#### **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 14:54:59

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 13

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))

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

Dwelling Carbon Dioxide Emission Rate (DER) 14.30 kg/m<sup>2</sup> OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 56.5 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 45.4 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

		Hear	Details:										
Assessor Name:	Zahid Ashraf	0301	Strom	a Nium	bori		STD∪	001082					
Software Name:	Stroma FSAP 2012	2	Softwa					on: 1.0.5.9					
		Propert	y Address:	Plot 13									
Address: 1. Overall dwelling dimensions:													
Overall dwelling dime	ensions:	•	( 2)		A I I .	last (/as)		) / - l /					
Ground floor		Ar	ea(m²)	(1a) x		<b>ight(m)</b> 2.5	(2a) =	Volume(m³	(3a)				
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)-	+ (1n)		(4)			]` '	120.00					
Dwelling volume	۵٫۰(۱۵٫۰(۱۵٫۰(۱۵٫۰	(,	30.34		)+(3c)+(3c	d)+(3e)+	.(3n) =	126.26	7(5)				
				(50) (50)	, , (00) , (00	.,	.(0)	126.36	(5)				
2. Ventilation rate:		condary	other		total			m³ per hou	r				
Number of chimneys	heating he	eating +	0	1 = [	0	x 4	40 =	0	(6a)				
Number of open flues	0 +	0 +	0	Ј <u>Г</u>	0	x	20 =	0	(6b)				
Number of intermittent fa				J <u>L</u>	0	x	10 =	0	(7a)				
Number of passive vents				L	0	x	10 =	0	(7b)				
Number of flueless gas f				L	0		40 =	<u> </u>	(7c)				
Number of flueless gas fi	1163			L				0	(70)				
							Air ch	anges per ho	our				
Infiltration due to chimne	ys, flues and fans = (6a)	)+(6b)+(7a)+(7b)	+(7c) =		0		÷ (5) =	0	(8)				
	peen carried out or is intended	l, proceed to (17)	), otherwise o	ontinue fr	om (9) to	(16)	'		_ 				
Number of storeys in the Additional infiltration	ne aweiling (ns)					[(9)]	-1]x0.1 =	0	(9)				
	.25 for steel or timber fr	ame or 0.35 f	or masonr	v constr	uction	[(0)	1]XO.1 =	0	(11)				
	resent, use the value correspo	onding to the gre	ater wall are	a (after					` ′				
deducting areas of opening	ngs); if equal user 0.35 floor, enter 0.2 (unseale	d) or 0.1 (sea	aled) else	enter ()				0	(12)				
If no draught lobby, en	•	u) 01 0.1 (302	1100), 0130	Critici o				0	(13)				
•	s and doors draught stri	pped						0	(14)				
Window infiltration	-		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)				
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)				
•	q50, expressed in cubic	•	•	•	etre of e	envelope	area	3	(17)				
If based on air permeabil	•							0.15	(18)				
Air permeability value applie  Number of sides sheltere	es if a pressurisation test has l	been done or a c	legree air pei	meability	is being u	sed		2	(19)				
Shelter factor	,u		(20) = 1 -	0.075 x (1	19)] =			0.78	(20)				
Infiltration rate incorpora	ting shelter factor		(21) = (18)	x (20) =				0.12	(21)				
Infiltration rate modified f	or 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						
		<del></del>	•		•	•	•	•					

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	) v Emy (c	auation (I	VEVV otho	nuico (22h	) - (222)			0.5	(23a
If balanced with		•		, ,		•		,	) = (23a)			0.5	(23b
		-	-	_					21. )	001.) [	4 (00)	79.05	(230
a) If balance						<del></del>	<del>- ^ ` </del>	<del>í `</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		(246
b) If balance						<del>-                                    </del>	<del></del>	ŕ	<del> </del>	<del></del>	Ι ,	1	(24h
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b
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	0	0	1	(240
` ' '						<u> </u>						J	(=
d) If natural v if (22b)m				•	•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24d
Effective air	change	rate - er	nter (24a	or (24b	o) or (24	c) or (24	d) in box	x (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)
							1	ı			1		
3. Heat losses		·			NI a t A a		11 -1	_	A 3/ 11		1 -1	-	A 37 I
ELEMENT	Gros area	_	Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²-l		A X k kJ/K
Doors		( )			2	x	1.4		2.8	$\stackrel{\prime}{\Box}$			(26)
Windows					8.651	x1	/[1/( 1.4 )+	0.04] =	11.47	=			(27)
Floor					50.54	<b>=</b>	0.12		6.0654	=			(28)
Walls Type1	23.0	7	8.65		14.42	=	0.12			᠆		<b>-</b>	(29)
Walls Type2				_		=		=	2.16	북 남		$\dashv$ $\vdash$	==
• •	19.7		2		17.7	=	0.14	= [	2.5				(29)
Total area of el		,	effootivo vii	ndow II ve	93.31		y formula 1	1/1/1/11	) . 0 041 .	a airan in	naraaranl		(31)
* for windows and ** include the area						ated using	j iorriiula T	/[( I/ <b>U-</b> vaiu	ie)+0.04] a	is given in	paragrapi	1 3.2	
Fabric heat los	s, W/K =	= S (A x	U)				(26)(30)	) + (32) =				25	(33)
Heat capacity (	Cm = S(	Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	4240.54	(34)
Thermal mass	,	•	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	e indicative	values of	TMP in Ta	able 1f		`` ^
can be used instea	nd of a det	tailed calc	ulation.										
Thermal bridge	•	•		• .	•	<						10.41	(36)
if details of therma		are not kn	own (36) =	= 0.05 x (3	11)			(00)	(00)				
Total fabric hea		da. let	l						(36) =	OE) (5)		35.41	(37)
Ventilation hea					l .		T .		= 0.33 × (		i	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	-	(00)
(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	J	(38)
Heat transfer c	oefficier	nt, W/K				ı		(39)m	= (37) + (	38)m	1	1	
(39)m= 45.96	45.84	45.72	45.11	44.99	44.38	44.38	44.26	44.63	44.99	45.23	45.48		
									Average =	Sum(39) <sub>1</sub>	12 /12=	45.08	(39)

