19.01		(92)
Apply adjust	ment to t	he mean	internal	temper	ature fr	om Table	4e, v	whe	re appro	priate			l	
(93)m= 19.04	19.27	19.67	20.15	20.44	20.57	20.6	20.5	59	20.51	20.12	19.53	19.01		(93)
8. Space hea	ating requ	uirement												
Set Ti to the					ned at s	tep 11 of	Table	e 9b	o, so tha	t Ti,m=(	76)m an	d re-calc	culate	
the utilisation	1				<del> </del>	1	<del>.</del>		_		1	Ι_	Ī	
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
Utilisation factors (94)m= 0.91	otor for g	ains, nm 0.84	0.73	0.58	0.41	0.3	0.3	, <u>,</u> [	0.55	0.78	0.88	0.92		(94)
(94)m= 0.91 Useful gains					0.41	0.3	0.3	94	0.55	0.76	0.00	0.92		(34)
(95)m= 326.9	344.37	356.67	350.66	304.14	217.26	148.3	154.	27	223.85	281.19	303.19	317.12		(95)
Monthly ave					ļ	140.0	104.	'	220.00	201.10	000.10	017.12		()
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.	.4	14.1	10.6	7.1	4.2		(96)
Heat loss rat					l .	1					<u> </u>	<u> </u>		
(97)m= 576.08	1	511.23	429.84	333.11	223.87	149.86	156.	<del></del>	241.78	362.88	476.81	571.45		(97)
Space heatir	ng require	ement fo	r each n	nonth, k	Wh/mor	1 = 0.02	24 x [	(97)	m – (95	)m] x (4	1)m	!	1	
(98)m= 185.39	<del></del>	114.99	57.01	21.55	0	0	0	Ť	0	60.78	125	189.22		
						•							1	

Total per year (kWh/year) = Sum(98) <sub>15,912</sub> =	898.63	(98)
Space heating requirement in kWh/m²/year	17.78	(99)
9b. Energy requirements – Community heating scheme		
This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)
The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; to	L he latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C. Fraction of heat from Community boilers		(303a)
Fraction of total space heat from Community boilers (302) x (303a) =	1	(304a)
	1	╡`
Factor for control and charging method (Table 4c(3)) for community heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	1.05	(306)
Space heating Annual space heating requirement	<b>kWh/yea</b> 898.63	<u></u>
Space heat from Community boilers (98) x (304a) x (305) x (306) =	943.56	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) =	0	(309)
		`
Water heating Annual water heating requirement	1888.37	٦
If DHW from community scheme:		
Water heat from Community boilers (64) x (303a) x (305) x (306) =	1982.79	(310a)
Electricity used for heat distribution 0.01 × [(307a)(307e) + (310a)(310e)] =	29.26	(313)
Cooling System Energy Efficiency Ratio	0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0) = $(107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside	175.36	(330a)
warm air heating system fans	0	(330b)
pump for solar water heating	0	(330g)
Total electricity for the above, kWh/year =(330a) + (330b) + (330g) =	175.36	(331)
Energy for lighting (calculated in Appendix L)	241.09	(332)
Electricity generated by PVs (Appendix M) (negative quantity)	-510.48	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)	0	(334)
12b. CO2 Emissions – Community heating scheme		
Energy Emission factor kWh/year kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)  Efficiency of heat source 1 (%)  If there is CHP using two fuels repeat (363) to (366) for the second fuel	94	(367a)
CO2 associated with heat source 1 [(307b)+(310b)] x 100 ÷ (367b) x 0.22 =	672.44	(367)
Electrical energy for heat distribution [(313) x 0.52 =		(372)

Total CO2 associated with community systems	(363)(366) + (368)(372)		=	687.63	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instanta	neous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			687.63	(376)
CO2 associated with electricity for pumps and fans within dwe	elling (331)) x	0.52	=	91.01	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	125.12	(379)
Energy saving/generation technologies (333) to (334) as appl Item 1		.52 x 0.01	1 = _	-264.94	(380)
Total CO2, kg/year sum of (376)(382) =				638.82	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =				12.64	(384)
El rating (section 14)				91.04	(385)

#### **SAP 2012 Overheating Assessment**

Calculated by Stroma FSAP 2012 program, produced and printed on 28 October 2020

Property Details: Plot 12

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: No Number of storeys: 1

Front of dwelling faces: South West

Overshading: Average or unknown

Overhangs: None

Thermal mass parameter: Indicative Value Low

**Night ventilation:** False

Blinds, curtains, shutters:

Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 166.8 (P1)

Transmission heat loss coefficient: 28.5

Summer heat loss coefficient: 195.32 (P2)

Overhangs:

Orientation: Ratio: Z\_overhangs:

North East (NE) 0 1

Solar shading:

Orientation:Z blinds:Solar access:Overhangs:Z summer:North East (NE)10.910.9

Solar gains:

Orientation FF Area Flux Shading Gains  $g_{-}$ 98.85 0.9 305.45 North East (NE) 0.9 x8.65 0.63 0.7 **Total** 305.45 (P3/P4)

Internal gains:

June July **August** 360.45 Internal gains 366.65 353.83 696.41 659.28 610.35 (P5) Total summer gains Summer gain/loss ratio 3.57 3.38 3.12 (P6) Mean summer external temperature (Thames valley) 16 17.9 17.8 Thermal mass temperature increment 1.3 1.3 1.3 (P7) Threshold temperature 20.87 22.58 22.22 Likelihood of high internal temperature Slight Medium Medium

Assessment of likelihood of high internal temperature: Medium

		User_[	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	0001082 on: 1.0.5.9							
		Property	Address	: Plot 12					
Address :									
1. Overall dwelling dime	ensions:								
One word floor			a(m²)	1,, ,	Av. He	<u> </u>	<u>^</u>	Volume(m <sup>3</sup>	<u>-</u>
Ground floor			50.54	(1a) x	2	2.5	(2a) =	126.36	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(	n)	50.54	(4)					
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+.	(3n) =	126.36	(5)
2. Ventilation rate:									
	main seconda heating heating		other		total			m³ per hou	ır
Number of chimneys	0 + 0	+ [	0	_ = [	0	,	x 40 =	0	(6a)
Number of open flues	0 + 0	_ + [	0	<u> </u>	0	;	x 20 =	0	(6b)
Number of intermittent fa	ins				2	;	x 10 =	20	(7a)
Number of passive vents	;				0		x 10 =	0	(7b)
Number of flueless gas fi					0		x 40 =	0	(7c)
				L					(, o)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+$	(7a)+(7b)+	(7c) =	Γ	20		÷ (5) =	0.16	(8)
	peen carried out or is intended, proce	ed to (17),	otherwise (	continue fi	rom (9) to	(16)			
Number of storeys in the Additional infiltration	he dwelling (ns)						2) 41-0 4	0	(9)
	.25 for steel or timber frame of	or 0 35 fc	ır masonı	rv consti	ruction	[(3	9)-1]x0.1 =	0	(10)
	resent, use the value corresponding			•	detion			0	(11)
deducting areas of openi		24/	1) 1						_
·	floor, enter 0.2 (unsealed) or	J.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	s and doors draught stripped							0	(13)
Window infiltration	o and doors draught stripped		0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (	12) + (13) -	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic meti	es per h	our per s	quare m	etre of e	envelop	e area	3	(17)
If based on air permeabil	lity value, then $(18) = [(17) \div 20]$	(8), otherw	vise (18) =	(16)				0.31	(18)
	es if a pressurisation test has been de	one or a de	gree air pe	rmeability	is being u	sed			<b></b>
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0.075 x (	19)] =			0.78	(19) (20)
Infiltration rate incorporate	ting shelter factor		(21) = (18	3) x (20) =	,-			0.78	(21)
Infiltration rate modified f	•							0.24	(= : /
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
Monthly average wind sp	peed from Table 7	•	•	•	•		•	•	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a) == (2	2)m : 4		-	•	-		_	-	
Wind Factor $(22a)m = (2(22a)m = 1.27   1.25)$	2)m ÷ 4 1.23	0.95	0.92	1	1.08	1.12	1.18	]	
(220)1117 1.21 1.20	1.20 1.11 1.00 0.30	1 0.00	1 0.02		L	1.12	10	J	

Adjusted infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.3	0.3	0.29	0.26	0.26	0.23	0.23	0.22	0.24	0.26	0.27	0.28		
Calculate effe		•	rate for t	he appli	cable ca	se	•	•	•	•	•	•	<del></del> .
If mechanica			andiv N. (O	ah) (aa	s) Fm. / (	auation (	NEN othor	muiaa (22h	·) (22a)			0	(238
If exhaust air h		0 11		, ,	,	. ,	,, .	,	)) = (23a)			0	(23h
If balanced with		-	-	_								0	(230
a) If balance		·	i		·	<u> </u>	<del>- ´ `                                  </del>	ŕ	<del>-                                    </del>	<del></del>	<del>- `                                   </del>	) ÷ 100] 1	(0.4)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24a
b) If balance							<del>,                                    </del>	ŕ	<del>r ´       `</del>	<del></del>		1	(2.1)
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h				•	•				- (00)	,			
	i	· · · · ·	then (24d		i e		· · · · ·	r e	· ·	i	1 .	1	(0.4)
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(240
d) If natural if (22b)r			ole hous m = (22b						0.5]		,		
(24d)m= 0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.52	0.53	0.53	0.54	0.54		(240
Effective air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in box	x (25)				_	
(25)m= 0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.52	0.53	0.53	0.54	0.54		(25)
3. Heat losse	s and he	eat loss i	paramete	er.									
ELEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/	K)	k-value kJ/m²-l		A X k kJ/K
Doors	a.oa	( )	•••	-	2	 x	1.4	 = [	2.8				(26)
Windows					8.651	╡,	/[1/( 1.4 )+	!	11.47	$\dashv$			(27)
Floor						_							
					33.58	=	0.12	=	4.0303	<u></u>		$\dashv$ $\vdash$	(28)
Walls Type1	19.	7	8.65		11.05	x	0.15	=	1.66	ᆜ !		-	(29)
Walls Type2	19.		2		17.7	X	0.14	= [	2.5				(29)
Total area of e					72.98								(31)
* for windows and ** include the area						ated using	g formula 1	/[(1/U-valu	ıe)+0.04] á	as given in	paragraph	1 3.2	
Fabric heat los				is and pan	uuons		(26)(30)	) + (32) =				22.46	(33
Heat capacity		,	σ,				, , , ,		(30) + (32	2) + (32a)	(32e) =	2921.41	(34)
Thermal mass			P – Cm –	- TFΔ) ir	n k I/m²K			., ,	itive Value	, , ,	(020) =		=
For design assess	•	,		•			ecisely the				able 1f	100	(35)
can be used inste				CONSTRUCT	ion are no	. Kilowii pi	colocity the	maioaire	varaco or	, , , , , , , , , , , , , , , , , , ,	abic II		
Thermal bridge	es : S (L	x Y) cal	culated (	using Ap	pendix l	<						6.06	(36
f details of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	11)								
Total fabric he	at loss							(33) +	(36) =			28.52	(37)
Ventilation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (	(25)m x (5)	)	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	[	
38)m= 22.78	22.71	22.64	22.29	22.23	21.92	21.92	21.87	22.04	22.23	22.36	22.49		(38)
Heat transfer	coefficier	nt, W/K						(39)m	= (37) + (	38)m			
							·		T			7	
(39)m= 51.31	51.23	51.16	50.81	50.75	50.45	50.45	50.39	50.56	50.75	50.88	51.02		

