# **Regulations Compliance Report**

Printed on 28 October 2020 at 14		ma FSAP 2012 program, Version: 1.0.5.9	
Project Information:			
Assessed By: Zahid Ashraf	(STRO001082)	Building Type: Flat	
Dwelling Details:			
NEW DWELLING DESIGN STAG	E	Total Floor Area: 50.85m <sup>2</sup>	
Site Reference : Hermitage La		Plot Reference: Plot 50	
Address :			
Client Details:			
Name:			
Address :			
This report covers items include	d within the SAP calculations		
It is not a complete report of reg			
1a TER and DER			
Fuel for main heating system: Mai	ns gas (c)		
Fuel factor: 1.00 (mains gas (c))			
Target Carbon Dioxide Emission F	Rate (TER)	20.32 kg/m <sup>2</sup>	
Dwelling Carbon Dioxide Emissior	Rate (DER)	13.93 kg/m²	OK
1b TFEE and DFEE			
Target Fabric Energy Efficiency (T	FEE)	51.4 kWh/m <sup>2</sup>	
Dwelling Fabric Energy Efficiency	(DFEE)	43.7 kWh/m <sup>2</sup>	
			ОК
2 Fabric U-values			
Element	Average	Highest	
External wall	0.14 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	(no floor)		
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculat	ed from linear thermal transmitta	nces for each junction	
3 Air permeability			
Air permeability at 50 pasca	als	3.00 (design value)	
Maximum		10.0	OK
4 Heating efficiency			
Main Heating system:	Community heating schem	nes - mains gas	
Secondary heating system:	None		
5 Cylinder insulation			
Hot water Storage:	No cylinder		
6 Controls			
Space heating controls		use of community heating,	
	programmer and at least t	wo room thermostats	OK
Hot water controls:	No cylinder thermostat		
	No cylinder		

# **Regulations Compliance Report**

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK
8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.91	
Maximum	1.5	ОК
MVHR efficiency:	93%	
Minimum	70%	ОК
9 Summertime temperature		
Overheating risk (Thames valley):	Medium	ОК
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	8.65m <sup>2</sup>	
Ventilation rate:	4.00	
10 Key features		
Air permeablility	3.0 m³/m²h	
Roofs U-value	0.1 W/m²K	
Community heating, heat from boilers – mains gas		

Photovoltaic array

User Details:	
Assessor Name: Zahid Ashraf Stroma Number: STROO	01082
Software Name: Stroma FSAP 2012 Software Version: Version	n: 1.0.5.9
Property Address: Plot 50	
Address :	
1. Overall dwelling dimensions:	
Area(m²)Av. Height(m)Ground floor $50.85$ (1a) x $2.5$ (2a) =	Volume(m <sup>3</sup> ) 127.12 (3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 50.85 (4)	
Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$	127.12 (5)
2. Ventilation rate:	<u>.</u>
main heatingsecondary heatingothertotalNumber of chimneys $0$ $+$ $0$ $=$ $0$ $\times 40 =$ Number of open flues $0$ $+$ $0$ $+$ $0$ $=$ $0$ $\times 20 =$	m³ per hour         0       (6a)         0       (6b)
	0 (7a)
Number of passive vents 0 x 10 =	0 (7b)
Number of flueless gas fires 0 x 40 =	0 (7c)
Air cha	anges per hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 0$ If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) $\div$ (5) =	0 (8)
Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration [(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35	
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
If no draught lobby, enter 0.05, else enter 0	0 (13)
Percentage of windows and doors draught strippedWindow infiltration $0.25 - [0.2 \times (14) \div 100] =$	0 (14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$	0 (15)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	0 (16) 3 (17)
If based on air permeability value, then $(18) = [(17) \div 20]+(8)$ , otherwise $(18) = (16)$	3 (17) 0.15 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used	0.13
Number of sides sheltered	3 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor (21) = (18) x (20) =	0.12 (21)
Infiltration rate modified for monthly wind speed	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Monthly average wind speed from Table 7	
(22)m=       5.1       5       4.9       4.4       4.3       3.8       3.8       3.7       4       4.3       4.5       4.7	
Wind Factor (22a)m = (22)m $\div$ 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	