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.91	0.91	0.9	0.89	0.89	0.88	0.88	0.88	0.88	0.89	0.89	0.9		
		!							Average =	Sum(40) <sub>1</sub>	12 /12=	0.89	(40)
Number of day	<u> </u>	<del></del>	· ·						<u> </u>				
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 requ	irement:								kWh/ye	ear:	
Assumed occu if TFA > 13. if TFA £ 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13		71		(42)
Annual average Reduce the annual not more that 125	ge hot wa al average	hot water	usage by	5% if the $a$	lwelling is	designed t			se target c		3.65		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i								l geb	I OCI	INOV	Dec		
(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		
(11)	1 00.07	00.20	77.00	70.00	70.70	70.70	70.00	<u> </u>		Im(44) <sub>112</sub> =	L	943.85	(44)
Energy content of	f hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	n x nm x E	OTm / 3600			. ,	L		` ′
(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		
	•	•							Total = Su	ım(45) <sub>112</sub> =	=	1237.53	(45)
If instantaneous v	vater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	) to (61)					
(46)m= 19.25	16.83	17.37	15.14	14.53	12.54	11.62	13.33	13.49	15.72	17.16	18.64		(46)
Water storage					/\/\ IDO	-1	20.2						
Storage volum	,					_		ame ves	sei		0		(47)
If community hotherwise if no	-			-			, ,	are) ante	ar '∩' in <i>l</i>	<b>(</b> 17)			
Water storage		not wate	i (uno n	iciuues i	iistaiitai	ieous co	ATIOI DOII	ers) erik	51 0 111 (	(77)			
a) If manufact		eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro	om watei	r storage	, kWh/ye	ear			(48) x (49)	) =		1	10		(50)
b) If manufact			-										
Hot water stor	-			e 2 (kW	h/litre/da	ay)				0.	02		(51)
If community he Volume factor	•		on 4.3										(50)
Temperature f			2h							-	.6		(52) (53)
·				oor			(47) v (51)	) x (52) x (	52) _				, ,
Energy lost fro Enter (50) or		_	, KVVII/y	zai			(47) X (31)	) X (32) X (	JJ) =		.03		(54) (55)
Water storage	` , ` `	,	for each	month			((56)m = (	(55) × (41)	m		.03		(00)
					00.00		. , ,	. , , ,	ı	1 00 00	00.04		(EC)
(56)m= 32.01 If cylinder contain	28.92	32.01	30.98	32.01 m = (56)m	30.98	32.01	32.01	30.98 7)m = (56)	32.01	30.98 (H11) is fro	32.01	v H	(56)
				· · ·						1		A11	(57)
(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 circuit	t loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit				,	•	` '	, ,		.1				
(modified by			ı —	ı —	ı —		<del></del>	<del>-</del>		<del>-                                    </del>			(==)
(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	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	Ç	91.1	x		0.63	x	0.7	=	240.86	(75)
Northeast <sub>0.9x</sub>	0.77	х	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	×	0.7		133.31	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	55	x	2	28.07	x		0.63	x	0.7	<del>=</del>	74.21	(75)
Northeast <sub>0.9x</sub>	0.77	х	8.6	55	x	,	14.2	x		0.63	x	0.7	<del>-</del>	37.53	(75)
Northeast 0.9x	0.77	X	8.6	55	x	Ç	9.21	x		0.63	<b>-</b> x [	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 – i	nternal a	nd solar	(84)m =	(73)m	+ (8	33)m	, watts							•	
(84)m= 357.5	386.59	425.35	479.81	525.99	52	26.58	499.8	456	3.05	405.31	362.19	343.84	344.04		(84)
7. Mean inter	nal temp	erature	(heating	season	)										
Temperature						area 1	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= 0.94	0.93	0.89	0.8	0.66		0.5	0.38	0.4	Ŭ	0.64	0.84	0.92	0.95		(86)
Mean interna	l tompor	oturo in	livina or	no T1 /f/	مالد	w cto	no 2 to 7	7 in T	الحد	2 (10)	<u> </u>				
(87)m= 19.34	19.54	19.9	20.37	20.73	_	0.92	20.97	20.		20.82	20.37	19.79	19.31		(87)
` ′							<u> </u>				20.07	10.10	10.01		(- /
Temperature					т —			T		·	00.40	T 00.47	00.47	Ī	(00)
(88)m= 20.16	20.16	20.16	20.17	20.18	2	0.19	20.19	20.	.19	20.18	20.18	20.17	20.17		(88)
Utilisation fac	tor for g	ains for I	rest of d	welling,	h2,	m (se	e Table	9a)			ı		1	•	
(89)m= 0.94	0.92	0.87	0.78	0.62		).45	0.31	0.3	36	0.59	0.82	0.91	0.94		(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= 17.94	18.22	18.73	19.4	19.87	2	0.11	20.17	20.	.16	20	19.41	18.59	17.89		(90)
										f	LA = Livi	ng area ÷ (	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= 18.54	18.79	19.24	19.82	20.24	_	0.46	20.52	20.		20.35	19.82	19.11	18.5		(92)
Apply adjustn	nent to tl	ne mean	internal	temper	atu	re fro	m Table	4e,	whe	re appro	priate				
(93)m= 18.54	18.79	19.24	19.82	20.24	2	0.46	20.52	20.	.51	20.35	19.82	19.11	18.5		(93)
8. Space hea	ting requ	uirement													
Set Ti to the					ned	at ste	ep 11 of	Tabl	le 9b	o, so tha	t Ti,m=	(76)m an	d re-cald	culate	
the utilisation					_							1	Ι_	l	
Jan	Feb	Mar	Apr	May		Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation fac	0.9	0.86	0.76	0.63	٦,	0.46	0.34	0.3	20	0.6	0.8	0.89	0.93		(94)
Useful gains,					Ц,	7.40	0.34	0.0	50	0.0	0.0	0.09	0.93		(04)
(95)m= 329.19	348.17	364.17	366.79	329.81	24	14.53	169.52	175	43	244.12	291.04	307.13	319.05		(95)
Monthly average												1 000	1 0.0.00		, ,
(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	an intern	al tempe	erature,	L Lm	. W =	 =[(39)m	x [(9:	3)m-	– (96)m	l ]		1		
(97)m= 654.66	636.51	582.33	492.62	384.34	_	50.08	173.83	18		279.04	414.86	543.28	650.47		(97)
Space heatin	g require	ement fo	r each m	nonth, k	Wh	/mont	th = 0.02	24 x	[(97)	m – (95	)m] x (4	11)m		1	
(98)m= 242.15	193.77	162.31	90.6	40.57		0	0		<del>- `</del>	0	92.13	170.02	246.57		
					•		•	•			•	•	•	•	

٦	Total per year (kWh/year) = Sum(98) <sub>15,912</sub> =	1238.13	(98)
Space heating requirement in kWh/m²/year		24.5	(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) =		1	(302)
The community scheme may obtain heat from several sources. The procedure allows	for CHP and up to four other heat sources; th	e latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See Approximation of heat from Community boilers	ppendix C. Г	1	(303a)
Fraction of total space heat from Community boilers	(302) × (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community l		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating	L	kWh/yea	<b>」</b> ```
Annual space heating requirement		1238.13	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1300.03	(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	4000 27	_
If DHW from community scheme:	L	1888.37	
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)] =	32.83	(313)
Cooling System Energy Efficiency Ratio		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	ide	175.36	(330a)
warm air heating system fans		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)		241.09	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-510.48	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity	<i>'</i> )	0	(334)
12b. CO2 Emissions – Community heating scheme			
	Energy Emission factor E kWh/year kg CO2/kWh k	Emissions cg CO2/year	
CO2 from other sources of space and water heating (not CHP)  Efficiency of heat source 1 (%)  If there is CHP using two forms	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 =	754.35	(367)
Electrical energy for heat distribution [(313)	x 0.52 =	17.04	(372)

Total CO2 associated with community sy	stems	(363)(366) + (368)(372	2)	=	771.39	(373)
CO2 associated with space heating (second	ondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion	on heater or instanta	neous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space and wa	ter heating	(373) + (374) + (375) =			771.39	(376)
CO2 associated with electricity for pumps	s and fans within dwe	elling (331)) x	0.52	=	91.01	(378)
CO2 associated with electricity for lighting	g	(332))) x	0.52	=	125.12	(379)
Energy saving/generation technologies (3 Item 1	333) to (334) as appl	icable	0.52 x 0.01 :	- [	-264.94	(380)
Total CO2, kg/year	sum of (376)(382) =				722.59	(383)
<b>Dwelling CO2 Emission Rate</b>	(383) ÷ (4) =				14.3	(384)
El rating (section 14)					89.87	(385)

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

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

Property Details: Plot 13

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: 35.4

Summer heat loss coefficient: 202.21 (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 3.44 3.26 3.02 (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 20.74 22.46 22.12 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		Strom Softwa					0001082 on: 1.0.5.9	
		Property	Address						
Address :									
1. Overall dwelling dime	ensions:								
One word floor			ea(m²)	1,, ,		ight(m)	_	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)+(	In)	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	<b>=</b> + [	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)					1/0	) 41×0.4	0	(9)
	.25 for steel or timber frame of	or 0 35 fc	or masoni	rv consti	ruction	[(9	)-1]x0.1 =	0	(10)
	resent, use the value corresponding			•	detion			0	(11)
deducting areas of openii		0.4./	1) 1						_
·	floor, enter 0.2 (unsealed) or	U.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 met	es per h	our per s	quare m	etre of e	envelope	e area	3	(17)
If based on air permeabil	lity value, then $(18) = [(17) \div 20]$	-(8), otherv	vise (18) =	(16)				0.31	(18)
	es if a pressurisation test has been d	one or a de	egree 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	1	
(220)1117 1.21 1.20	1.20 1.11 1.00 0.90	1 0.00	1 0.02		L	1.12	10	J	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(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	•				•	-	
If mechanic  If exhaust air h			andiv N (2	3h) - (23s	a) × Fmv (e	aguation (1	VS)) othe	rwisa (23h	) <i>- (</i> 23a)			0	(23
If balanced wit									) = (20u)			0	(23
		•	•	J		`		,	3l-\ <i>(</i>	00h) [	4 (00-)	0	(23
a) If balance	ea mech	anicai ve	ntilation	with nea	at recove	ery (IVIVI	1R) (248	$\frac{1}{1} = \frac{2}{2}$	2b)m + ( 0	23b) × [1	$\frac{1 - (23c)}{0}$	) ÷ 100] 1	(24
												J	(2-
b) If balance	ea mecna 0	1		without	neat red	overy (i	<del>- ´ ` -</del>	0)m = $(22)$	<del>- ^ `</del>	<del></del>	Ι ,	1	(24
24b)m= 0		0	0		<u> </u>		0		0	0	0	J	(2-
c) If whole h	nouse ex n < 0.5 <b>x</b>				•				5 v (22h	.)			
$\frac{11(220)1}{24c)m=0}$	0.5 7	0	0	0 = (230)	0	0	$C_{i} = (221)$	0	0	0	0	1	(24
			, i									J	(2)
d) If natural if (22b)r	ventilation = 1, the			•	•				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	]	(24
Effective air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in box	(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	at loce i	aramata	or:								_	
ELEMENT	Gros		Openin		Net Ar	00	U-valı	10	AXU		k-value	2	ΑΧk
ELEIVIENI	area		operiiri m		A,r		W/m2		(W/I	K)	kJ/m <sup>2</sup> ·	-	kJ/K
Doors					2	х	1.4	_ [	2.8				(26
Vindows					8.651	x1.	/[1/( 1.4 )+	0.04] =	11.47	=			(27
loor					50.54	5 X	0.12	[	6.0654	<b>=</b>			(28
Walls Type1	23.0	17	8.65		14.42	=	0.15	<u> </u>	2.16	<b>=</b>		<b>=</b>  =	(29
Valls Type2	19.		2	_	17.7	x	0.14		2.5	룩 ;		╡	(29
otal area of						=	0.14	[	2.5				
for windows and		•	offective wi	ndow H-vs	93.31		ı formula 1	/[/1/    <sub>-</sub> val	امرا ۱۸۵ دامر	se aivon in	naragrani	h 2 2	(31
* include the are						atou using	nonnula 1	/[( i/ O - vaia	ic)+0.0+j c	is giveri iii	paragrapi	7 3.2	
abric heat lo	ss, W/K :	= S (A x	U)				(26)(30)	) + (32) =				25	(33
leat capacity	Cm = S(	(Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	4240.	54 (34
hermal mass	parame	ter (TMF	P = Cm ÷	TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35
or design asses	sments wh	ere the de	tails of the	construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		`
an be used inste	ad of a de	tailed calc	ulation.										
hermal bridg	es : S (L	x Y) cal	culated (	using Ap	pendix l	<						10.4	(36
details of therm		are not kn	own (36) =	= 0.05 x (3	11)			(0.0)	(0.0)			Г	
otal fabric he									(36) =			35.4	(37
entilation he	i	i	· ·		Ι.			· · · · ·	= 0.33 × (			1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	4	(0)
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	J	(38
leat transfer	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
		r	r									7	
39)m= 58.2	58.12	58.05	57.7	57.64	57.34	57.34	57.28	57.45	57.64	57.77	57.9		(39