Heat loss para	meter (I	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.02	1.01	1.01	1.01	1	1	1	1	1	1	1.01	1.01		
		!			<u> </u>				Average =	Sum(40) <sub>1</sub> .	12 /12=	1.01	(40)
Number of day	s in mo	nth (Tab	le 1a)								•		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13		71		(42)
Annual averag Reduce the annua	e hot wa al average	hot water	usage by	5% if the a	lwelling is	designed t			se target c		.65		(43)
not more that 125	litres per	person per	aay (ali w	rater use, r r	not ana co r	ıа) г					1		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	able 1c x	(43)				· · · · · · · · · · · · · · · · · · ·		
(44)m= 86.52	83.37	80.23	77.08	73.93	70.79	70.79	73.93	77.08	80.23	83.37	86.52		_
Energy content of	hot water	used - cal	culated mo	onthly = $4$ .	190 x Vd,r	m x nm x E	)Tm / 3600			ım(44) <sub>112</sub> = ables 1b, 1		943.85	(44)
(45)m= 128.31	112.22	115.8	100.96	96.87	83.59	77.46	88.89	89.95	104.82	114.42	124.26		
				ı	I.	ı	ı		Total = Su	ım(45) <sub>112</sub> =	=	1237.53	(45)
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	) to (61)			'		_
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage									•				
Storage volum	e (litres)	) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	-			•			' '		(01.1	· \			
Otherwise if no		not wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er 'O' in (	(47)			
Water storage  a) If manufact		eclared l	oss facto	or is kno	wn (k\/\/ł	n/day).					0		(48)
Temperature fa				JI 13 KIIO	WII (ICVVI	ı, day j.							
•				oor			(48) x (49)	<b>\</b> _			0		(49)
Energy lost fro b) If manufact		_	-		or is not		(46) X (49)	) =			0		(50)
Hot water stora			-								0		(51)
If community h	_			•									, ,
Volume factor	from Ta	ble 2a									0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro	m watei	storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or (	54) in (5	55)									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	T 0	О	0		(56)
If cylinder contains	dedicate	-		-				-			-	ix H	, ,
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nual) fro	m Tahla	3							0		(58)
Primary circuit	•	•			59)m = (	(58) ÷ 36	55 × (41)	m					` '
(modified by				•	•	. ,	, ,		r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)
						L	L	L	ь	L			

Combi loss calculate	d for each	month (	(61)m =	(60) ÷ 3	65 × (41	)m							
(61)m= 0 0	0	0	0 0	0	00 % (41)	)   0		0	0	T 0	0	]	(61)
Total heat required for	or water h	eating ca	alculated	l for eac	h month	<u> </u>	!			ļ	ļ	J (59)m + (61)m	, ,
(62)m= 109.06 95.38		85.81	82.34	71.05	65.84	75.	_	76.45	89.1	97.26	105.62	]	(62)
Solar DHW input calculate	d using App	endix G o	r Appendix	L H (negat	Iive quantity	y) (ent	er '0'	if no sola	r contribu	I ition to wate	er heating)	J	
(add additional lines											0,		
(63)m= 0 0	0	0	0	0	0	0		0	0	0	0	]	(63)
Output from water he	ater						•			•	!	•	
(64)m= 109.06 95.38	98.43	85.81	82.34	71.05	65.84	75.	55	76.45	89.1	97.26	105.62	]	
		Į.	ı	<u> </u>			Outp	ut from wa	ater heat	er (annual)	112	1051.9	(64)
Heat gains from water	er heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (6	1)m	] + 0.8 x	: [(46)m	n + (57)m	+ (59)m	]	
(65)m= 27.26 23.85	24.61	21.45	20.58	17.76	16.46	18.8	89	19.11	22.28	24.32	26.4	]	(65)
include (57)m in ca	alculation	of (65)m	only if c	ylinder i	s in the	dwell	ing (	or hot w	ater is	from com	munity h	neating	
5. Internal gains (s	ee Table 5	and 5a	):									-	
Metabolic gains (Tab			,										
Jan Feb		Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(66)m= 85.31 85.31	85.31	85.31	85.31	85.31	85.31	85.3	31	85.31	85.31	85.31	85.31	1	(66)
Lighting gains (calcu	lated in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso s	ee T	Table 5				•	
(67)m= 13.65 12.12	9.86	7.47	5.58	4.71	5.09	6.6	52	8.88	11.28	13.16	14.03	]	(67)
Appliances gains (ca	lculated ir	Append	dix L, eq	uation L	.13 or L1	3a), a	also	see Tal	ole 5	•	•	•	
(68)m= 148.65 150.1	146.3	138.03	127.58	117.77	111.21	109.	.66	113.55	121.83	132.27	142.09	]	(68)
Cooking gains (calcu	lated in A	ppendix	L, equat	ion L15	or L15a	), als	o se	e Table	5	•	•	•	
(69)m= 31.53 31.53	31.53	31.53	31.53	31.53	31.53	31.	53	31.53	31.53	31.53	31.53	]	(69)
Pumps and fans gair	ıs (Table క	Ба)	•		•		•			•	•	4	
(70)m= 0 0	0	0	0	0	0	0		0	0	0	0	]	(70)
Losses e.g. evapora	ion (nega	tive valu	es) (Tab	le 5)			•					•	
(71)m= -68.25 -68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.	.25	-68.25	-68.25	-68.25	-68.25		(71)
Water heating gains	(Table 5)	•	•	•	•	•				•	•	•	
(72)m= 36.65 35.49	33.07	29.8	27.67	24.67	22.12	25.3	39	26.55	29.94	33.77	35.49	]	(72)
Total internal gains	=	•	•	(66	)m + (67)m	n + (68	3)m +	· (69)m + (	70)m + (	71)m + (72)	)m	•	
(73)m= 247.54 246.3	237.83	223.88	209.42	195.74	187.01	190.	.26	197.57	211.64	227.8	240.2	]	(73)
6. Solar gains:	•				,	,	j			•	•		
Solar gains are calculate	d using sola	r flux from	Table 6a	and assoc	iated equa	ations t	to co	nvert to th	e applica	ble orienta	tion.		
Orientation: Access		Area		Flu			_	g_ - b l - Cb	_	FF		Gains	
Table 6	oa 	m²			ble 6a		1 8	able 6b		Table 6c		(W)	_
Northeast 0.9x 0.7	7 ×	8.6	S5	х	11.28	X		0.63	x	0.7	=	29.83	(75)
Northeast 0.9x 0.7	7 ×	8.6	S5	x	22.97	X		0.63	x [	0.7	=	60.72	(75)
Northeast 0.9x 0.7	7 ×	8.6	S5	x	41.38	X		0.63	x [	0.7	=	109.4	(75)
Northeast 0.9x 0.7	7 ×	8.6	65	x (	67.96	X		0.63	x [	0.7	=	179.67	(75)
Northeast 0.9x 0.7	7 ×	8.6	35	x .	91.35	X		0.63	X	0.7	=	241.51	(75)

Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x	ç	7.38	x		0.63	x [	0.7	=	257.47	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x		91.1	x		0.63	x	0.7	=	240.86	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x	7	72.63	x		0.63	x	0.7	=	192.02	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x	5	50.42	x		0.63	_ x [	0.7		133.31	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x	2	28.07	x		0.63	_ x [	0.7	=	74.21	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x		14.2	x		0.63	×	0.7		37.53	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x	,	9.21	x		0.63		0.7	_ =	24.36	(75)
_								•							
Solar gains in w	atts, ca	lculated	for each	n month				(83)m	n = Si	um(74)m .	(82)m				
(83)m= 29.83	60.72	109.4	179.67	241.51		57.47	240.86	192	2.02	133.31	74.21	37.53	24.36		(83)
Total gains – in	ternal a	nd solar	(84)m =	(73)m	+ (8	33)m	, watts					•	•	•	
(84)m= 277.37	307.12	347.23	403.55	450.93	45	53.21	427.87	382	2.28	330.88	285.84	265.33	264.56		(84)
7. Mean intern	al temp	erature	(heating	season	)							•			
Temperature of						area :	from Tal	ole 9	. Th	1 (°C)				21	(85)
Utilisation factor	•	•			-				,	. ( •)					
Jan	Feb	Mar	Apr	May	È	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m= 0.97	0.96	0.93	0.87	0.76	┢	0.61	0.48	0.5	Ŭ	0.76	0.91	0.96	0.98		(86)
` '	ļ.				_						0.0.	1 0.00	0.00		` '
Mean internal (87)m= 18.82				<u> </u>	_		i –				20.04	1 40 00	40.77		(87)
(87)m= 18.82	19.03	19.45	20.02	20.51		0.82	20.93	20	.9	20.64	20.01	19.32	18.77		(07)
Temperature of				rest of	1			T		· ,				Ī	
(88)m= 20.07	20.07	20.07	20.08	20.08	2	80.0	20.08	20.	.09	20.08	20.08	20.08	20.08		(88)
Utilisation factor	or for ga	ains for r	est of d	welling,	h2,	m (se	ee Table	9a)							
(89)m= 0.97	0.95	0.92	0.85	0.72	(	).54	0.39	0.4	45	0.71	0.89	0.95	0.97		(89)
Mean internal	tempera	ature in t	the rest	of dwell	ing	T2 (f	ollow ste	eps 3	3 to 7	7 in Tabl	e 9c)				
(90)m= 18.07	18.28	18.69	19.24	19.7	Ť	9.97	20.05	20.		19.83	19.24	18.56	18.02		(90)
	'				_					f	LA = Livi	ng area ÷ (4	4) =	0.43	(91)
Mean internal	tamnara	atura (fo	r tha wh	awa dwa	llin	a) – f	ΙΔ <b>ν</b> Τ1	<b>⊥</b> /1	_ fl	Δ\ <b>~</b> T2					
(92)m= 18.39	18.6	19.02	19.58	20.05	_	9) – 1 0.34	20.43	20.		20.18	19.57	18.89	18.35		(92)
Apply adjustme												1 .0.00	.0.00		` '
(93)m= 18.39	18.6	19.02	19.58	20.05	1	0.34	20.43	20.		20.18	19.57	18.89	18.35		(93)
8. Space heati	ng regu	irement													
Set Ti to the m			nperatur	e obtair	ned	at st	ep 11 of	Tab	le 9k	o, so tha	t Ti,m=	(76)m an	d re-calc	culate	
the utilisation f										<u>,                                     </u>		. ,			
Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation factor	or for ga	ains, hm											•	•	
(94)m= 0.96	0.94	0.91	0.84	0.72	(	).56	0.43	0.4	48	0.71	0.88	0.94	0.96		(94)
Useful gains, h	<del></del>	<u> </u>	<u> </u>		_			_				_		1	<i>(</i> )
` '	289.69	316.12	337.92	323.12		54.07	181.88	185	5.3	235.69	251.85	250.07	254.61		(95)
Monthly avera	<del></del>				_		T					T		Ì	(00)
(96)m= 4.3	4.9	6.5	8.9	11.7	<u> </u>	14.6	16.6	16		14.1	10.6	7.1	4.2		(96)
Heat loss rate					_		- · · ·	<del></del>		·		E00.04	704.00		(97)
` '	702.08	640.35	542.56	423.86		89.4	193.39	202		307.24	455.22	599.81	721.69		(31)
Space heating (98)m= 340.3	require 277.12	241.23	r each m	74.95	vvn. T	/mon <sup>-</sup> 0	$\frac{\ln = 0.02}{0}$	24 X	<del>- `</del>	)m – (95 0	)m] x (4 151.31	251.81	347.51		
(00)111- 340.3	211.12	۷-۱۱۲۷	171.04	14.30		-				U	101.01	1 201.01	U+1.01	1	

		Total per year (kWh/year) = Sum(98											1831.58	(98)
Space	e heating	g require	ement in	kWh/m²	<sup>2</sup> /year								36.24	(99)
8c. Sp	oace co	oling rec	uiremer	nt										
Calcu	lated for	r June, J	July and	August.	See Tal	ole 10b					_		i	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	loss rate	Lm (ca	lculated	using 2	5°C inter	nal temp	erature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	474.2	373.31	382.98	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm									-		
(101)m=	0	0	0	0	0	0.82	0.87	0.84	0	0	0	0		(101)
Usefu	ıl loss, h	mLm (V	/atts) = (	(100)m x	(101)m									
(102)m=	0	0	0	0	0	387.65	324.42	320.3	0	0	0	0		(102)
Gains	(solar ç	gains ca	lculated	for appli	cable we	eather re	gion, se	e Table	10)	•	•		'	
(103)m=	0	0	0	0	0	594.22	563.42	511.11	0	0	0	0		(103)
						lwelling,	continu	ous ( kW	h = 0.0	24 x [(10	)3)m – (	102)m ] x	k (41)m	
set (1	04)m to	zero if (	104)m <	3 × (98	)m								ı	
(104)m=	0	0	0	0	0	148.74	177.81	141.96	0	0	0	0		
									Total	= Sum(	104)	=	468.51	(104)
	fraction								f C =	cooled	area ÷ (4	4) =	1	(105)
r		actor (Ta	able 10b	)				1		1	1		ı	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
									Total	I = Sum(	(104)	=	0	(106)
			1	month =				1		Г		1	l	
(107)m=	0	0	0	0	0	37.18	44.45	35.49	0	0	0	0		_
									Total	= Sum(	107)	=	117.13	(107)
Space	cooling	requirer	ment in k	kWh/m²/y	/ear				(107)	) ÷ (4) =			2.32	(108)
8f. Fab	ric Ener	gy Effici	iency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabrio	c Energy	/ Efficier	псу						(99) -	+ (108) =	=		38.55	(109)

#### **SAP Input**

Property Details: Plot 12

Address:

Located in: England Region: Thames valley

**UPRN**:

Date of assessment: 08 July 2020
Date of certificate: 28 October 2020

Assessment type: New dwelling design stage

Transaction type:

Tenure type:

Related party disclosure:

Thermal Mass Parameter:

New dwelling
Unknown
No related party
Indicative Value Low

Water use <= 125 litres/person/day: False

PCDF Version: 466

Property description:

Dwelling type: Flat

Detachment:

Year Completed: 2020

Floor Location: Floor area:

Storey height:

Floor 0 50.545 m<sup>2</sup> 2.5 m

Living area: 21.831 m<sup>2</sup> (fraction 0.432)

Front of dwelling faces: South West

Opening types:

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

SW Manufacturer Solid

NE Manufacturer Windows double-glazed Yes

Name: Gap: Frame Factor: g-value: **U-value:** Area: No. of Openings: 1.4 SW mm 0 0 2 ΝE 16mm or more 0.7 0.63 1.4 8.651

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

SW Corridor Wall South West 0 0
NE External Wall North East 0 0

Overshading: Average or unknown

Opaque Elements:

Type: Gross area: Openings: Net area: U-value: Ru value: Curtain wall: Kappa: **External Elements External Wall** 19.699 8.65 11.05 0.15 0 False N/A Corridor Wall 19.699 2 17.7 0.15 0.4 False N/A 33.586 N/A **Exposed Floor** 0.12

Internal Elements
Party Elements

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0831

LengthPsi-value4.7950.289E2Other lintels (including other steel lintels)13.20.047E4Jamb16.8640.065E7Party floor between dwellings (in blocks of flats)

#### **SAP Input**

10.90.055E18Party wall between dwellings8.8690.14E21Exposed floor (inverted)20.9760P3Intermediate floor between dwellings (in blocks of flats)

6.992 0.16 P7 Exposed floor (normal)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery

Number of wet rooms: Kitchen + 1

Ductwork: Insulation, rigid

Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 3

Main heating system:

Main heating system: Community heating schemes

Heat source: Community boilers

heat from boilers – mains gas, heat fraction 1, efficiency 94 Piping>=1991, pre-insulated, low temp, variable flow

Central heating pump: 2013 or later Design flow temperature: Unknown

Boiler interlock: Yes

Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and at least two room

thermostats

Control code: 2312

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system

Water code: 901
Fuel :mains gas
No hot water cylinder
Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory

Low energy lights: 100%

Terrain type: Low rise urban / suburban

EPC language: English Wind turbine: No

Photovoltaics: Photovoltaic 1

Installed Peak power: 0.62 Tilt of collector: 30°

Overshading: None or very little Collector Orientation: South West

Assess Zero Carbon Home: No

		l lser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	- <del>036</del> F1	Strom Softwa					0001082 on: 1.0.5.9	
Address :	F	roperty	Address	: Plot 12					
1. Overall dwelling dime	ensions:								
		Are	a(m²)		Av. He	ight(m)		Volume(m	3)
Ground floor			50.54	(1a) x	2	2.5	(2a) =	126.36	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n) [	50.54	(4)					
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	126.36	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys	0 + 0	] + [	0	= [	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	<u> </u>	0	_ = _	0	x 2	20 =	0	(6b)
Number of intermittent fa	ns				2	x <sup>2</sup>	10 =	20	(7a)
Number of passive vents				Ē	0	x ′	10 =	0	(7b)
Number of flueless gas fi	res			F	0	X 4	40 =	0	(7c)
				L					
				_			Air ch	nanges per ho	our 
	ys, flues and fans = $(6a)+(6b)+(6b)+(6a)$				20		÷ (5) =	0.16	(8)
Number of storeys in the	een carried out or is intended, procee he dwelling (ns)	u 10 (17),	ourer wise t	conunue n	om (9) to	(10)		0	(9)
Additional infiltration	3 (					[(9)-	-1]x0.1 =	0	(10)
	.25 for steel or timber frame o			•	ruction			0	(11)
if both types of wall are padeducting areas of openia	resent, use the value corresponding t ngs): if equal user 0.35	o the grea	ter wall are	ea (after					
,	floor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
-	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	. ,	-	(45)		0	(15)
Infiltration rate	aEO avaraged in auhia matr	o nor b			12) + (13)		oroo	0	(16)
•	q50, expressed in cubic metre (ity value, then $(18) = [(17) \div 20] + (18)$		•	•	ietre or e	rivelope	area	0.41	(17)
•	es if a pressurisation test has been do				is being u	sed		0.41	(10)
Number of sides sheltered	ed							3	(19)
Shelter factor			(20) = 1 -		19)] =			0.78	(20)
Infiltration rate incorporat	•		(21) = (18	s) x (20) =				0.32	(21)
Infiltration rate modified f	<del>- 1                                   </del>	Jul	Διια	Con	Oct	Nov	Doo	]	
Jan Feb	1 ' 1 ' 1	Jui	Aug	Sep	Oct	I NOV	Dec		
Monthly average wind sp (22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7	1	
, , , , , , , , , , , , , , , , , , , ,	1 1 1	1	1	<u> </u>	L	<u> </u>	I	J	
Wind Factor (22a)m = (2	<del>'                                    </del>					_		1	
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m		
	36 0.37	
Calculate effective air change rate for the applicable case  If mechanical ventilation:		
If mechanical ventuation.  If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)		0 (23
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		0 (23
	[4 (22	0 (23
a) If balanced mechanical ventilation with heat recovery (MVHR) $(24a)m = (22b)m + (23b)m = (24a)m = 0$ 0 0 0 0 0 0 0	$\frac{0 \times [1 - (23)]}{0  0}$	(24) – 100j
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)		
	0 0	(24
c) If whole house extract ventilation or positive input ventilation from outside		
if $(22b)m < 0.5 \times (23b)$ , then $(24c) = (23b)$ ; otherwise $(24c) = (22b)m + 0.5 \times (23b)$		
	0 0	(24
d) If natural ventilation or whole house positive input ventilation from loft	<u>.</u>	_
if $(22b)m = 1$ , then $(24d)m = (22b)m$ otherwise $(24d)m = 0.5 + [(22b)m^2 \times 0.5]$		
(24d)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.	56 0.57	(24
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)		
(25)m= 0.58 0.58 0.58 0.56 0.56 0.55 0.55 0.54 0.55 0.56 0.	56 0.57	(25)
3. Heat losses and heat loss parameter:		
ELEMENT Gross Openings Net Area U-value A X U	k-valı	ue AXk
area ( $m^2$ ) $m^2$ A , $m^2$ W/m2K (W/K)	kJ/m²	
Doors 2 x 1 = 2		(26
Windows $8.651   x^{1/[1/(1.4) + 0.04]} = 11.47$		(27
Floor 33.586 x 0.13 = 4.366179		(28
Walls Type1 19.7 8.65 11.05 x 0.18 = 1.99		(29)
Walls Type2 19.7 2 17.7 x 0.18 = 3.19		(29
Total area of elements, m <sup>2</sup> 72.98		(31
* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as giv	en in paragra <sub>l</sub>	
** include the areas on both sides of internal walls and partitions		
Fabric heat loss, W/K = S (A x U) $(26)(30) + (32) =$		23.01 (33
Heat capacity $Cm = S(A \times k)$ ((28)(30) + (32) + (	, , ,	2921.41 (34
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Med		250 (35)
For design assessments where the details of the construction are not known precisely the indicative values of TMF can be used instead of a detailed calculation.	in Table 1f	
Thermal bridges : S (L x Y) calculated using Appendix K		6.69 (36
if details of thermal bridging are not known (36) = $0.05 \times (31)$		<u> </u>
Total fabric heat loss (33) + (36) =		29.7 (37
	· · (E)	
Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m$	1 X (5)	
	lov Dec	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct N		
Jan Feb Mar Apr May Jun Jul Aug Sep Oct N	Nov Dec .49 23.73	
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         N           (38)m=         24.24         24.11         23.98         23.38         23.26         22.73         22.73         22.64         22.94         23.26         23.26           Heat transfer coefficient, W/K         (39)m = (37) + (38)m	Nov Dec .49 23.73	(38