eat loss para	meter (H	HLP), W/	m²K					(40)m	= (39)m ÷	· (4)			
0)m= 1.15	1.15	1.15	1.14	1.14	1.13	1.13	1.13	1.14	1.14	1.14	1.15		
umber of day	s in mor	oth (Tahl	(د1 م		-	-	-		Average =	Sum(40) <sub>1</sub> .	12 /12=	1.14	(40
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41
4. Water heat	ing ener	gy requi	rement:								kWh/yea	ar:	
ssumed occu if TFA > 13.9 if TFA £ 13.9	N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13.		71		(42
nnual averag educe the annua ot more that 125	e hot wa I average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		.65		(43
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ot water usage ir	litres per	day for ea	ch month	Vd,m = fa	ctor from	Table 1c x	(43)	•	•	•			
4)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> ,,,
nergy content of	hot water	used - cal	culated mo	onthly = $4$ .	190 x Vd,r	n x nm x E	0Tm / 3600			m(44) <sub>112</sub> = ables 1b, 1		943.85	(44
5)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		
:	- 4- v l 4i:		-f (				havea (40		Total = Su	m(45) <sub>112</sub> =		1237.53	(4
instantaneous w													(46
6)m= 0 /ater storage	0 loss:	0	0	0	0	0	0	0	0	0	0		(4)
torage volum	e (litres)	includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(4
community h	•			•			` '				_		
therwise if no		hot wate	er (this in	cludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	47)			
/ater storage		eclared le	oss facto	or is kno	wn (kWł	n/dav):					0		(4
emperature fa					(	, , .					0		(4
nergy lost fro				ear			(48) x (49)	) =			0		(5
) If manufact			-										
ot water stora	•			e 2 (kW	h/litre/da	ay)					0		(5
community h	_		JII 4.3								0		(5:
emperature fa	-		2b							-	0		(5
nergy lost fro				ear			(47) x (51)	) x (52) x (	53) =		0		(5
Inter (50) or (		-	,				, , , , ,		,	-	0		(5
/ater storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)	m				
6)m= 0	0	0	0	0	0	0	0	0	0	0	0		(5
cylinder contains	dedicated	d solar sto	rage, (57)r	n = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	1 7)m = (56)	m where (	H11) is fro	m Appendix	Н	
7)m= 0	0	0	0	0	0	0	0	0	0	0	0		(5
ىـــــــا rimary circuit	loss (an	nual) fro	m Tahla	. 3	•	•	•	•			0		(5
rimary circuit	•	•			59)m = (	(58) ÷ 36	65 × (41)	m					•
,				,	•	. ,	, ,						
(modified by	factor fr	om Tabl	e H5 if t	here is s	solar wat	ter heatii	ng and a	ı cylinde	r thermo	stat)			

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	S5	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	9	7.38	X		0.63	x [	0.7	=	257.47	(75)
Northeast <sub>0.9x</sub>	0.77	Х	8.6	5	x	Ç	91.1	X		0.63	x	0.7	=	240.86	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x	7	2.63	X		0.63	x	0.7	=	192.02	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x	5	0.42	X		0.63	x	0.7		133.31	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x	2	8.07	x		0.63	_ x [	0.7	=	74.21	(75)
Northeast <sub>0.9x</sub>	0.77	Х	8.6	5	x	,	14.2	X		0.63	×	0.7	_	37.53	(75)
Northeast 0.9x	0.77	X	8.6	5	x	Ç	9.21	x		0.63		0.7		24.36	(75)
_					١										
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 – i	nternal 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 inter	nal temp	erature	(heating	season	)										
Temperature						area 1	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= 0.97	0.96	0.94	0.88	0.78	C	).64	0.52	0.5	Ŭ	0.79	0.92	0.96	0.98		(86)
Mean interna	l tompor	oturo in	livina or	22 T1 /f/	حالد	w cto	nc 2 to 7	Tin T	الحد	2 00)			<u>I</u>		
(87)m= 18.52	18.74	19.18	19.79	20.35	1	0.73	20.89	20.		20.52	19.81	19.06	18.47		(87)
` ′											10.01	10.00	10.11		(- /
Temperature					1			1		· ,	40.07	1 40 07	40.00	1	(00)
(88)m= 19.96	19.96	19.96	19.97	19.97	1	9.97	19.97	19.	.97	19.97	19.97	19.97	19.96		(88)
Utilisation fac	tor for g	ains for I	rest of d	welling,	h2,	m (se	e Table	9a)			<u> </u>		ı	•	
(89)m= 0.97	0.96	0.93	0.86	0.74	C	).58	0.42	0.4	48	0.73	0.9	0.96	0.97		(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= 17.69	17.91	18.34	18.94	19.47	1	19.8	19.92	19	.9	19.63	18.97	18.23	17.64		(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	_A × T1	+ (1	– fL	.A) × T2					
(92)m= 18.05	18.26	18.7	19.31	19.85	_	0.21	20.34	20.		20.01	19.33	18.59	18		(92)
Apply adjustn	nent to tl	ne mean	internal	temper	atu	re fro	m Table	4e,	whe	re appro	priate	•	Į.		
(93)m= 18.05	18.26	18.7	19.31	19.85	2	0.21	20.34	20.	.31	20.01	19.33	18.59	18		(93)
8. Space hea	ting requ	uirement													
Set Ti to the					ned	at ste	ep 11 of	Tab	le 9b	o, so tha	t Ti,m=	(76)m an	d re-calc	culate	
the utilisation												1	_	1	
Jan	Feb	Mar	Apr	May	<u> </u>	Jun	Jul	<u> </u>	ug	Sep	Oct	Nov	Dec		
Utilisation fac	0.94	0.91	0.85	0.74		0.59	0.46	0.5	52	0.73	0.89	0.94	0.96		(94)
Useful gains,						).55	0.40	0.0	<i>J</i> 2	0.73	0.09	0.94	0.90		(01)
(95)m= 265.68	290.04	317.47	342.36	333.08	26	88.37	195.63	197	.57	242.87	253.7	250.38	254.57		(95)
Monthly average												1			` '
(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	an intern	al tempe	erature,	Lm	, W =	=[(39)m	x [(9	 3)m-	– (96)m	]	1	I	1	
(97)m= 800.04	776.76	708.24	600.45	469.7	_	21.43	214.56	224		339.78	503.14	663.69	799.08		(97)
Space heatin	g require	ement fo	r each m	nonth, k	Wh	/mont	h = 0.02	24 x	[(97)	m – (95	)m] x (4	-1)m		•	
(98)m= 397.56	327.07	290.73	185.82	101.64		0	0		)	0	185.58	297.58	405.12		
														-	

								Tota	l per year	(kWh/yeaı	r) = Sum(9	8)15,912 =	2191.12	(98)
Space h	heating	g require	ement in	kWh/m²	/year								43.35	(99)
8c. Spa	ice coc	oling req	uiremen	it										
Calcu <u>la</u>	ted for	June, J	luly and	August.	See Tal	ole 10b								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat los	ss rate	Lm (ca	lculated	using 25	5°C inter	nal temp	erature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	538.95	424.28	435.33	0	0	0	0		(100)
Utilisati	on fact	or for lo	ss hm										•	
(101)m=	0	0	0	0	0	0.76	0.82	0.78	0	0	0	0		(101)
Useful I	loss, hi	mLm (W	/atts) = (	100)m x	(101)m								•	
(102)m=	0	0	0	0	0	409.11	347.06	339.62	0	0	0	0		(102)
Gains (	solar g	ains cal	culated	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	03)m – (	102)m ] :	x (41)m	
` —	4)m to	zero if (	104)m <	3 × (98	)m				-		,		•	
(104)m=	0	0	0	0	0	133.29	160.97	127.59	0	0	0	0		
										= Sum(	,	=	421.84	(104)
Cooled for									f C =	cooled	area ÷ (4	4) =	1	(105)
Intermitte											ı		ı	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
_									Total	l = Sum(	(104)	=	0	(106)
Space co	Ť										Т	_	Ī	
(107)m=	0	0	0	0	0	33.32	40.24	31.9	0	0	0	0		_
									Total	= Sum(	107)	=	105.46	(107)
Space co	ooling	requiren	nent in k	:Wh/m²/y	/ear				(107)	÷ (4) =			2.09	(108)
8f. Fabrio	c Ener	gy Effici	ency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabric E	Energy	Efficier	псу						(99) -	+ (108) =	=		45.44	(109)

#### **SAP Input**

Property Details: Plot 13

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** 23.071 8.65 14.42 0.15 0 False N/A Corridor Wall 19.699 2 17.7 0.15 0.4 False N/A 50.545 N/A **Exposed Floor** 0.12

Internal Elements
Party Elements

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1116

LengthPsi-value4.7950.289E2Other lintels (including other steel lintels)13.20.047E4Jamb

15.696 0.064 E7 Party floor between dwellings (in blocks of flats)

#### **SAP Input**

8.175	0.053	E18	Party wall between dwellings
15.696	0.293	E20	Exposed floor (normal)
2.725	0.12	E25	Staggered party wall between dwellings
12.747	0	P3	Intermediate floor between dwellings (in blocks of flats)
12.747	0.16	P7	Exposed floor (normal)

Yes (As designed) Pressure test:

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: Number of passive stacks: 0 3 Number of sides sheltered: 3 Pressure test:

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

thermostats Control code: 2312

Secondary heating system: None

From main heating system Water heating:

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

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

100% Low energy lights:

Low rise urban / suburban Terrain type:

English **EPC language:** 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

		User-I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa					001082 on: 1.0.5.9	
Address :	F	roperty	Address	Plot 13					
Address: 1. Overall dwelling dime	ensions:								
		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 = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n) = ==================================	50.54	(4)					<u> </u>
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	+0 =	0	(6a)
Number of open flues	0 + 0	<u> </u>	0	Ī <b>-</b> [	0	x 2	20 =	0	(6b)
Number of intermittent fa	ins				2	x 1	0 =	20	(7a)
Number of passive vents	<b>;</b>			Ē	0	x 1	0 =	0	(7b)
Number of flueless gas fi	ires			F	0	x 4	10 =	0	(7c)
				L					
				_			Air ch	anges per ho	our —
	ys, flues and fans = (6a)+(6b)+(			ontinus fr	20		÷ (5) =	0.16	(8)
Number of storeys in the	peen carried out or is intended, procee he dwelling (ns)	a 10 (17),	otrierwise	onunue ir	om (9) to (	(16)		0	(9)
Additional infiltration	<b>3</b> \					[(9)-	1]x0.1 =	0	(10)
	.25 for steel or timber frame o			•	ruction			0	(11)
if both types of wall are p deducting areas of openi	resent, use the value corresponding t ngs): if equal user 0.35	o the grea	ter wall are	a (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	. ,	-	(4.5)		0	(15)
Infiltration rate	aco avaraged in autic mater		(8) + (10)					0	(16)
•	q50, expressed in cubic metro lity value, then $(18) = [(17) \div 20] + (18)$			•	etre 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 incorporate	•		(21) = (18	) x (20) =				0.32	(21)
Infiltration rate modified f	<del>- 1                                   </del>	1	1 4	0.5.5	0-4	N.	Dan	1	
Jan Feb	Mar   Apr   May   Jun	Jul	Aug	Sep	Oct	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	]	
( <u></u> /	0.0	<u> </u>	1	<u>'</u>	I	1		I	
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 infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(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			andiv N (2	3h) - (23s	a) v Emy (e	auation (1	VSV) other	rwisa (23h	) – (23a)			0	(23
If balanced with		0 11	, ,	, (	, ,	. `	,, .	`	) = (25a)			0	(23
		-	-	_					Ol- \	005) [	4 (00-)	0	(23
a) If balance	i		i		·	<u> </u>	<del>- ^ ` `</del>	ŕ	<del>,                                    </del>	<del></del>	<del>```</del>	i ÷ 100] I	(24
(24a)m= 0	0		0	0	0	0	0	0	0	0	0		(24
b) If balance	1						<del>ÉÉÉ</del>	ŕ	<del>r ´     `</del>	<del></del>	1 .	1	(0.4
24b)m= 0	0	0	0	0		0	0	0	0	0	0		(24
c) If whole h				•	•				E (00k	. \			
	i		then (24d		i e		· · · · ·	r e	· ·	i	1 0	]	(24
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)r			ole hous m = (22l						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 (24k	o) or (24	c) or (24	d) in box	x (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 losse	s and he	at loss i	naramete	or.									
ELEMENT	Gros		Openin		Net Ar	ea	U-valı	IIE	ΑXU		k-value	Δ Δ	λΧk
	area	_	m		A ,r		W/m2		(W/		kJ/m²·l		J/K
Doors					2	х	1	=	2				(26
Vindows					8.651	x1.	/[1/( 1.4 )+	0.04] =	11.47				(27
Floor					50.54	5 x	0.13		6.57084	<u></u>			(28
Nalls Type1	23.0	17	8.65		14.42	_	0.18	<u>-</u>	2.6	<del>-</del>			(29
Walls Type2			2			×		=		륵 ¦			(29
Fotal area of e	19.1				17.7	=	0.18	[	3.19				
					93.31			/F/4/11	) . 0 0 41 .			- 2.2	(31
for windows and it include the area						atea using	i tormula 1	/[(1/ <b>U-</b> vail	ie)+0.04j a	as given in	paragrapr	1 3.2	
abric heat los	s, W/K :	= S (A x	U)	•			(26)(30)	) + (32) =				25.82	(33
Heat capacity		,	,					((28)	(30) + (32	2) + (32a).	(32e) =	4240.54	(34
Thermal mass		,	⊃ = Cm -	- TFA) ir	n kJ/m²K			., ,	tive Value	, , ,	` '	250	(35
For design asses	•	,		•			ecisely the				able 1f	230	(00
an be used inste	ad of a de	tailed calc	ulation.			,							
Thermal bridge	es : S (L	x Y) cal	culated (	using Ap	pendix I	<						9.71	(36
f details of therma		are not kn	own (36) =	= 0.05 x (3	11)								
Total fabric he	at loss							(33) +	(36) =			35.54	(37
/entilation 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= 24.24	24.11	23.98	23.38	23.26	22.73	22.73	22.64	22.94	23.26	23.49	23.73		(38
Heat transfer of	coefficier	nt, W/K						(39)m	= (37) + (	38)m			
					1		r			1	1	1	
39)m= 59.78	59.65	59.52	58.91	58.8	58.27	58.27	58.17	58.47	58.8	59.03	59.27		