Heat loss para	ımeter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.04	1.04	1.05	1.05	1.06		
									Average =	Sum(40) <sub>1</sub>	12 /12=	1.05	(40)
Number of day	1	nth (Tab	le 1a)	1	1	1	1	ı	1				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assumed occu	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13.		71		(42)
if TFA £ 13.9	,	otor uoo	ao in litra	o nor de	\/d o	0.000	(05 v NI)	. 26					(40)
Annual average Reduce the annual									se target o		.72		(43)
not more that 125	litres per	person pei	day (all w	/ater use, i	hot and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	!	!	•			
(44)m= 82.19	79.2	76.22	73.23	70.24	67.25	67.25	70.24	73.23	76.22	79.2	82.19		
	•	•				•	•			m(44) <sub>112</sub> =		896.65	(44)
Energy content of	hot water	used - cal	culated m	onthly = $4$ .	190 x Vd,ı	m x nm x E	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 121.89	106.61	110.01	95.91	92.03	79.41	73.59	84.44	85.45	99.58	108.7	118.04		
If instantaneous u	votor boot	na ot noint	of upo /pa	a hat water	r otorogol	antar O in	haves (46		Total = Su	m(45) <sub>112</sub> =	=	1175.66	(45)
If instantaneous w									i				
(46)m= 0 Water storage	0	0	0	0	0	0	0	0	0	0	0		(46)
Storage volum		) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	`					Ū					100		()
Otherwise if no	•			•			` '	ers) ente	er '0' in (	(47)			
Water storage			`					,	`	,			
a) If manufact	turer's d	eclared I	oss facto	or is kno	wn (kWl	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro	m wate	rstorage	, kWh/ye	ear			(48) x (49)	) =			0		(50)
b) If manufact			-										
Hot water stor	•			le 2 (kW	h/litre/da	ay)					0		(51)
If community he Volume factor	_		on 4.3								0		(52)
Temperature f			2b								0		(52)
Energy lost fro				ear			(47) x (51)	) x (52) x (	53) =				(54)
Enter (50) or		_	, IXVVII/ y	cai			(17) X (01)	) X (02) X (	<i>-</i>		0		(55)
Water storage	` , ` `	,	or each	month			((56)m = (	(55) × (41)	m				,
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains		•		_	_	_	_	_			_	ix H	(30)
·					1								(57)
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	•	•									0		(58)
Primary circuit					•	. ,	, ,						
(modified by		1	i		i		<del></del>			<del>' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' </del>			/F=1
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss ca	lculated	for each	month (	′61)m =	(60) ± 3	865 <b>v</b> (41	)m							
(61)m= 0	0	0	0	0	0	0	)   0		0	0	0	0	]	(61)
	uired for	water h	eating ca	alculated	l for ead	ch month	(62)ı	—— m =	0.85 × (	(45)m +	(46)m +	(57)m +	נ · (59)m + (61)m	
(62)m= 103.61	90.62	93.51	81.52	78.22	67.5	62.55	71.	_	72.63	84.65	92.4	100.34	1	(62)
Solar DHW input	calculated	using App	endix G oı	· Appendix	H (nega	tive quantity	y) (ent	er '0'	if no sola	r contribu	tion to wate	er heating)	)	
(add additiona	al lines if	FGHRS	and/or \	WWHRS	applie	s, see Ap	pend	lix C	3)					
(63)m= 0	0	0	0	0	0	0	0		0	0	0	0	]	(63)
Output from w	ater hea	ter												
(64)m= 103.61	90.62	93.51	81.52	78.22	67.5	62.55	71.	77	72.63	84.65	92.4	100.34		_
								Outp	out from wa	ater heate	er (annual)	112	999.31	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ′ [0.8	5 × (45)m	ı + (6	1)m	] + 0.8 x	( [(46)m	+ (57)m	+ (59)m	<u>]</u> ]	
(65)m= 25.9	22.65	23.38	20.38	19.56	16.87	15.64	17.9	94	18.16	21.16	23.1	25.08		(65)
include (57)	m in cald	culation	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal g	ains (see	Table 5	and 5a	):										
Metabolic gair	ns (Table	5), Wat	ts	_			_			_			_	
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec	]	
(66)m= 85.31	85.31	85.31	85.31	85.31	85.31	85.31	85.3	31	85.31	85.31	85.31	85.31	]	(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9 d	or L9a), a	lso s	ee ¯	Table 5				_	
(67)m= 13.65	12.12	9.86	7.47	5.58	4.71	5.09	6.6	2	8.88	11.28	13.16	14.03	]	(67)
Appliances ga	ins (calc	ulated ir	Append	dix L, eq	uation l	_13 or L1	3a), a	also	see Tal	ble 5				
(68)m= 148.65	150.19	146.3	138.03	127.58	117.77	111.21	109	.66	113.55	121.83	132.27	142.09	]	(68)
Cooking gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a	), als	o se	e Table	5			_	
(69)m= 31.53	31.53	31.53	31.53	31.53	31.53	31.53	31.	53	31.53	31.53	31.53	31.53	]	(69)
Pumps and fa	ns gains	(Table 5	ōa)										_	
(70)m= 0	0	0	0	0	0	0	0		0	0	0	0	]	(70)
Losses e.g. ev	vaporatio	n (nega	tive valu	es) (Tab	le 5)								_	
(71)m= -68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.	.25	-68.25	-68.25	-68.25	-68.25	]	(71)
Water heating	gains (T	able 5)											_	
(72)m= 34.81	33.71	31.42	28.31	26.28	23.44	21.02	24.	12	25.22	28.44	32.08	33.72	]	(72)
Total internal	gains =				(66	6)m + (67)m	า + (68	3)m +	- (69)m + (	(70)m + (7	71)m + (72)	)m	_	
(73)m= 245.71	244.62	236.18	222.39	208.04	194.51	185.91	188	.99	196.24	210.14	226.11	238.43		(73)
6. Solar gain														
Solar gains are		•					ations 1	to co		e applica		tion.		
Orientation:	Access F Table 6d		Area m²			ux able 6a		Т	g_ able 6b	Т	FF able 6c		Gains (W)	
_							1 1					_	. ,	٦
Northeast 0.9x	0.77	X	8.6		X	11.28	X 1		0.63	×	0.7	_ =	29.83	(75)
Northeast 0.9x	0.77	X	8.6			22.97	X		0.63	X	0.7	=	60.72	(75)
Northeast 0.9x	0.77	X	8.6		<b>—</b>	41.38	X 1		0.63		0.7	=	109.4	(75)
Northeast 0.9x	0.77	X	8.6		-	67.96	X 1		0.63	×	0.7	=	179.67	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	35	X	91.35	X		0.63	X	0.7	=	241.51	(75)

Northeast <sub>0.9x</sub>	0.77	X	8.6	S5	X	97.38	x		0.63	x	0.7	=	257.47	(75)
Northeast <sub>0.9x</sub>	0.77	х	8.6	S5	x	91.1	x		0.63	x	0.7	=	240.86	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	35	X	72.63	x		0.63	x	0.7	=	192.02	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	35	X	50.42	x		0.63	x	0.7	=	133.31	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	35	X .	28.07	x		0.63	x	0.7	=	74.21	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	S5	х	14.2	x		0.63	x	0.7	<u> </u>	37.53	(75)
Northeast 0.9x	0.77	X	8.6	35	х	9.21	x		0.63	x	0.7	=	24.36	(75)
·														
Solar gains in	watts, ca	alculated	l for eac	h month			(83)m	ı = Sı	um(74)m .	(82)m		_		
(83)m= 29.83	60.72	109.4	179.67	241.51	257.47	240.86	192.	.02	133.31	74.21	37.53	24.36		(83)
Total gains – i	nternal a	nd solar	(84)m =	= (73)m	+ (83)m	, watts					,			
(84)m= 275.54	305.34	345.58	402.06	449.55	451.98	426.77	381.	.01	329.55	284.34	263.64	262.79		(84)
7. Mean inter	nal temp	erature	(heating	season	)									
Temperature	during h	eating p	eriods ir	n the livi	ng area	from Tal	ble 9,	, Th′	1 (°C)				21	(85)
Utilisation fac	ctor for g	ains for l	iving are	ea, h1,m	(see Ta	able 9a)								_
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99	0.97	0.88	0.7	0.53	0.6	61	0.88	0.99	1	1		(86)
Mean interna	ıl temper	ature in	living are	ea T1 (fo	ollow ste	eps 3 to 7	7 in T	able	e 9c)					
(87)m= 19.82	19.94	20.18	20.52	20.82	20.96	20.99	20.9	99	20.86	20.49	20.1	19.8		(87)
Temperature	during h	eating p	eriods ir	rest of	dwelling	r from Ta	able 9	 7 Th	n2 (°C)		•			
(88)m= 20.03	20.03	20.03	20.04	20.04	20.05	20.05	20.0	Т	20.05	20.04	20.04	20.04		(88)
Litilization for	tor for a	oine for	root of d	L	h2 m /a	oo Toblo	. 00)				Ţ			
Utilisation fac	1	0.99	0.96	0.84	0.61	0.42	0.5	<sub>5</sub> T	0.82	0.98	1	1		(89)
				<u> </u>	<u> </u>	<u> </u>					<u> </u>	,		()
Mean interna	· ·			ı	ing 12 (1	1	<del>i                                     </del>				10.22	10.02		(90)
(90)m= 18.95	19.07	19.31	19.65	19.92	20.04	20.05	20.0	05	19.97	19.62	19.23 ng area ÷ (4	18.93	0.42	(90)
									•	L/ ( - L/VII	ig area . (	-,, -	0.43	(31)
Mean interna	<del></del>					1	<del>- ` </del>							
(92)m= 19.32	19.44	19.68	20.03	20.31	20.44	20.46	20.4		20.36	20	19.61	19.31		(92)
Apply adjustr					1	1	1	T			1,004	40.04		(02)
(93)m= 19.32	19.44	19.68	20.03	20.31	20.44	20.46	20.4	45	20.36	20	19.61	19.31		(93)
8. Space hea				ra abtair	od at at	on 11 of	Tobl	o 0h	oo tha	t Time /	76\m an	d ro oolo	uloto	
Set Ti to the the utilisation					ieu ai si	ер п ог	Iabi	e an	), 50 liia	t 11,111=(	70)III ali	u re-caic	uiale	
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
Utilisation fac	tor for g	ains, hm	•	,	•	'	!		•					
(94)m= 1	1	0.99	0.96	0.85	0.65	0.47	0.5	55	0.84	0.98	1	1		(94)
Useful gains,	hmGm ,	W = (94	4)m x (8	4)m										
(95)m= 274.96	304.13	341.74	384.53	382.12	293.23	200.45	208.	.26	278.3	278.31	262.57	262.37		(95)
Monthly aver	age exte	rnal tem	perature	from T	able 8						•			
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.		14.1	10.6	7.1	4.2		(96)
Heat loss rate					1	1	<del></del>	<del>-</del> -	· ,		T			(07)
(97)m= 810.42	782.66	707.69	590.57	455.84	305.98	202.27	212.		329.26	497.7	665.33	807.21		(97)
Space heatin	Ť							Ť		<u> </u>	<del> </del>	405.07		
(98)m= 398.38	321.57	272.27	148.35	54.85	0	0	0	<u>'</u>	0	163.23	289.99	405.37		