Heat loss para	ımeter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.18	1.18	1.18	1.17	1.16	1.15	1.15	1.15	1.16	1.16	1.17	1.17		
							ı	,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.17	(40)
Number of day	1	nth (Tab	le 1a)	1	1	ı		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	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 average Reduce the annual not more that 125	, al average	hot water	usage by	5% if the $c$	lwelling is	designed t	,		se target o		.72		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	n litres pe	r day for ea		Vd,m = fa	ctor from	Table 1c x							
(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.i	n x nm x F.	Tm / 3600			m(44) <sub>112</sub> =		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		
(10)111= 121.00	100.01	110.01	00.01	02.00	70.11	7 0.00	0			m(45) <sub>112</sub> =	L	1175.66	(45)
If instantaneous w	vater heati	ng at point	of use (no	o hot water	storage),	enter 0 in	boxes (46			,	'		
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage		. !		-1\	/\// IDC								
Storage volum	`		•			Ū		ame ves	Sei		150		(47)
If community h Otherwise if no	•			•			` '	ers) ente	er '0' in <i>(</i>	(47)			
Water storage			. (					o. o, o		,			
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		_	-				(48) x (49)	) =			0		(50)
<ul><li>b) If manufact</li><li>Hot water store</li></ul>			-										(54)
If community h	•			ie z (KVV	n/nue/ua	1y <i>)</i>					0		(51)
Volume factor	_										0		(52)
Temperature f	actor fro	m Table	2b								0		(53)
Energy lost fro	m wate	rstorage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or	(54) in (	55)									0		(55)
Water storage	loss cal	culated t	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	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	[H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit					•	. ,	, ,						
(modified by		1			i		<del></del>			<del>' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' </del>	<del>                                     </del>		<i>(</i> )
(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	5	x [	97.38	X		0.63	x	0.7	=	257.47	(75)
Northeast <sub>0.9x</sub>	0.77	х	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	72.63	×		0.63	x	0.7	=	192.02	(75)
Northeast <sub>0.9x</sub>	0.77	X	8.6	5	x $\lceil$	50.42	×		0.63	x	0.7	<del>-</del>	133.31	(75)
Northeast <sub>0.9x</sub>	0.77	x	8.6	5	x	28.07	<b>=</b> x		0.63	_ x [	0.7	=	74.21	(75)
Northeast <sub>0.9x</sub>	0.77	x	8.6	5	x [	14.2	×		0.63	×	0.7	_	37.53	(75)
Northeast 0.9x	0.77	x	8.6	5	x	9.21	= x		0.63	x	0.7		24.36	(75)
_														
Solar gains in	watts, ca	alculated	for eacl	n month			(83)r	m = S	um(74)m .	(82)m				
(83)m= 29.83	60.72	109.4	179.67	241.51	257	7.47 240.86	6 192	2.02	133.31	74.21	37.53	24.36		(83)
Total gains – i	nternal a	nd solar	(84)m =	(73)m	+ (83	3)m , watts	;							
(84)m= 275.54	305.34	345.58	402.06	449.55	451	1.98 426.7	7 38	1.01	329.55	284.34	263.64	262.79		(84)
7. Mean inter	nal temp	erature	(heating	season	)									
Temperature						rea from T	able 9	), Th	1 (°C)				21	(85)
Utilisation fac	_	•			_			,	( )					`
Jan	Feb	Mar	Apr	May	<u> </u>	un Jul	<del></del>	Aug	Sep	Oct	Nov	Dec		
(86)m= 1	1	0.99	0.97	0.9	0.	74 0.58	+-	.66	0.91	0.99	1	1		(86)
Mean interna	l tompor	aturo in	living or	22 T1 /f/	الملا	ctope 2 to	7 in -	Tabl	0.00)		Į.	<u>I</u>		
(87)m= 19.66	19.79	20.04	20.4	20.74		.93 20.98		).97	20.8	20.39	19.97	19.64		(87)
` ′										20.00	10.07	10.01		(- /
Temperature									· `	10.05	1 40.05	40.04	[	(00)
(88)m= 19.93	19.94	19.94	19.95	19.95	19	.96 19.96	19	9.96	19.95	19.95	19.95	19.94		(88)
Utilisation fac	tor for g	ains for i	est of d	welling,	h2,n	n (see Tab	le 9a)			<u> </u>	T	ı	ı	
(89)m= 1	1	0.99	0.96	0.86	0.	65 0.45	0.	.53	0.85	0.98	1	1		(89)
Mean_interna	l temper	ature in	the rest	of dwelli	ng T	2 (follow s	steps 3	3 to 7	7 in Tabl	e 9c)				
(90)m= 18.72	18.84	19.09	19.46	19.77	19	.93 19.95	19	9.95	19.84	19.45	19.03	18.7		(90)
									f	LA = Livir	ng area ÷ (4	4) =	0.43	(91)
Mean interna	l temper	ature (fo	r the wh	ole dwe	lling	) = fLA × T	1 + (1	– fL	.A) × T2					
(92)m= 19.13	19.25	19.5	19.87	20.19		.36 20.4		).39	20.26	19.85	19.43	19.11		(92)
Apply adjustr	nent to t	he mean	internal	temper	atur	e from Tab	le 4e,	whe	ere appro	priate		Į.	l	
(93)m= 19.13	19.25	19.5	19.87	20.19	20	.36 20.4	20	).39	20.26	19.85	19.43	19.11		(93)
8. Space hea	iting requ	uirement												
Set Ti to the					ed a	at step 11 o	of Tab	ole 9l	o, so tha	t Ti,m=(	76)m an	d re-calc	culate	
the utilisation					Г.	<del></del>	Τ.				1	_	1	
Jan	Feb	Mar	Apr	May	J	un Jul		∖ug	Sep	Oct	Nov	Dec		
Utilisation fac	tor for g	0.99	0.96	0.87		69 0.51		.59	0.87	0.98	1	1		(94)
Useful gains,					0.	0.51		.55	0.07	0.90	'	'		(01)
(95)m= 274.93		341.96	386.8	392.5	312	2.37 217.33	3 224	4.27	286.01	278.87	262.56	262.33		(95)
Monthly aver							-				1			` '
(96)m= 4.3	4.9	6.5	8.9	11.7	_	1.6 16.6	16	6.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate	e for mea	an intern	al tempe	erature,	Lm ,	W =[(39)n	n x [(9	93)m	– (96)m	]	1	I	I	
(97)m= 886.25	855.95	773.82	646.12	499.08	_	5.7 221.3	<del></del>	2.21	359.96	544.09	728.04	883.57		(97)
Space heatin	g require	ement fo	r each m	nonth, k	Nh/r	nonth = 0.0	024 x	[(97	)m – (95	)m] x (4	1)m		•	
(98)m= 454.83	370.84	321.3	186.71	79.29		0		0	0	197.33	335.15	462.2		
													•	

								Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	2407.64	(98)
Space	e heating	g require	ement in	kWh/m²	<sup>2</sup> /year								47.63	(99)
8c. Sp	pace cod	oling req	uiremen	it										
Calcu	lated for	June, J	luly and	August.	See Tab	ole 10b	_							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat	loss rate	Lm (ca	lculated	using 2	5°C inter	nal temp	oerature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	547.74	431.2	442.11	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm										-	
(101)m=	0	0	0	0	0	0.87	0.92	0.89	0	0	0	0		(101)
Usefu	ıl loss, h	mLm (V	/atts) = (	100)m x	(101)m		_							
(102)m=	0	0	0	0	0	473.81	397.91	392.29	0	0	0	0		(102)
Gains	(solar g	gains cal	culated	for appli	cable we	eather re	egion, se	e Table	10)					
(103)m=	0	0	0	0	0	592.99	562.31	509.84	0	0	0	0		(103)
	e <i>cooling</i> 04)m to					lwelling,	continue	ous ( kW	h') = 0.02	24 x [(10	03)m – (	102)m ] :	x (41)m	
(104)m=	0	0	0	0	0	85.81	122.32	87.46	0	0	0	0		
	•								Total	= Sum(	104)	=	295.58	(104)
Cooled	fraction	1							f C =	cooled	area ÷ (4	<b>4)</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	l = Sum(	(104)	=	0	(106)
		requirer	nent for	month =	(104)m	× (105)	× (106)r	n					Ī	_
(107)m=	0	0	0	0	0	21.45	30.58	21.86	0	0	0	0		
									Total	= Sum(	107)	=	73.9	(107)
Space	cooling	requirer	nent in k	:Wh/m²/y	/ear				(107)	÷ (4) =			1.46	(108)
8f. Fab	ric Ener	gy Effici	ency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabrio	c Energy	/ Efficier	псу						(99) -	+ (108) =	=		49.1	(109)
Targe	et Fabrio	Energ	y Efficie	ency (TF	EE)								56.46	(109)

		l lser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	_ <u> </u>	Strom Softwa					0001082 on: 1.0.5.9	
A	F	roperty	Address	: Plot 13					
Address: 1. Overall dwelling dime	ensions:								
1. Overall aweiling aime		Are	a(m²)		Av. He	ight(m)		Volume(m <sup>3</sup>	3)
Ground floor				(1a) x		2.5	(2a) =	126.36	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	50.54	(4)			_		
Dwelling volume				l (3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	126.36	(5)
2. Ventilation rate:									
2. Veridiation rate.	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys		7 + [	0	] = [	0	x 4	40 =	0	(6a)
Number of open flues	0 + 0	<b></b>	0	j = [	0	x2	20 =	0	(6b)
Number of intermittent fa	ins				0	x -	10 =	0	(7a)
Number of passive vents	<b>S</b>			F	0	x ′	10 =	0	(7b)
Number of flueless gas f	ires			F	0	X 4	40 =	0	(7c)
· ·				L					`
							Air ch	nanges per ho	our
	ys, flues and fans = $(6a)+(6b)+(6b)$			_ [	0		÷ (5) =	0	(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 of	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	r 0.35 fc	r masoni	ry consti	ruction			0	(11)
if both types of wall are p deducting areas of openi	resent, use the value corresponding to	o the grea	ter wall are	a (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)
Percentage of window	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	. ,	-			0	(15)
Infiltration rate			(8) + (10)					0	(16)
,	q50, expressed in cubic metre	-	•	•	etre of e	envelope	area	3	(17)
•	lity value, then $(18) = [(17) \div 20] + (6)$ es if a pressurisation test has been do.				is beina u	sed		0.15	(18)
Number of sides sheltere		10 01 a ac	groo un po	modelinty	io boilig a	004		3	(19)
Shelter factor			(20) = 1 -	[0.075 x (	19)] =			0.78	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18	) x (20) =				0.12	(21)
Infiltration rate modified f	or 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		
-		•	•	•	•	•	•	•	

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 effect If mechanica		_	rate for t	he appli	cable ca	se	-	-	-	-	-	0.5	(23
If exhaust air he	eat pump (	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	) = (23a)			0.5	(23
If balanced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h	) =				79.05	(23
a) If balance	d mecha	anical ve	entilation	with he	at recove	ery (MVI	HR) (24a	a)m = (22)	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
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		(24
b) If balance	d mecha	anical ve	entilation	without	heat red	overy (I	ЛV) (24b	)m = (22	2b)m + (	23b)		_	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h if (22b)n					•				5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)n				•					0.5]			•	
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24
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		(2
3. Heat losse	s and he	eat loss i	paramete	er:									
LEMENT	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 J/K
oors					2	x	1.4	=	2.8	Ì			(2
Vindows					8.651	x1	/[1/( 1.4 )+	0.04] =	11.47				(2
loor					50.54	5 X	0.12	= [	6.0654				(2
Valls Type1	23.0	)7	8.65	;	14.42	<u>x</u>	0.15	=	2.16				(2
Valls Type2	19.7	7	2		17.7	X	0.14	=	2.5				(2
otal area of e	lements	, m²			93.31								(3
for windows and * include the area						ated using	formula 1	/[(1/U-valu	ie)+0.04] á	as given in	paragraph	1 3.2	
abric heat los	s, W/K =	= S (A x	U)				(26)(30)	) + (32) =				25	(3
leat capacity	Cm = S(	(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	4240.54	(3
hermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(3
or design assess an be used instea				construct	ion are no	t known pi	ecisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridge				ısina Ar	nendix k	<						10.41	(3
details of therma	,	,		• .	•	`						10.41	(0
otal fabric he			, ,	·	,			(33) +	(36) =			35.41	(3
entilation hea	t loss ca	alculated	monthly	<u>/</u>				(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		(3
leat transfer o	oefficier	nt, W/K						(39)m	= (37) + (	38)m			
89)m= 45.96	45.84	45.72	45.11	44.99	44.38	44.38	44.26	44.63	44.99	45.23	45.48	]	
10100													

	<del>-</del> -	meter (F	HLP), W/	m²K		Т	Т	Т	· · ·	= (39)m ÷	· (4)			
))m=	0.91	0.91	0.9	0.89	0.89	0.88	0.88	0.88	0.88	0.89	0.89	0.9		
ımher	of day	s in mor	nth (Tab	le 1a)						Average =	Sum(40) <sub>1</sub>	12 /12=	0.89	(
Г	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m=	31	28	31	30	31	30	31	31	30	31	30	31		(
_														
. Wate	er heati	ing ener	gy requi	rement:								kWh/ye	ear:	
		pancy, N		[1 ovn	( 0 0003	240 v /TE	EΛ 12.0	)2)] + 0.(	1012 v /*	TEA 12		71		(
		0, N = 1	T 1.70 A	[i - exp	(-0.000	743 X (11	A - 13.8	)Z)] + 0.(	) X C10X	II A - 13.	.9)			
								(25 x N) to achieve		an target o		3.65		(
		•	not water person per	0,		•	Ū	o acriieve	a water ut	se largel o	ı			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
t water	usage in	litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
)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		
eray co.	ntent of	hot water	used - cal	culated mo	onthly = 4	190 x Vd r	n x nm x F	)Tm / 3600			m(44) <sub>112</sub> =		943.85	
	128.31	112.22	115.8	100.96	96.87	83.59	77.46	88.89	89.95	104.82	114.42	124.26		
	120.51	112.22	113.0	100.90	30.07	03.39	77.40	00.09			m(45) <sub>112</sub> =	L	1237.53	
stantar	neous wa	ater heatir	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		· otal	(10)112	l	.20.100	
′ I	19.25	16.83	17.37	15.14	14.53	12.54	11.62	13.33	13.49	15.72	17.16	18.64		
	orage		مالم بام ما			WALLDO		م ماطفاند						
_			nd no ta	-			_	within sa	anie ves	SCI		0		
	•	_			_			mbi boil	ers) ente	er '0' in (	47)			
ater st	orage	loss:		`					,	`	,			
			eclared l		or is kno	wn (kWh	n/day):					0		
•			m Table									0		
•			storage eclared o	-		or is not		(48) x (49)	=		1	10		
			factor fr	•							0.	.02		
omm	unity h	eating s	ee secti	on 4.3	•		• /							
		rom Tal		01							1.	.03		
•			m Table						,,	,	0	.6		
•		m water 54) in (5	storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	_	03		
,	, ,	, ,	culated f	or each	month			((56)m = (	55) × (41)	m	1.	.03		
_	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		
												m Append	ix H	
_	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		
	circuit	loce /on	nual) fra	m Toble	. 3					I .		0		
-		•	inual) fro culated f			59)m = (	(58) ÷ 36	65 × (41)	m			~		•
-					,	•	. ,	ng and a		r thermo	stat)			

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$														
(61)m= 0	0	0	0	01)111 =	00) - (	0 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 <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	X		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	x	9.21	X		0.63	x	0.7	=	24.36	(75)
•		<u>_</u>												_
Solar gains in	watts, ca	alculated	I for eacl	h month			(83)m	n = Si	um(74)m .	(82)m				
(83)m= 29.83	60.72	109.4	179.67	241.51	257.47	240.86	192	2.02	133.31	74.21	37.53	24.36		(83)
Total gains –	internal a	nd solar	(84)m =	= (73)m ·	+ (83)n	n , watts							•	
(84)m= 483.67	511.23	544.67	591.47	629.68	624.12	594.69	552	2.46	507.03	471.58	461.21	467.55		(84)
7. Mean inte	rnal temp	erature	(heating	season	)									
Temperature	during h	eating p	eriods ir	the livi	ng area	a from Ta	ble 9	, Th	1 (°C)				21	(85)
Utilisation fa	ctor for g	ains for I	living are	ea, h1,m	(see 1	able 9a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	А	ug	Sep	Oct	Nov	Dec		
(86)m= 0.89	0.87	0.82	0.72	0.59	0.43	0.32	0.3	36	0.55	0.75	0.86	0.9		(86)
Mean interna	l temper	atura in	living ar	22 T1 (f	llow e	tone 3 to	7 in T	Table	2 0c)					
(87)m= 19.7	19.87	20.17	20.54	20.81	20.95	-i	20.		20.88	20.56	20.09	19.67		(87)
	ļ.				<u> </u>	_ <u>i</u>	ļ							, ,
Temperature (88)m= 20.16	20.16				20.19	<u> </u>	Т		· ,	20.40	20.17	20.47	Ī	(88)
(88)m= 20.16	20.16	20.16	20.17	20.18	20.19	20.19	20.	.19	20.18	20.18	20.17	20.17		(00)
Utilisation fac	T	ains for I	rest of d	welling,	h2,m (	see Table	9a)			ı		1	Ī	
(89)m= 0.88	0.86	0.8	0.7	0.55	0.38	0.26	0.3	3	0.5	0.72	0.84	0.89		(89)
Mean interna	al temper	ature in	the rest	of dwell	ng T2	(follow ste	eps 3	3 to 7	7 in Tabl	e 9c)				
(90)m= 18.45	18.68	19.1	19.62	19.97	20.14	20.18	20.	.17	20.07	19.66	19.01	18.41		(90)
									f	fLA = 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= 18.99	19.19	19.56	20.02	20.33	20.49		20.		20.42	20.05	19.48	18.95		(92)
Apply adjust	ment to the	he mean	internal	temper	ature f	rom Table	e 4e,	whe	re appro	priate	1			
(93)m= 18.99	19.19	19.56	20.02	20.33	20.49	20.52	20.	.52	20.42	20.05	19.48	18.95		(93)
8. Space hea	ating requ	uirement					•							
Set Ti to the					ed at s	step 11 of	Tabl	le 9b	o, so tha	t Ti,m=	(76)m an	d re-calc	culate	
the utilisation	1					1	1		_		1	I _	Ī	
Jan	Feb	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation fac	otor for ga			0.55	0.4	1 0 20	1 00	22	0.51	0.71	0.82	0.07		(94)
(94)m= 0.86		0.79	0.69	0.55	0.4	0.29	0.3	32	0.51	0.71	0.82	0.87		(34)
Useful gains (95)m= 416.33		428.32	407.7	349.29	250.83	3 171.46	178	2 44	259.73	336.89	379.06	406.48		(95)
Monthly avei					<u> </u>	7 171.40	170	,	200.10	330.03	373.00	400.40		(00)
(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 rat	<u> </u>				ļ.					l	1	I		• •
(97)m= 675.17	655.18	597.13	501.56	388.29	261.25	<del></del>	182		282.11	425	559.91	670.91		(97)
Space heatir	ng require	ement fo	r each n	nonth, k	Vh/mo	nth = 0.02	24 x [	 [(97)	)m – (95	)m] x (4	1)m	1	ı	
(98)m= 192.58	152.79	125.59	67.58	29.01	0	0		<u> </u>	0	65.56	130.21	196.73		
							-						1	

	Total per year (kWh/year) = Sum(98) <sub>15,912</sub> =	960.05	(98)
Space heating requirement in kWh/m²/year		18.99	(99)
9b. Energy requirements – Community heating scheme			
This part is used for space heating, space cooling or water heating. Fraction of space heat from secondary/supplementary heating (1)		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 a includes boilers, heat pumps, geothermal and waste heat from power stations. S		e latter	_
Fraction of heat from Community boilers		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 commun	nity heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system	n [	1.05	(306)
Space heating		kWh/yea	<u>r</u>
Annual space heating requirement		960.05	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1008.06	(307a
Efficiency of secondary/supplementary heating system in % (from	m Table 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary systematics	em (98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement	Γ	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)] =	29.91	(313)
Cooling System Energy Efficiency Ratio		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 o	outside [	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 qua	antity)	0	(334)
10b. Fuel costs – Community heating scheme	L		
<b>Fuel</b> kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating from CHP (307a) x	4.24 × 0.01 =	42.74	(340a
Water heating from CHP (310a) x	4.24 × 0.01 =	84.07	(342a)