								Tota	l per year	(kWh/year	r) = Sum(9	8) <sub>15,912</sub> =	2054.01	(98)
Space	e heating	g require	ement in	kWh/m²	/year								40.64	(99)
8c. Sp	pace cod	oling req	uiremen	it										
Calcu	lated for	r June, J	luly and	August.	See Tal	ole 10b							-	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	oss rate	Lm (ca	lculated	using 25	5°C inter	nal temp	perature	and exte	ernal ten	nperatur	e from T	able 10)	1	
(100)m=	0	0	0	0	0	492.88	388.02	397.76	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm										•	
(101)m=	0	0	0	0	0	0.91	0.96	0.93	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = (	100)m x	(101)m								•	
(102)m=	2)m= 0 0 0 0 0 449.43 370.58 369.63 0 0 0 0 ains (solar gains calculated for applicable weather region, see Table 10)													(102)
Gains	(solar g	gains cal	lculated	for appli	cable we	eather re	gion, se	e Table	10)				-	
(103)m=	03)m= 0 0 0 0 0 592.99 562.31 509.84 0 0 0 0													(103)
			<i>ment fo</i> 104)m <			lwelling,	continue	ous ( kW	h') = 0.02	24 x [(10	03)m – (	102)m ] :	x (41)m	
(104)m=		0	0	0	0	103.37	142.65	104.31	0	0	0	0		
							•		Total	= Sum(	104)	=	350.33	(104)
Cooled	I fraction	า							f C =	cooled	area ÷ (4	<b>1</b> ) =	1	(105)
Intermi	ttency fa	actor (Ta	able 10b	)									•	_
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
									Total	' = Sum(	104)	=	0	(106)
· .		requirer	nent for	month =	(104)m	× (105)	× (106)r	n		<u> </u>			Ī	
(107)m=	0	0	0	0	0	25.84	35.66	26.08	0	0	0	0		
									Total	= Sum(	107)	=	87.58	(107)
Space	cooling	requirer	ment in k	:Wh/m²/y	/ear				(107)	÷ (4) =			1.73	(108)
8f. Fab	ric Ener	gy Effici	ency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabrio	Energy	/ Efficier	псу						(99) -	+ (108) =	=		42.37	(109)
Targe	et Fabrio	c Energ	y Efficie	ency (TF	EE)								48.73	(109)

		l lser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	<u> </u>	Strom Softwa					0001082 on: 1.0.5.9	
Address :	F	roperty	Address	Plot 12					
1. Overall dwelling dime	nsions:								
<u> </u>		Are	a(m²)		Av. He	ight(m)		Volume(m <sup>3</sup>	3)
Ground floor			50.54	(1a) x	2	2.5	(2a) =	126.36	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1	n) [	50.54	(4)					
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	126.36	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys	0 + 0	+ [	0	] = [	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	<b>-</b> + -	0	Ī <b>-</b> [	0	x	20 =	0	(6b)
Number of intermittent fa	ns				0	x '	10 =	0	(7a)
Number of passive vents				Ē	0	x .	10 =	0	(7b)
Number of flueless gas fi	res			F	0	x	40 =	0	(7c)
				L					
							Air ch	nanges per ho	our 
•	ys, flues and fans = $(6a)+(6b)+(6b)+(6b)$				0		÷ (5) =	0	(8)
Number of storeys in the	een carried out or is intended, procee ne dwelling (ns)	ia 10 (17),	otrierwise (	onunue ii	om (9) to	(10)		0	(9)
Additional infiltration	3 ( )					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r masoni	y constr	ruction			0	(11)
if both types of wall are pu deducting areas of openir	resent, use the value corresponding to	o the grea	ter wall are	a (after					
,	loor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
Percentage of windows	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	. ,	-			0	(15)
Infiltration rate	50		(8) + (10)					0	(16)
•	q50, expressed in cubic metro ity value, then $(18) = [(17) \div 20] + (18)$	-	•	•	etre of e	envelope	area	3	(17)
•	s if a pressurisation test has been do				is being u	sed		0.15	(18)
Number of sides sheltere								3	(19)
Shelter factor			(20) = 1 -		19)] =			0.78	(20)
Infiltration rate incorporat	_		(21) = (18	) x (20) =				0.12	(21)
Infiltration rate modified for	<del>-                                    </del>	<del></del>	1 .			<u> </u>		1	
Jan Feb	Mar   Apr   May   Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp (22)m= 5.1 5	eed from Table 7 4.9	3.8	3.7	4	4.3	4.5	4.7	1	
(22)m= 5.1 5	7.0   4.4   4.3   3.8	] 3.6	3.1	4	4.3	4.0	4.1		
Wind Factor (22a)m = (22	2)m ÷ 4							1	
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14	]	
Calculate effec		-	rate for t	he appli	cable ca	se	!	ļ.	<u>l</u>	!	<u>l</u>	J	<b></b>
If mechanica If exhaust air he			andiv N (2	3h) - (23a	) × Fmv (e	auation (N	VS)) othe	rwica (23h	) = (23a)			0.5	(23a)
If balanced with									) = (23a)			0.5	(23b)
		•	•	· ·		`		,	2h\m . /	22b) v [4	1 (220)	79.05	(23c)
a) If balance (24a)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24	<del>-</del> 100] 	(24a)
b) If balance					<u> </u>					ļ	0.21		( - 7
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If whole ho												J	, ,
if (22b)m				•	•				.5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural v					•				0.51	•		•	
(24d)m= 0	0	0	0	0	0	0	0.0 1 [(2	0	0.01	0	0	]	(24d)
Effective air	change	rate - er	ter (24a	or (24b	o) or (24	c) or (24	d) in box	к (25)	ļ	!	ļ	l	
(25)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24	1	(25)
												ı	
3. Heat losses		·			NI n.t. A m		المناا		A V 11		l l	- ^	V I.
ELEMENT	Gros area	_	Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/		k-value kJ/m²-l		X k I/K
Doors					2	х	1.4	=	2.8				(26)
Windows					8.651	x1.	/[1/( 1.4 )+	0.04] =	11.47	一			(27)
Floor					33.58	6 ×	0.12	i i	4.0303	2			(28)
Walls Type1	19.7	7	8.65		11.05	x	0.15	<b>=</b> i	1.66	F i			(29)
Walls Type2	19.7	7	2	=	17.7	x	0.14	<b>=</b> i	2.5	F i			(29)
Total area of el	lements	, m²			72.98								(31)
* for windows and ** include the area						ated using	formula 1	/[(1/U-valu	ıe)+0.04] á	as given in	paragraph	1 3.2	
Fabric heat los							(26)(30)	) + (32) =				22.46	(33)
Heat capacity (	Cm = S(	Axk)	•					((28)	(30) + (3	2) + (32a).	(32e) =	2921.41	(34)
Thermal mass	parame	ter (TMF	P = 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		
Thermal bridge				usina Ap	pendix ł	<						6.06	(36)
if details of therma	,	,		٠.	•							0.00	()
Total fabric hea	at loss							(33) +	(36) =			28.52	(37)
Ventilation hea	t loss ca	alculated	monthly	/				(38)m	= 0.33 × (	(25)m x (5)		-	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 10.55	10.43	10.31	9.7	9.58	8.97	8.97	8.85	9.22	9.58	9.82	10.06		(38)
Heat transfer c	oefficier	nt, W/K						(39)m	= (37) + (	38)m		_	
(39)m= 39.07	38.95	38.83	38.22	38.1	37.5	37.5	37.38	37.74	38.1	38.34	38.59		_
								,	Average =	Sum(39) <sub>1</sub>	12 /12=	38.19	(39)

Heat loss par	ameter (I	HLP), W	/m²K					(40)m	= (39)m ÷	÷ (4)			
(40)m= 0.77	0.77	0.77	0.76	0.75	0.74	0.74	0.74	0.75	0.75	0.76	0.76		
	-!					l	l		Average =	: Sum(40) <sub>1</sub>	12 /12=	0.76	(40)
Number of da	<del>i                                     </del>	nth (Tab	le 1a)		ı			1	1				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ating ene	rgy requ	irement:								kWh/ye	ar:	
Assumed occ if TFA > 13 if TFA £ 13	s.9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		71		(42)
Annual avera Reduce the annu not more that 12	ual average	hot water	usage by	5% if the $a$	lwelling is	designed t			se target o		3.65		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage								- 1					
(44)m= 86.52	83.37	80.23	77.08	73.93	70.79	70.79	73.93	77.08	80.23	83.37	86.52		
	_ <b>!</b>								Total = Su	ım(44) <sub>112</sub> =	-	943.85	(44)
Energy content of	of hot water	used - cal	culated m	onthly = $4$ .	190 x Vd,r	n x nm x C	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 128.31	112.22	115.8	100.96	96.87	83.59	77.46	88.89	89.95	104.82	114.42	124.26		_
If instantaneous	water heat	na at naint	of uso (no	hot water	r storago)	ontor O in	havas (16		Total = Su	ım(45) <sub>112</sub> =	= [	1237.53	(45)
			· `	·	· · ·		· · ·	, , , I		1			(40)
(46)m= 19.25 Water storage	16.83 e loss:	17.37	15.14	14.53	12.54	11.62	13.33	13.49	15.72	17.16	18.64		(46)
Storage volur		) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community	heating a	and no ta	ınk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if r	no stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage													
a) If manufac				or is kno	wn (kWł	n/day):					0		(48)
Temperature											0		(49)
Energy lost fr		•			or io not		(48) x (49)	) =		1	10		(50)
<ul><li>b) If manufact</li><li>Hot water sto</li></ul>			-							0	02		(51)
If community	•			_ (	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	-77				0.	.02		(0.7)
Volume facto	r from Ta	ble 2a								1.	.03		(52)
Temperature	factor fro	m Table	2b							0	.6		(53)
Energy lost fr		_	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter (50) or	(54) in (	55)								1.	.03		(55)
Water storage	e loss cal	culated	for each	month			((56)m = (	(55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain	ns 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 Appendi	хH	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circu	it loss (ar	nnual) fro	m Table	 3							0		(58)
Primary circu	`	,			59)m = (	(58) ÷ 36	65 × (41)	m					
(modified b	y factor f	rom Tab	le H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss o	ealculated	for each	month (	(61)m –	(60) <i>- '</i>	R65 <b>v</b> (41	)m							
(61)m= 0	0	0	0	01)111 =	00) - (	1 0	) T o		0	0	0	0	1	(61)
				alculated	for ea	ch month						<u> </u>	J · (59)m + (61)m	` ,
(62)m= 183.5	<u> </u>	171.07	154.45	152.15	137.08		144	_	143.44	160.1	167.92	179.53	1	(62)
Solar DHW inpu		<u> </u>	<u> </u>	<u> </u>	H (nega		<u> </u>					er heating	<u></u>	` ,
(add addition												-: ····································		
(63)m= 0	0	0	0	0	0	0	0		0	0	0	0	7	(63)
Output from	water hea	ter	ı			_							_	
(64)m= 183.5		171.07	154.45	152.15	137.08	132.74	144.	.16	143.44	160.1	167.92	179.53	1	
		ı	ı	ı		-1		Outp	out from wa	ater heate	er (annual)	112	1888.37	(64)
Heat gains fr	om water	heating,	kWh/m	onth 0.2	5 ′ [0.8	5 × (45)m	ı + (6	1)m	n] + 0.8 x	د [(46)m	+ (57)m	+ (59)m	 n ]	_
(65)m= 86.88	77.25	82.72	76.36	76.43	70.59	69.98	73.	78	72.7	79.08	80.84	85.54	1	(65)
include (57	7)m in cal	culation	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a	):										
Metabolic ga	ins (Table	5), Wat	ts										_	
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec	]	
(66)m= 102.3	7 102.37	102.37	102.37	102.37	102.37	102.37	102	.37	102.37	102.37	102.37	102.37	]	(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equat	ion L9	or L9a), a	lso s	ee -	Table 5					
(67)m= 34.13	30.31	24.65	18.66	13.95	11.78	12.73	16.	54	22.2	28.19	32.9	35.08	]	(67)
Appliances g	ains (calc	ulated ir	Append	dix L, eq	uation	_13 or L1	3a), a	also	see Ta	ble 5			_	
(68)m= 221.8	6 224.17	218.37	206.01	190.42	175.77	165.98	163	.68	169.48	181.83	197.42	212.08	]	(68)
Cooking gair	ns (calcula	ited in A	ppendix	L, equat	ion L1	or L15a	), als	o se	e Table	5				
(69)m= 46.94	46.94	46.94	46.94	46.94	46.94	46.94	46.9	94	46.94	46.94	46.94	46.94		(69)
Pumps and f	ans gains	(Table 5	5a)											
(70)m= 0	0	0	0	0	0	0	0		0	0	0	0	]	(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)									
(71)m= -68.25	5 -68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.	.25	-68.25	-68.25	-68.25	-68.25	]	(71)
Water heatin	g gains (T	able 5)											_	
(72)m= 116.7	8 114.96	111.19	106.06	102.73	98.04	94.05	99.	16	100.98	106.28	112.28	114.97	]	(72)
Total interna	al gains =				(6	6)m + (67)n	า + (68	8)m +	- (69)m + (	(70)m + (7	71)m + (72)	)m	_	
(73)m= 453.8	4 450.51	435.27	411.8	388.17	366.65	353.83	360	.45	373.72	397.37	423.67	443.19		(73)
6. Solar gai														
Solar gains are		•					ations 1	to co		e applical		tion.		
Orientation:	Access F Table 6d		Area m²			ux able 6a		Т	g_ able 6b	т	FF able 6c		Gains (W)	
North coat a c					_		1 1					_	. ,	1,
Northeast 0.9		X			X	11.28	X		0.63	×	0.7	=	29.83	(75)
Northeast 0.9		×			x	22.97	] X ] ,,		0.63	_  ×	0.7	_ =	60.72	](75) ] <sub>(75)</sub>
Northeast 0.9		X	8.6		x	41.38	X 1		0.63	×	0.7	=	109.4	[(75)
Northeast 0.9		X	8.6		x	67.96	X ]		0.63	×	0.7	=	179.67	](75) ] <sub>(75)</sub>
Northeast 0.9	0.77	X	8.6	65	X	91.35	X		0.63	X	0.7	=	241.51	(75)