		ı	Fuel Price		
Pumps and fans	(331)	[	13.19 x 0.01	= 23.13	(349)
Energy for lighting	(332)		13.19 x 0.01	= 31.8	(350)
Additional standing charges (Table 12)				120	(351)
Energy saving/generation technologies  Total energy cost	= (340a)(342e) + (345)(3	354) =		301.74	(355)
11b. SAP rating - Community heating	scheme				
Energy cost deflator (Table 12)				0.42	(356)
Energy cost factor (ECF)	[(355) x (356)] ÷ [(4) + 45.0] =	=		1.33	(357)
SAP rating (section12)				81.5	(358)
12b. CO2 Emissions - Community hea	ting scheme				
		Energy kWh/year	Emission factor kg CO2/kWh	or Emissions kg CO2/year	
CO2 from other sources of space and v Efficiency of heat source 1 (%)	• ,	g two fuels repeat (36	3) to (366) for the second	fuel 94	(367a)
CO2 associated with heat source 1	[(307b)+(	(310b)] x 100 ÷ (367b)	0.22	= 687.26	(367)
Electrical energy for heat distribution	]	(313) x	0.52	= 15.52	(372)
Total CO2 associated with community s	systems	(363)(366) + (368)	(372)	= 702.78	(373)
CO2 associated with space heating (se	condary)	(309) x	0	= 0	(374)
CO2 associated with water from immer	sion heater or instantane	ous heater (312)	) x 0.22	= 0	(375)
Total CO2 associated with space and v	vater heating	(373) + (374) + (375)	=	702.78	(376)
CO2 associated with electricity for pum	ps and fans within dwelli	ng (331)) x	0.52	= 91.01	(378)
CO2 associated with electricity for light	ing (	(332))) x	0.52	= 125.12	(379)
Energy saving/generation technologies Item 1	(333) to (334) as applica	able [	0.52 x 0.01	-264.94	(380)
Total CO2, kg/year	sum of (376)(382) =	_		653.98	(383)
<b>Dwelling CO2 Emission Rate</b>	(383) ÷ (4) =			12.94	(384)
El rating (section 14)				90.83	(385)
13b. Primary Energy – Community hea	ting scheme	<b>F</b>	Deimon	D.F	
		Energy kWh/year	Primary factor	P.Energy kWh/year	
Energy from other sources of space an Efficiency of heat source 1 (%)			3) to (366) for the second	fuel 94	(367a)
Energy associated with heat source 1	[(307b)+(	(310b)] x 100 ÷ (367b)	) x 1.22	= 3881.74	(367)
Electrical energy for heat distribution	]	((313) x		= 91.82	(372)
Total Energy associated with community	ty systems (	(363)(366) + (368)	(372)	= 3973.56	(373)
if it is negative set (373) to zero (unle	ess specified otherwise, s	see C7 in Append	lix C)	3973.56	(373)
Energy associated with space heating	(secondary)	(309) x	0	= 0	(374)

Total Primary Energy, kWh/year sum of (3)	76)(382) =			3684.88	(383)
Energy saving/generation technologies Item 1		3.07 × 0.01	1 =	-1567.16	(380)
Energy associated with electricity for lighting	(332))) x	3.07	=	740.13	(379)
Energy associated with electricity for pumps and fans within	dwelling (331)) x	3.07	=	538.35	(378)
Energy associated with space cooling	(315) x	3.07	=	0	(377)
Total Energy associated with space and water heating	(373) + (374) + (375) =			3973.56	(376)
Energy associated with water from immersion heater or insta	antaneous heater(312) x	1.22	=	0	(375)

		Hear	Details:										
Assessor Name:	Zahid Ashraf	0301	Stroma	. Num	hor		STDO	001082					
Software Name:	Stroma FSAP 2012		Softwa	-				on: 1.0.5.9					
Property Address: Plot 13													
Address :													
Overall dwelling dime	ensions:	<b>A</b>	( · · · 2)		A 11-	last (Cost)		Volume(m³					
Ground floor	Ground floor												
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)-	+ (1n) —		(4)			]` '	126.36	(3a)				
Dwelling volume	۵,۰(۰۵,۰(۰۵,۰(۰۵,۰(۰۵,۰		30.54		)+(3c)+(3c	d)+(3e)+	.(3n) =	126.26	7(5)				
				(54) (54)	,	., (66)	.(0)	126.36	(5)				
2. Ventilation rate:		condary	other		total			m³ per hou	r				
Number of chimneys	heating he	eating + [	0	] = [	0	X 4	40 =	0	(6a)				
Number of open flues	0 +	0 +	0	Ј <u>Г</u>	0	x 2	20 =	0	(6b)				
Number of intermittent fa				J	2	x	10 =	20	(7a)				
Number of passive vents				L	0		10 =	0	(7b)				
Number of flueless gas fi				L			40 =		(7c)				
Number of flueless gas in	1163			L	0			0	(70)				
Air changes per hour													
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	, proceed to (17,	), otherwise o	ontinue fr	om (9) to	(16)	'						
Number of storeys in the Additional infiltration	ne aweiling (ns)					[(9).	-1]x0.1 =	0	(9)				
	.25 for steel or timber fra	ame or 0.35 f	or masonr	v constr	uction	[(0)]	1]XO.1 =	0	(11)				
	resent, use the value correspo	onding to the gre	ater wall area	a (after					` ′				
deducting areas of openia	ngs); if equal user 0.35 floor, enter 0.2 (unseale	d) or 0.1 (sea	iled) else	enter ()				0	(12)				
If no draught lobby, en	,	a) or 0.1 (300	iica), cisc	critor o				0	(13)				
• •	s and doors draught stri	pped						0	(14)				
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)				
Infiltration rate			(8) + (10)	+ (11) + (1	2) + (13)	+ (15) =		0	(16)				
•	q50, expressed in cubic	•	•	•	etre of e	envelope	area	5	(17)				
If based on air permeabil	•							0.41	(18)				
Air permeability value applie  Number of sides sheltere	es if a pressurisation test has b ad	oeen done or a d	legree air pei	meability	is being u	sed		2	(19)				
Shelter factor	,u		(20) = 1 - [	0.075 x (1	9)] =			3 0.78	(20)				
Infiltration rate incorporate	ting shelter factor		(21) = (18)	x (20) =				0.32	(21)				
Infiltration rate modified f	or 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												
	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18						
		<del></del>	•		•	•	•	•					

Adjusted infiltration rate (allowi	ng for shelter a	nd 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	]	
Calculate effective air change	rate for the app	licable ca	se						J	_
If mechanical ventilation:	N. (00k) (00	(-) <b>F</b> (-	(° ( <b>)</b>	(IE)) - (I		\ (00-\			0	(23a)
If exhaust air heat pump using Appe						) = (23a)			0	(23b)
If balanced with heat recovery: effic								. ( )	0	(23c)
a) If balanced mechanical ve		1	<del>'                                    </del>	<del>, ``</del>	ŕ	<del> </del>	<del>,                                    </del>	<u>` `                                  </u>	) ÷ 100] 1	(0.4=)
(24a)m= 0 0 0	0 0	0	0	0	0	0	0	0		(24a)
b) If balanced mechanical ve		1	<del>-                                    </del>	<del>- ^ ` ` </del>	<del>i `</del>	<del> </del>	<del>'</del>		1	(O.4h.)
(24b)m= 0 0 0	0 0	0	0	0	0	0	0	0		(24b)
c) If whole house extract ven if (22b)m < 0.5 x (23b), t	•	•				E v (22h	<b>,</b> )			
(24c)m =	0 = (23)		0	$C_{i} = (221)$	0	0	0	0	1	(24c)
d) If natural ventilation or wh									]	(= .0)
if (22b)m = 1, then (24d)						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	]	(24d)
Effective air change rate - er	nter (24a) or (24	b) or (24	c) or (24	d) in box	x (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 p	narameter:								•	
ELEMENT Gross	Openings	Net Ar	ea	U-valı	ue.	AXU		k-value	Δ Α	X k
area (m²)	m²	A ,r		W/m2		(W/I		kJ/m²-		/K
Doors		2	X	1	=	2				(26)
Windows		8.651	x1.	/[1/( 1.4 )+	0.04] =	11.47				(27)
Floor		50.54	5 X	0.13	_ = [	6.57084	9			(28)
Walls Type1 23.07	8.65	14.42	<u>2</u> x	0.18		2.6	<b>=</b> [			(29)
Walls Type2 19.7	2	17.7	x	0.18	<b>=</b> i	3.19	₹ i		<u> </u>	(29)
Total area of elements, m <sup>2</sup>		93.31	一							(31)
* for windows and roof windows, use e	effective window U-			formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	h 3.2	
** include the areas on both sides of in	•	rtitions							_	_
Fabric heat loss, $W/K = S (A x)$	U)			(26)(30)	) + (32) =				25.82	(33)
Heat capacity $Cm = S(A \times k)$					((28)	(30) + (32	2) + (32a).	(32e) =	4240.54	(34)
Thermal mass parameter (TMF	•					tive Value			250	(35)
For design assessments where the de can be used instead of a detailed calcu		tion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridges : S (L x Y) cal-		ppendix I	K						9.71	(36)
if details of thermal bridging are not kn	_								0.71	(2.2)
Total fabric heat loss					(33) +	(36) =			35.54	(37)
Ventilation heat loss calculated	monthly				(38)m	= 0.33 × (	(25)m x (5)	)		
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 24.24 24.11 23.98	23.38 23.26	22.73	22.73	22.64	22.94	23.26	23.49	23.73		(38)
Heat transfer coefficient, W/K					(39)m	= (37) + (3	38)m			
(39)m= 59.78 59.65 59.52	58.91 58.8	58.27	58.27	58.17	58.47	58.8	59.03	59.27		
						Average =	Sum(39) <sub>1</sub>	12 /12=	58.91	(39)

Heat loss para	motor (l	JI D\ \\//	m2k					(40)m	= (39)m ÷	- (A)			
(40)m= 1.18	1.18	1.18	1.17	1.16	1.15	1.15	1.15	1.16	1.16	1.17	1.17		
(40)111= 1.10	1.10	1.10	1.17	1.10	1.13	1.13	1.13			Sum(40) <sub>1</sub> .		1.17	(40)
Number of day	s in mo	nth (Tab	le 1a)					,	Average =	3um(40)1.	12 / 12=	1.17	(40)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
		<u> </u>		<u> </u>	I	l	l	<u> </u>	l	Į	<u> </u>		
											130/1/		
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occur 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	ıl average	hot water	usage by	5% if the $a$	lwelling is	designed t			se target o		.72		(43)
not more that 125	nires per	person per T	uay (ali w	i	101 and 60								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	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	m x nm x C	OTm / 3600			m(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		
									Total = Su	m(45) <sub>112</sub> =	=	1175.66	(45)
If instantaneous w	ater heati	ng at point	of use (no	o hot water	r 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	loss:				!	!	!						
Storage volum	e (litres)	) includin	ig any s	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	eating a	and no ta	nk in dw	velling, e	nter 110	litres in	(47)						
Otherwise if no		hot water	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage													
a) If manufact				or is kno	wn (kWł	n/day):				1.	39		(48)
Temperature fa	actor fro	m Table	2b							0.	54		(49)
Energy lost fro		_	-				(48) x (49)	) =		0.	75		(50)
b) If manufact			-										(= 4)
Hot water stora	-			ie 2 (KVV	n/litre/da	iy)					0		(51)
If community h	•		on 4.3										(50)
Temperature fa			2h								0		(52) (53)
•							(47) × (51)	) v (E2) v (	E2) _				, ,
Energy lost fro Enter (50) or (		_	, KVVII/y	eai			(47) X (31)	) x (52) x (	JJ) =		0 75		(54) (55)
` , ,		•	or ooob	month			((EC)m - (	'EE) ~ (41)	<b></b>	0.	75		(55)
Water storage							·	(55) × (41)	···				
(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	dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)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	•	•									0		(58)
Primary circuit				,	•	. ,	, ,		41.	-1-1			
(modified by							<u> </u>	<u> </u>		<del>-                                    </del>	<del>                                     </del>		<b>/</b> :
(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(	SE (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	]	(63)
Output from	water hea	ter				ļ.	Į.	•		•			
(64)m= 168.4		156.6	141	138.62	124.5	120.18	131.04	130.54	146.18	153.79	164.64	1	
	Į.	<u> </u>					Ou	put from w	ater heate	r (annual) <sub>1</sub>	112	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	n ]	_
(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	]	(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 fı	rom com	munity h	neating	
5. Internal	gains (see	e Table 5	and 5a	):								_	
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	on 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	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.	evaporatio	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	Table 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 gai	ins:												
Solar gains ar	e calculated	using solar	flux from	Table 6a		•	itions to c	onvert to th	ne applicat		tion.		
Orientation:	Access F Table 6d		Area m²		Flu	ıx ble 6a		g_ Table 6b	т	FF		Gains	
						Die da	. –	able ob	_ '	able 6c		(W)	7
Northeast 0.9		X	8.6	35	x 1	1.28	X	0.63	x	0.7	=	29.83	(75)
Northeast 0.9	0	X	8.6	35	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	35	x 6	67.96	x	0.63	x	0.7	=	179.67	(75)
Northeast 0.93	× 0.77	X	8.6	65	x 9	91.35	X	0.63	X	0.7	=	241.51	(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	х	8.6	55	x	72.63	x		0.63	х	0.7	=	192.02	(75)
Northeast <sub>0.9x</sub>	0.77	х	8.6	65	x	50.42	x		0.63	х	0.7	=	133.31	(75)
Northeast <sub>0.9x</sub>	0.77	x	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	ı = Sı	um(74)m .	(82)m				
(83)m= 29.83	60.72	109.4	179.67	241.51	257.47	7 240.86	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= 348.3	377.48	416.42	471.15	517.49	518.3	491.74	447	.73	396.89	353.51	334.86	334.93		(84)
7. Mean inte	rnal temp	perature	(heating	season	)									
Temperature	during h	neating p	eriods ir	the livi	ng area	a from Ta	ble 9,	, Th	1 (°C)				21	(85)
Utilisation fa	ctor for g	ains for I	iving are	ea, h1,m	see 7	Table 9a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aı	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.99	0.95	0.85	0.67	0.51	0.5	58	0.84	0.97	0.99	1		(86)
Mean interna	al temper	ature in	living ar	22 T1 (fo	ollow s	tens 3 to	7 in T	ahla	2 9c)					
(87)m= 19.8	19.92	20.16	20.51	20.81	20.96	- <del>i</del>	20.9		20.87	20.5	20.1	19.78		(87)
					مال معالات		-1-1- (		-0 (00)		<u> </u>	<u> </u>		
Temperature	19.94	19.94	19.95	19.95	19.96	<u> </u>	19.9		12 (°C) 19.95	19.95	19.95	19.94		(88)
` '	ļ	<u> </u>				<u> </u>		90	19.95	19.95	19.95	19.94		(00)
Utilisation fa	<del> </del>				`		T				Т		1	
(89)m= 1	0.99	0.98	0.94	0.8	0.58	0.4	0.4	16	0.77	0.96	0.99	1		(89)
Mean interna	al temper	ature in	the rest	of dwell	ing T2	(follow ste	eps 3	to 7	7 in Tabl	e 9c)	_			
(90)m= 18.34	18.52	18.88	19.38	19.76	19.93	19.95	19.9	95	19.85	19.38	18.79	18.32		(90)
									f	LA = Livir	ng area ÷ (4	4) =	0.43	(91)
Mean interna	al temper	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1	– fL	A) × T2					
(92)m= 18.97	19.13	19.43	19.87	20.21	20.37		20.		20.29	19.86	19.35	18.95		(92)
Apply adjust	ment to t	he mean	internal	temper	ature f	rom Table	4e,	whe	re appro	priate	•			
(93)m= 18.97	19.13	19.43	19.87	20.21	20.37	20.4	20.	.4	20.29	19.86	19.35	18.95		(93)
8. Space hea	ating requ	uirement												
Set Ti to the					ned at s	step 11 of	Tabl	e 9b	o, so tha	t Ti,m=(	76)m an	d re-calc	culate	
the utilisation	1				Γ.	<del></del>					T	_	l	
Jan	Feb	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation factors (94)m= 0.99	0.99	0.98	0.93	0.82	0.62	0.45	0.5	1 1	0.79	0.96	0.99	0.99		(94)
Useful gains					0.02	0.43	0.5	'' ]	0.79	0.90	0.99	0.99		(04)
(95)m= 346.04		406.94	439.86	423.64	321.83	3 219.31	228	35	314.68	337.91	330.89	333.13		(95)
Monthly ave						7 2.0.0.	1	.00	000	001101	1 000.00	0000		, ,
(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										]	1	I	I	
(97)m= 877.03	1	769.75	646.08	500.59	336.42	<del>-``</del>	232	<del></del>	362.01	544.63	723.29	874.03		(97)
Space heatir	ng require	ement fo	r each n	nonth, k	Wh/mo	nth = 0.02	24 x [	(97)	m – (95	)m] x (4	1)m			
(98)m= 395.05	319.15	269.93	148.48	57.25	0	0	0	)	0	153.8	282.53	402.43		
													-	

Total per year (kWh/year) = Sum(98) <sub>15,912</sub> =	2028.62	(98)
Space heating requirement in kWh/m²/year	40.13	(99)
9a. Energy requirements – Individual heating systems including micro-CHP)		
Space heating:		_
Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 - (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec	kWh/ye	ear
Space heating requirement (calculated above)		
395.05 319.15 269.93 148.48 57.25 0 0 0 0 153.8 282.53 402.43		
$ (211)m = \{ [(98)m \times (204)] \} \times 100 \div (206) $ $ 422.51  341.34  288.7  158.8  61.23  0  0  0  0  164.49  302.17  430.41 $		(211)
Total (kWh/year) =Sum(211) <sub>151012</sub> =	2169.65	(211)
Space heating fuel (secondary), kWh/month		`
$= \{[(98)m \times (201)]\} \times 100 \div (208)$		
(215)m= 0 0 0 0 0 0 0 0 0 0 0		
Total (kWh/year) =Sum(215) <sub>15,1012</sub> =	0	(215)
Water heating		
Output from water heater (calculated above)  168.49		
Efficiency of water heater	79.8	(216)
(217)m= 87.01 86.8 86.25 84.95 82.66 79.8 79.8 79.8 79.8 84.95 86.42 87.11		(217)
Fuel for water heating, kWh/month		
$ (219)m = (64)m \times 100 \div (217)m $ $ (219)m = 193.63  171.3  181.56  165.98  167.71  156.02  150.6  164.21  163.59  172.08  177.97  189 $		
Total = Sum(219a) <sub>1-12</sub> =	2053.64	(219)
Annual totals kWh/year	kWh/yea	
Space heating fuel used, main system 1	2169.65	
Water heating fuel used	2053.64	=
Electricity for pumps, fans and electric keep-hot		
central heating pump:		(230c)
boiler with a fan-assisted flue		(230e)
Total electricity for the above, kWh/year sum of (230a)(230g) =	75	(231)
Electricity for lighting	241.09	(232)
	241.09	(202)
12a. CO2 emissions – Individual heating systems including micro-CHP		
<b>Energy Emission factor</b> kWh/year kg CO2/kWh	Emissions kg CO2/ye	
Space heating (main system 1) (211) x 0.216 =	468.64	(261)

Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	443.59 (264)
Space and water heating	(261) + (262) + (263) + (264) =		912.23 (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) =	1076.28 (272)

TER = 21.29 (273)