Northeast 0.9	0.77	×	8.6	65	x	97.38	X		0.63	X	0.7	=	257.47	(75)
Northeast 0.9	0.77	x	8.6	65	х	91.1	X		0.63	x	0.7	=	240.86	(75)
Northeast 0.9	0.77	x	8.6	55	x	72.63	X		0.63	x	0.7	=	192.02	(75)
Northeast 0.9	0.77	x	8.6	65	x	50.42	X		0.63	x	0.7	=	133.31	(75)
Northeast 0.9	0.77	×	8.6	55	x	28.07	x		0.63	x	0.7	=	74.21	(75)
Northeast 0.9	0.77	×	8.6	55	x	14.2	X		0.63	_ x	0.7	=	37.53	(75)
Northeast 0.9	0.77	х	8.6	65	х	9.21	X		0.63	x	0.7	=	24.36	(75)
														_
Solar gains i	n watts, c	alculated	I for eac	h month			(83)m	n = S	um(74)m .	(82)m			_	
(83)m= 29.83	60.72	109.4	179.67	241.51	257.47	240.86	192	.02	133.31	74.21	37.53	24.36		(83)
Total gains -	· internal a	and solar	(84)m =	= (73)m ·	+ (83)r	n , watts							-	
(84)m= 483.6	7 511.23	544.67	591.47	629.68	624.12	594.69	552	.46	507.03	471.58	461.21	467.55		(84)
7. Mean into	ernal temp	perature	(heating	season	)									
Temperatur	e during h	neating p	eriods ir	the livi	ng area	a from Ta	ble 9	, Th	1 (°C)				21	(85)
Utilisation fa	actor for g	ains for l	living are	ea, h1,m	(see 1	able 9a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m= 0.87	0.84	0.79	0.67	0.53	0.38	0.28	0.3	31	0.49	0.7	0.83	0.88		(86)
Mean interr	al temper	ature in	living an	-a T1 (fo	ollow s	tens 3 to	7 in T	 Table	2 9c)				1	
(87)m= 20.06		20.45	20.73	20.91	20.98	-i	20.		20.95	20.74	20.38	20.04		(87)
. ,					-l Ilia		-1-1- (		-0 (00)		1		l	
Temperatur (88)m= 20.28		20.28	20.29	20.29	20.3	20.3	20.		20.3	20.29	20.29	20.29	]	(88)
. ,						_ <u>İ</u>	<u> </u>	31	20.3	20.29	20.29	20.29		(00)
Utilisation fa	<u>_</u>	1			`		T			1		1	1	(0.0)
(89)m= 0.86	0.83	0.77	0.65	0.49	0.34	0.23	0.2	26	0.44	0.67	0.81	0.87		(89)
Mean interr	al temper	ature in	the rest	of dwell	ing T2	(follow ste	eps 3	to 7	7 in Tabl	e 9c)	_		-	
(90)m= 19.04	19.24	19.58	19.97	20.19	20.28	20.3	20	.3	20.25	19.98	19.5	19		(90)
									f	LA = Livir	ng area ÷ (	4) =	0.43	(91)
Mean interr	al temper	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1	– fL	A) × T2					
(92)m= 19.48	19.66	19.96	20.3	20.5	20.58	20.6	20	.6	20.55	20.31	19.88	19.45		(92)
Apply adjus	tment to t	he mean	interna	temper	ature f	rom Table	e 4e,	whe	re appro	opriate				
(93)m= 19.48	19.66	19.96	20.3	20.5	20.58	20.6	20	.6	20.55	20.31	19.88	19.45		(93)
8. Space he	eating req	uirement												
Set Ti to the					ned at s	step 11 of	Tabl	le 9k	o, so tha	t Ti,m=	(76)m an	d re-calc	culate	
the utilisation						<del>                                     </del>	Ι,		0	0.1	l Ni-		]	
Jan	_	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation for $(94)m = 0.84$		0.76	0.65	0.5	0.35	0.25	0.2	28	0.46	0.67	0.8	0.85		(94)
Useful gain					0.00	0.20	0.2		0.40	0.07	0.0	0.00		(= -)
(95)m= 408.2	<del></del>	412.27	381.93	316.38	220.3	149.07	155	.56	233.15	317.8	367.89	399.13		(95)
Monthly ave						1		-		L	1		I	• •
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat loss ra	ate for me	an intern	al tempe	erature,	Lm , W	/ =[(39)m	x [(9	 3)m-	– (96)m	]	1	I	I	
(97)m= 593.0		522.46	435.75	335.26	224.37	<del></del>	156		243.37	369.9	489.96	588.44		(97)
Space heat	ing requir	ement fo	r each n	nonth, k	Wh/mo	$\frac{1}{\text{nth}} = 0.02$	24 x [	[(97)	m – (95	)m] x (4	1)m		•	
(98)m= 137.5	105.94	81.98	38.75	14.05	0	0	0	)	0	38.77	87.9	140.84		

	Fotal per year (kWh/year) = Sum(98) <sub>15,912</sub> =	645.72	(98)
Space heating requirement in kWh/m²/year		12.78	(99)
9b. Energy requirements – Community heating scheme			
This part is used for space heating, space cooling or water heating p Fraction of space heat from secondary/supplementary heating (Table		0	(301)
Fraction of space heat from community system 1 – (301) =	Ī	1	(302)
The community scheme may obtain heat from several sources. The procedure allows		e latter	_
includes boilers, heat pumps, geothermal and waste heat from power stations. See Approximation of heat from Community boilers	openaix C.	1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community	heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		kWh/year	-
Annual space heating requirement		645.72	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	678.01	(307a
Efficiency of secondary/supplementary heating system in % (from Ta	able 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement	Г	1888.37	٦
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1982.79	<b>」</b> │(310a
Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] =	26.61	(313)
Cooling System Energy Efficiency Ratio	Ī	0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outsi	de	175.36	(330a)
warm air heating system fans	Ī	0	(330b
pump for solar water heating	Ī	0	(330g
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	175.36	(331)
Energy for lighting (calculated in Appendix L)	Ī	241.09	(332)
Electricity generated by PVs (Appendix M) (negative quantity)	Ī	-510.48	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity	<i>(</i> )	0	(334)
10b. Fuel costs – Community heating scheme			
<b>Fuel</b> kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating from CHP (307a) x	4.24 x 0.01 =	28.75	(340a
Water heating from CHP (310a) x	4.24 x 0.01 =	84.07	(342a

		F	Fuel Price		
Pumps and fans	(331)	Ĺ	13.19 × 0.01 =	23.13	(349)
Energy for lighting	(332)		13.19 × 0.01 =	31.8	(350)
Additional standing charges (Table 12)				120	(351)
Energy saving/generation technologies	(0.40 ) (0.40 ) (0.45)	(05.1)			_
Total energy cost	= (340a)(342e) + (345)	.(354) =		287.75	(355)
11b. SAP rating - Community heating	scheme				
Energy cost deflator (Table 12)				0.42	(356)
Energy cost factor (ECF)	$[(355) \times (356)] \div [(4) + 45.0]$	)] =		1.26	(357)
SAP rating (section12)				82.35	(358)
12b. CO2 Emissions – Community hea	ting scheme	Energy	Emission factor	r Emissions	
		kWh/year	kg CO2/kWh	kg CO2/year	
CO2 from other sources of space and v Efficiency of heat source 1 (%)			B) to (366) for the second fu	uel 94	(367a)
CO2 associated with heat source 1	[(307b)	)+(310b)] x 100 ÷ (367b)	x 0.22	= 611.42	(367)
Electrical energy for heat distribution		[(313) x	0.52	= 13.81	(372)
Total CO2 associated with community s	systems	(363)(366) + (368)	.(372)	= 625.23	(373)
CO2 associated with space heating (se	condary)	(309) x	0	= 0	(374)
CO2 associated with water from immer	sion heater or instantar	neous heater (312)	x 0.22	= 0	(375)
Total CO2 associated with space and w	ater heating	(373) + (374) + (375) =	=	625.23	(376)
CO2 associated with electricity for pum	ps and fans within dwe	lling (331)) x	0.52	91.01	(378)
CO2 associated with electricity for light	ng	(332))) x	0.52	= 125.12	(379)
Energy saving/generation technologies Item 1	(333) to (334) as applied	cable [	0.52 x 0.01 =	-264.94	(380)
Total CO2, kg/year	sum of (376)(382) =	_		576.43	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.4	(384)
El rating (section 14)				91.92	(385)
13b. Primary Energy - Community hea	ting scheme				
		Energy kWh/year	Primary factor	P.Energy kWh/year	
Energy from other sources of space and Efficiency of heat source 1 (%)	d water heating (not Ch If there is CHP usi	HP) ing two fuels repeat (363	3) to (366) for the second fu	uel 94	(367a)
Energy associated with heat source 1	[(307b)	)+(310b)] x 100 ÷ (367b)	x 1.22	= 3453.38	(367)
Electrical energy for heat distribution		[(313) x		= 81.69	(372)
Total Energy associated with communit	y systems	(363)(366) + (368)	(372)	= 3535.07	(373)
if it is negative set (373) to zero (unle	ess specified otherwise,	see C7 in Appendi	ix C)	3535.07	(373)
Energy associated with space heating (	secondary)	(309) x	0	= 0	(374)

Energy associated with water from immersion heater or insta	ntaneous heater(312) x	1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =			3535.07	(376)
Energy associated with space cooling	(315) x	3.07	=	0	(377)
Energy associated with electricity for pumps and fans within	dwelling (331)) x	3.07	=	538.35	(378)
Energy associated with electricity for lighting	(332))) x	3.07	=	740.13	(379)
Energy saving/generation technologies Item 1		3.07 × 0.0	1 =	-1567.16	(380)
Total Primary Energy, kWh/year sum of (37	6)(382) =			3246.39	(383)

		l lser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa					0001082 on: 1.0.5.9	
Address :	F	roperty	Address	: Plot 12					
1. Overall dwelling dime	ensions:								
<u> </u>		Are	a(m²)		Av. He	ight(m)		Volume(m	3)
Ground floor			50.54	(1a) x	2	2.5	(2a) =	126.36	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n) =	50.54	(4)					
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	126.36	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys	0 + 0	7 + [	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	<u> </u>	0		0	x 2	20 =	0	(6b)
Number of intermittent fa	ins				2	x ′	10 =	20	(7a)
Number of passive vents	3			F	0	x -	10 =	0	(7b)
Number of flueless gas f	ires			Ĺ	0	x 4	40 =	0	(7c)
_				L					
							Air ch	nanges per ho	our
	ys, flues and fans = $(6a)+(6b)+(6b)$			_ [	20		÷ (5) =	0.16	(8)
If a pressurisation test has be Number of storeys in t	peen carried out or is intended, procee he dwelling (ns)	ed to (17),	otherwise (	continue fr	rom (9) to	(16)		0	(9)
Additional infiltration	ne awening (115)					[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	0.35 fo	r masoni	ry consti	ruction	• • •	•	0	(11)
	resent, use the value corresponding to	o the grea	ter wall are	a (after					
deducting areas of openial If suspended wooden to	ngs);	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	,	(	,,					0	(13)
Percentage of window	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
,	q50, expressed in cubic metre		•	•	etre of e	envelope	area	5	(17)
•	lity value, then $(18) = [(17) \div 20] + (6)$ es if a pressurisation test has been do.				io boing u	and		0.41	(18)
Number of sides sheltere		ie or a de	gree air pe	ппеаышу	is being u	seu		3	(19)
Shelter factor			(20) = 1 -	[0.075 x (′	19)] =			0.78	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18	) x (20) =				0.32	(21)
Infiltration rate modified f	for monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7							_	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		
				<u> </u>				ı	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37	]	
Calcul <del>ate effe</del> If mechanic		•	rate for t	he appli	cable ca	se						- -	
If exhaust air h			endix N (2	3h) = (23a	a) x Fmv (e	equation (1	N5)) othe	rwise (23h	) = (23a)			0	(23
If balanced wit									) — ( <b>20</b> 0)			0	
a) If balance		•	•	J		`		,	Dh\m ı (	23h) v [	1 (226)	0	(23
24a)m= 0	0		0	0	0	0	0	0	0	0	0	] - 100j	(24
b) If balance									<u> </u>			J	(-
24b)m= 0	0		0	0	0	0	0	0	0	0	0	1	(24
c) If whole h							<u> </u>					]	(_
if (22b)r	n < 0.5 ×	(23b), t	hen (24	c) = (23b	o); other	wise (24	c) = (22k	o) m + 0.	5 × (23b	)		_	
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24
d) If natural if (22b)r	ventilation				•				0.5]				
24d)m= 0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	]	(24
Effective air	change	rate - er	nter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)				1	
25)m= 0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57	1	(2
0 11(1		( ]			•							<b>.</b>	
3. Heat losse					Net Ar	••	LLvol	10	AXU		k-valu	•	ΑΧk
LEMENT	Gros area		Openin m		A ,r		U-valı W/m2		(W/	K)	kJ/m².	-	kJ/K
oors					2	х	1	_ = [	2				(20
Vindows					8.651	x1	/[1/( 1.4 )+	0.04] =	11.47				(2
loor					33.58	6 X	0.13		4.36617	9 [			(28
Valls Type1	19.	7	8.65		11.05	5 x	0.18	<u> </u>	1.99	Ŧ i		7 7	(29
Valls Type2	19.	7	2		17.7	X	0.18	<u> </u>	3.19	<b>=</b>		i i	(29
otal area of	elements	., m²			72.98	<u> </u>							(3
for windows and		,	effective wi	ndow U-va			ı formula 1	/[(1/U-valu	re)+0.04] a	as given in	paragrapi	h 3.2	(-
* include the are				ls and pan	titions		(0.0) (0.0)	(00)					
abric heat lo		,	U)				(26)(30)					23.01	(3:
leat capacity									.(30) + (32	, , ,	(32e) =	2921.4	1 (3
hermal mass	•	`		,					tive Value			250	(3
or design asses an be used inste				construct	ion are noi	t known pr	ecisely the	e indicative	values of	IMP IN T	able 1f		
hermal bridg				using Ap	pendix l	<						6.69	(30
details of therm	al bridging	are not kn	own (36) =	= 0.05 x (3	11)								
otal fabric he	at loss							(33) +	(36) =			29.7	(3
entilation he	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (	25)m x (5)	)	_	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
38)m= 24.24	24.11	23.98	23.38	23.26	22.73	22.73	22.64	22.94	23.26	23.49	23.73	]	(3
leat transfer	coefficie	nt, W/K						(39)m	= (37) + (	38)m			
										_		_	
39)m= 53.94	53.81	53.68	53.08	52.96	52.43	52.43	52.34	52.64	52.96	53.19	53.43		

Heat loss para	meter (I	HLP). W/	m²K					(40)m	= (39)m ÷	÷ (4)			
(40)m= 1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.04	1.04	1.05	1.05	1.06		
` /				<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	L Average =	: Sum(40) <sub>1</sub> ,	12 /12=	1.05	(40)
Number of day	s in mo	nth (Tab	le 1a)						ŭ	, ,			
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)
-										1			
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		71		(42)
Annual averag Reduce the annua	e hot wa al average	hot water	usage by	$5\%$ if the $\alpha$	lwelling is	designed i			se target o		.72		(43)
not more that 125	litres per	person per	day (all w	ater use, I	not and co	ld) 							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage ir	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m= 82.19	79.2	76.22	73.23	70.24	67.25	67.25	70.24	73.23	76.22	79.2	82.19		
Energy content of	hot water	used - cal	culated m	onthly = $4$ .	190 x Vd,r	n x nm x E	OTm / 3600			ım(44) <sub>112</sub> = ables 1b, 1		896.65	(44)
(45)m= 121.89	106.61	110.01	95.91	92.03	79.41	73.59	84.44	85.45	99.58	108.7	118.04		
		1				l	1	-	Total = Su	.I ım(45) <sub>112</sub> =	=	1175.66	(45)
If instantaneous w	ater heati	ing at point	of use (no	hot water	storage),	enter 0 in	boxes (46	) to (61)			•		_
(46)m= 18.28	15.99	16.5	14.39	13.8	11.91	11.04	12.67	12.82	14.94	16.31	17.71		(46)
Water storage		•		•	•			•					
Storage volum	e (litres	) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	•			•			` '						
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage  a) If manufact		eclared l	nee fact	ar ie kna	wn (k\//k	2/d2v/).					00		(40)
•				JI IS KIIU	WII (KVVI	i/uay).					39		(48)
Temperature fa							(10)			0.	.54		(49)
Energy lost fro b) If manufact		_	-		or ic not		(48) x (49)	) =		0.	.75		(50)
Hot water stora			-								0		(51)
If community h	-			_ (	, ,	-97					<u> </u>		(0.)
Volume factor	•										0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro	m wate	r storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or (	54) in (	55)								0.	75		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	(55) × (41)	m				
(56)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(56)
If cylinder contains												ix H	(==)
(57)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Primary circuit	loss (ar	nual) fro	m Table	3							0		(58)
Primary circuit	loss ca	culated f	or each	month (	•	. ,	, ,		r thorns				. ,
(modified by					ı —		<u> </u>	<u> </u>		<del>-                                    </del>	00.00		(EO)
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss of	aclaulatad	for oach	month /	(61)m -	(60) · 2	65 v (41	١m						
(61)m= 0	0	0	0	0	00) + 3	0 7 (41)	0	T 0	0	0	0	1	(61)
(3)	!						<u> </u>	ļ		ļ	<u> </u>	J · (59)m + (61)m	(- /
(62)m= 168.4	<del></del>	156.6	141	138.62	124.5	120.18	131.04		146.18	153.79	164.64	1 (39)III + (01)IIII ]	(62)
Solar DHW inpu										ļ		]	(- /
(add addition										o to mate	o:ag)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from	water hea	ter				!	<u>I</u>	1		!	!	J	
(64)m= 168.4		156.6	141	138.62	124.5	120.18	131.04	130.54	146.18	153.79	164.64	1	
	L			l .			Ou	put from w	ater heate	r (annual) <sub>1</sub>	l12	1724.27	(64)
Heat gains f	rom water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m		_
(65)m= 77.8	1	73.85	67.96	67.87	62.48	61.74	65.35	64.49	70.39	72.22	76.53	1	(65)
include (5	7)m in cal	culation o	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is f	rom com	munity h	neating	
5. Internal	<u> </u>			•	•						•		
Metabolic ga				,									
Jar		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m= 85.3°	1 85.31	85.31	85.31	85.31	85.31	85.31	85.31	85.31	85.31	85.31	85.31	1	(66)
Lighting gair	ns (calcula	ted in Ap	pendix	L, equati	ion L9 o	r L9a), a	lso see	Table 5	•	•	•	•	
(67)m= 13.65	5 12.12	9.86	7.47	5.58	4.71	5.09	6.62	8.88	11.28	13.16	14.03	]	(67)
Appliances (	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	 3a), als	o see Ta	ble 5		!		
(68)m= 148.6	5 150.19	146.3	138.03	127.58	117.77	111.21	109.66	113.55	121.83	132.27	142.09	]	(68)
Cooking gair	ns (calcula	ted in Ap	pendix	L, equat	ion L15	or L15a	), also s	ee Table	5	!	!	•	
(69)m= 31.53	3 31.53	31.53	31.53	31.53	31.53	31.53	31.53	31.53	31.53	31.53	31.53	]	(69)
Pumps and	fans gains	(Table 5	ia)			•	•	•	•	•	•	•	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3	]	(70)
Losses e.g.	evaporatic	n (negat	ive valu	es) (Tab	le 5)	•	•	•	•	•	•	•	
(71)m= -68.2	5 -68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25	-68.25	]	(71)
Water heating	ng gains (T	able 5)				•	•	•	•		•	•	
(72)m= 104.5	8 102.85	99.27	94.39	91.23	86.77	82.99	87.84	89.56	94.61	100.3	102.86		(72)
Total intern	al gains =				(66)	)m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	'1)m + (72)	)m	•	
(73)m= 318.4	7 316.76	307.02	291.48	275.99	260.84	250.88	255.71	263.59	279.3	297.33	310.57	]	(73)
6. Solar ga	ins:							•	•				
Solar gains ar	e calculated	using solaı	flux from	Table 6a	and assoc	iated equa	itions to d	onvert to th	ne applicat	ole orientat	tion.		
Orientation:			Area		Flu			g_ Table 6b	_	FF		Gains	
	Table 6d		m²		Ta	ble 6a		Table 6b	_ '	able 6c		(W)	_
Northeast 0.9		х	8.6	S5	X	11.28	X	0.63	x	0.7	=	29.83	(75)
Northeast 0.9	0	х	8.6	65	X 2	22.97	X	0.63	x	0.7	=	60.72	(75)
Northeast 0.9	0	X	8.6	S5	X	11.38	x	0.63	x	0.7	=	109.4	(75)
Northeast 0.9		X	8.6	S5	x (	67.96	x	0.63	x	0.7	=	179.67	(75)
Northeast 0.9	× 0.77	X	8.6	65	x (	91.35	x	0.63	x	0.7	=	241.51	(75)

Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	9	7.38	x		0.63	x	0.7	=	257.47	(75)
Northeast <sub>0.9x</sub>	0.77	Х	8.6	55	x	(	91.1	x		0.63	x	0.7	=	240.86	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	7	2.63	x		0.63	x	0.7	=	192.02	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	5	0.42	x		0.63	x	0.7	<del>-</del>	133.31	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	2	8.07	x		0.63	x [	0.7	=	74.21	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x		14.2	x		0.63	×	0.7	_	37.53	(75)
Northeast 0.9x	0.77	X	8.6	55	x	(	9.21	x		0.63		0.7		24.36	(75)
_					,			•							
Solar gains in	watts, ca	alculated	for eacl	n month				(83)m	n = Si	um(74)m .	(82)m				
(83)m= 29.83	60.72	109.4	179.67	241.51	25	57.47	240.86	192	2.02	133.31	74.21	37.53	24.36		(83)
Total gains – ir	nternal a	nd solar	(84)m =	(73)m	+ (8	33)m	, watts							_	
(84)m= 348.3	377.48	416.42	471.15	517.49	5′	18.31	491.74	447	'.73	396.89	353.51	334.86	334.93		(84)
7. Mean inter	nal temp	erature	(heating	season	)										
Temperature						area f	from Tal	ole 9	, Th	1 (°C)				21	(85)
Utilisation fac	_	•			-				,	( )					``
Jan	Feb	Mar	Apr	May	È	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.98	0.94	0.82	(	0.62	0.47	0.5	Ŭ	0.81	0.97	0.99	1		(86)
Mean interna	Ltompor	oturo in	livina or	no T1 /f/	مالد	w cto	no 2 to 7	7 in T	الحد	2 00)		·	<u>I</u>	l .	
(87)m= 19.96	20.07	20.3	20.62	20.87	_	0.98	21	20.		20.92	20.6	20.23	19.93		(87)
` '							<u> </u>				20.0	20.20	10.00		(- /
Temperature					т —			T		· ,	00.04	T 00 04	00.04	1	(00)
(88)m= 20.03	20.03	20.03	20.04	20.04	2	0.05	20.05	20.	.05	20.05	20.04	20.04	20.04		(88)
Utilisation fac	tor for g	ains for I	rest of d	welling,	h2,	m (se	e Table	9a)			<u> </u>	•	ı	1	
(89)m= 0.99	0.99	0.98	0.92	0.77		0.54	0.37	0.4	42	0.73	0.95	0.99	1		(89)
Mean interna	l temper	ature in	the rest	of dwell	ing	T2 (f	ollow ste	eps 3	3 to 7	7 in Tabl	e 9c)			_	
(90)m= 18.64	18.81	19.15	19.61	19.92	2	0.04	20.05	20.	.05	19.98	19.59	19.05	18.62		(90)
										f	LA = Livi	ng area ÷ (4	4) =	0.43	(91)
Mean interna	l temper	ature (fo	r the wh	ole dwe	lling	g) = fl	LA × T1	+ (1	– fL	.A) × T2					
(92)m= 19.21	19.36	19.65	20.05	20.33	_	0.44	20.46	20.		20.39	20.03	19.56	19.19		(92)
Apply adjustn	nent to the	ne mean	internal	temper	atu	re fro	m Table	4e,	whe	re appro	priate	-!	Į.	I	
(93)m= 19.21	19.36	19.65	20.05	20.33	2	0.44	20.46	20.	.46	20.39	20.03	19.56	19.19		(93)
8. Space hea	ting requ	uirement													
Set Ti to the r					ned	at ste	ep 11 of	Tabl	le 9b	o, so tha	t Ti,m=	(76)m an	d re-calc	ulate	
the utilisation					_							1	_	l	
Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation fac	tor for ga	o.97	0.92	0.79	Γ,	0.58	0.41	0.4	17	0.76	0.95	0.99	0.99		(94)
Useful gains,						J.36	0.41	0.2	+/	0.76	0.95	0.99	0.99		(54)
(95)m= 346.02	373.38	405.96	434.67	407.61	29	99.09	201.42	210	47	301.32	335.66	330.66	333.13		(95)
Monthly average					_					0002	000.00	1 000.00	0000		, ,
(96)m= 4.3	4.9	6.5	8.9	11.7		14.6	16.6	16	5.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate	e for mea		al tempe		_		=[(39)m	L		 – (96)m	 ]	1	I .	l	
(97)m= 804.22	777.97	705.8	591.63	457.29	_	06.43	202.36	212	_	330.95	499.25	662.78	800.74		(97)
Space heating	g require	ement fo	r each m	nonth, k	Wh	/mont	th = 0.02	24 x	[(97)	m – (95	)m] x (4	11)m		I	
(98)m= 340.9	271.89	223.08	113.01	36.96		0	0		<del>- `</del>	0	121.71	239.13	347.9		
					_			•				•	•	ı	

						Tota	ıl per year	(kWh/yea	r) = Sum(9	8) <sub>15,912</sub> =	1694.59	(98)
Space heating:   Fraction of space heat from secondary/supplementary system	Space heating requiremen	nt in kWh/m	²/year								33.53	(99)
Fraction of space heat from secondary/supplementary system	9a. Energy requirements –	Individual h	eating s	ystems i	ncluding	micro-C	CHP)					
Fraction of space heating from main system 1 (202) = 1 - (201) =										,		_
Fraction of total heating from main system 1 (204) = (202) × (1 - (203)) =	Fraction of space heat from	n secondar	y/supple	mentary	-						0	(201)
Efficiency of secondary/supplementary heating system, %    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	Fraction of space heat from	n main sys	tem(s)			,	,				1	(202)
Efficiency of secondary/supplementary heating system, %    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	Fraction of total heating fro	om main sy	stem 1			(204) = (2	02) <b>x</b> [1 –	(203)] =			1	(204)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec   kWh/year	Efficiency of main space h	eating syst	em 1								93.5	(206)
Space heating requirement (calculated above)  340.9	Efficiency of secondary/su	pplementar	y heatin	g systen	n, %						0	(208)
340.9   271.89   223.08   113.01   36.96   0   0   0   121.71   239.13   347.9		<u>_</u>		I.	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	·	<del>`</del>	T	<u> </u>				1 404 74	000.40	0.47.0		
364.6   290.79   238.59   120.87   39.53   0   0   0   130.17   255.76   372.09     Total (kWh/year) =Sum(211)_{1, Na_{1}, x^{2}}			ļ	0	0	0	0	121.71	239.13	347.9	I	
Total (kWh/year) = Sum(211), x, x, x, z =   1812.4   (211)				I 0				120.47	255 76	272.00		(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)  (215)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	364.6   290.79   238	.59 120.87	39.53		0	_	_				1912.4	7(211)
Section   Sect	Space heating fuel (secon	dary) kWh	/month			1010	(1.17711) 300	ur) – <b>o</b> urri(i	- ' '/15,1012		1012.4	(211)
Calcing   Calc	, ,	• /	111011111									
Water heating Output from water heater (calculated above)  [168.49] 148.69   156.6   141   138.62   124.5   120.18   131.04   130.54   146.18   153.79   164.64    [217] m=   86.66   86.4   85.76   84.23   81.84   79.8   79.8   79.8   79.8   84.33   85.99   86.76    [217] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=   194.43   172.09   182.61   167.4   169.39   156.02   150.6   164.21   163.59   173.34   178.86   189.76    [219] m=			0	0	0	0	0	0	0	0		
Output from water heater (calculated above)    168.49		<u>'</u>		•	•	Tota	l (kWh/yea	ar) =Sum(	215),15,1012	,=	0	(215)
168.49   148.69   156.6	Water heating											_
Efficiency of water heater	·		1	l	l			T	l			
(217)   86.66   86.4   85.76   84.23   81.84   79.8   79.8   79.8   79.8   79.8   84.33   85.99   86.76		7.6 141	138.62	124.5	120.18	131.04	130.54	146.18	153.79	164.64	70.0	7(216)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m (219)m = 194.43 172.09 182.61 167.4 169.39 156.02 150.6 164.21 163.59 173.34 178.86 189.76  Total = Sum(219a)_{1.12} = 2062.28 (219)  Annual totals Space heating fuel used, main system 1		76   94 22	01 04	70.9	70.9	70.9	70.9	04 22	95.00	96.76	79.8	
(219)m = (64)m x 100 ÷ (217)m (219)m = 194.43 172.09 182.61 167.4 169.39 156.02 150.6 164.21 163.59 173.34 178.86 189.76  Total = Sum(219a) <sub>1-12</sub> = 2062.28 (219)  Annual totals Space heating fuel used, main system 1	` '		01.04	7 9.0	7 9.0	7 9.0	7 9.0	04.55	00.99	00.70		(=11)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump:  boiler with a fan-assisted flue Total electricity for the above, kWh/year  Electricity for lighting  Energy kWh/year  Energy kWh/year  Emission factor kg CO2/kWh  kWh/year  2062.28  (219)  kWh/year  kWh/year  kWh/year  Emission factor kg CO2/kWh  kg CO2/kWh	<b>3</b> ,					_	_					
Annual totals Space heating fuel used, main system 1  Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue  Total electricity for the above, kWh/year  Electricity for lighting  Energy kWh/year  Energy kWh/year  Emission factor kg CO2/kWh  kg CO2/year	(219)m= 194.43 172.09 182	.61 167.4	169.39	156.02	150.6				178.86	189.76		
Space heating fuel used, main system 1  Water heating fuel used  Electricity for pumps, fans and electric keep-hot  central heating pump:  boiler with a fan-assisted flue  Total electricity for the above, kWh/year  Electricity for lighting  Energy  kWh/year  Energy  kWh/year  Emission factor  kg CO2/kWh  Emissions  kg CO2/year						Tota	ıl = Sum(2					
Water heating fuel used  Electricity for pumps, fans and electric keep-hot  central heating pump:  boiler with a fan-assisted flue  Total electricity for the above, kWh/year  Electricity for lighting  Energy kWh/year  Energy kWh/year  Emission factor kg CO2/kWh  Emissions kg CO2/year		oin avatam	1					k	Wh/year	•		<u>r</u>
Electricity for pumps, fans and electric keep-hot  central heating pump:  boiler with a fan-assisted flue  Total electricity for the above, kWh/year  Electricity for lighting  Energy  kWh/year  Energy  kg CO2/kWh  Energy  kg CO2/year		ain system	1									=
central heating pump:  boiler with a fan-assisted flue  Total electricity for the above, kWh/year  Electricity for lighting  Energy kWh/year  Energy kg CO2/kWh  Energy kg CO2/kWh  Energy kg CO2/year	Water heating fuel used										2062.28	
boiler with a fan-assisted flue  Total electricity for the above, kWh/year  Electricity for lighting  Energy kWh/year  Energy kg CO2/kWh kg CO2/year	Electricity for pumps, fans a	and electric	keep-ho	t								
Total electricity for the above, kWh/year sum of (230a)(230g) = 75 (231)  Electricity for lighting 241.09 (232)  12a. CO2 emissions – Individual heating systems including micro-CHP  Energy kWh/year Emission factor kg CO2/kWh kg CO2/year	central heating pump:									30		(230c)
Electricity for lighting  241.09  (232)  12a. CO2 emissions – Individual heating systems including micro-CHP  Energy	boiler with a fan-assisted f	lue								45		(230e)
12a. CO2 emissions – Individual heating systems including micro-CHP  Energy Emission factor kg CO2/kWh kg CO2/year	Total electricity for the above	/e, kWh/yea	ar			sum	of (230a).	(230g) =			75	(231)
Energy Emission factor Emissions kWh/year kg CO2/kWh kg CO2/year	Electricity for lighting										241.09	(232)
kWh/year kg CO2/kWh kg CO2/year	12a. CO2 emissions – Ind	ividual heat	ing syste	ems inclu	uding mi	cro-CHF	)					_
										tor		
	Space heating (main system	m 1)			-					=		_

Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	445.45	(264)
Space and water heating	(261) + (262) + (263) + (264) =		836.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93	(267)
Electricity for lighting	(232) x	0.519 =	125.12	(268)
Total CO2, kg/year	sum	of (265)(271) =	1000.98	(272)

TER = 19.8 (273)