Adjust	ed infiltr	ation rat	e (allowi	ng for sł	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		
		c <i>tive air</i> al ventila	0	rate for t	he appli	cable ca	se						0.5	(23a)
				endix N. (2	23b) = (23a	a) x Fmv (e	equation (	N5)) , othe	rwise (23b	) = (23a)			0.5	(23b)
								n Table 4h		, (,			0.5	(230) (23c)
			-	-	-			HR) (24a		2h)m + ('	23h) x [ <sup>,</sup>	1 – (23c)		(200)
(24a)m=	<b></b>	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24	]	(24a)
		l d mech	I anical ve	Intilation	l without	L heat rec	L coverv (ľ	I MV) (24b	l = (22)	L 2b)m + (;	L 23b)		l	
(24b)m=	-	0	0	0	0	0		0	0	0	0	0		(24b)
		l ouse ex	I tract ver	tilation o	r positiv	L ve input v	ı ventilatio	n from c	utside				I	
,					•	•		c) = (22k		5 × (23b	)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilati	on from l	oft				1	
	if (22b)n	n = 1, th	en (24d)	m = (22l	b)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			1	
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effe	ctive air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	ld) in boy	(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)
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN	IENT	Gros area		Openin	igs 1 <sup>2</sup>	Net Ar A ,r		U-valı W/m2		A X U (W/ł	٢)	k-value kJ/m²·l		A X k (J/K
Doors		aroa	()		•	2	 x	1.4	= [	2.8				(26)
Windo	ws					8.651	=	/[1/( 1.4 )+	!	11.47	$\exists$			(27)
Walls		26.2		8.65				0.15	= [					(29)
Walls					,	17.61				2.64	╡╏		$\dashv$	
Roof	туред	23.0		2		21.03		0.14		2.98	╡╏		$\dashv$	(29)
	area of a	50.8		0		50.85		0.1	=	5.08				(30)
		elements		footivo wi	indow I I v	100.1		g formula 1	15/1/11 100	$(a) \cdot 0.041 a$	o aivon in	norograph	20	(31)
					ls and par		aleu using	g iomula i	/[(1/ <b>0-</b> valu	e)+0.04j a	s given in	parayrapr	1 3.2	
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	) + (32) =				24.97	(33)
Heat c	apacity	Cm = S(	(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	998.61	(34)
Therm	al mass	parame	ter (TM	- = Cm -	÷ TFA) ir	n kJ/m²K			Indica	tive Value:	Low		100	(35)
	-	sments wh ad of a de			construct	ion are noi	t known pi	recisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	<						13.68	(36)
if details	s of therma	al bridging	are not kr	own (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			38.66	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y				(38)m	= 0.33 × (	25)m x (5)	)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	10.61	10.49	10.37	9.76	9.64	9.03	9.03	8.91	9.27	9.64	9.88	10.12		(38)
Heat t	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	49.27	49.15	49.02	48.41	48.29	47.68	47.68	47.56	47.93	48.29	48.54	48.78		
										Average =	Sum(39)1	12 /12=	48.38	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.94	0.94	0.95	0.95	0.96		
Numbr	or of dou		nth (Tab							Average =	Sum(40)1.	12 /12=	0.95	(40)
Numbe	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(,														
4. Wa	iter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
if TF				: [1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13		72		(42)
Annua <i>Reduce</i>	l averag	je hot wa al average		usage by	5% if the a	lwelling is	designed	(25 x N) to achieve		se target o		.88		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	r	Table 1c x	(43)						
(44)m=	86.77	83.61	80.46	77.3	74.15	70.99	70.99	74.15	77.3	80.46	83.61	86.77		
Energy o	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	n x nm x [	) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) )			m(44) <sub>112</sub> = ables 1b, 1		946.54	(44)
(45)m=	128.67	112.54	116.13	101.24	97.14	83.83	77.68	89.14	90.2	105.12	114.75	124.61		
lf instan	taneous w	vater heati	na at point	t of use (no	o hot water	r storage).	enter 0 in	boxes (46		Total = Su	m(45) <sub>112</sub> =	-	1241.06	(45)
(46)m=	19.3	16.88	17.42	15.19	14.57	12.57	11.65	13.37	13.53	15.77	17.21	18.69		(46)
· · ·	storage											10100		
Storag	e volum	e (litres)	) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	•	-	and no ta		-			. ,		· · · (0) : · (	47)			
	nse i no storage		not wate	er (this ir	iciudes i	nstantar	ieous co	ombi boil	ers) ente	er u in (	47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature f	actor fro	m Table	2b								0		(49)
			r storage					(48) x (49)	) =		1	10		(50)
			eclared of	•										
		-	factor fr		ie z (kvv	n/iitre/ua	iy)				0.	02		(51)
		from Ta									1.	03		(52)
Tempe	erature f	actor fro	m Table	2b							0	.6		(53)
Energy	/ lost fro	m water	r storage	e, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter	(50) or (	(54) in (5	55)								1.	03		(55)
Water	storage	loss cal	culated	for each	month	-	-	((56)m = (	55) × (41)	m	-			
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (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=	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)
			nnual) fro									0		(58)
							. ,	65 × (41)		r tharms -	atat)			
(moo (59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	ng and a 23.26	22.51	23.26	22.51	23.26		(59)
(59)11=	23.20	21.01	23.20	22.01	23.20	22.01	23.20	23.20	22.01	23.20	22.01	20.20		(00)

Combi	loss ca	lculated	for eac	:h m	nonth (	(61)m =	(60	0) ÷ 36	65 × (41)	m						_	
(61)m=	0	0	0		0	0		0	0	0	C	)	0	0	0		(61)
Total h	eat req	uired for	water	hea	ting ca	alculated	d fo	r eacl	n month	(62)m	= 0.85	5×(	(45)m +	(46)m +	(57)m +	- (59)m + (61)m	
(62)m=	183.95	162.46	171.4	1	154.74	152.42	1	37.32	132.96	144.4	2 143	3.7	160.4	168.24	179.89	]	(62)
Solar DH	W input	calculated	using Ap	pen	idix G or	Appendi	хH	(negati	ve quantity	) (entei	'0' if no	solar	r contribu	tion to wate	er heating)	-	
(add a	dditiona	l lines if	FGHR	S ai	nd/or V	WWHR	S ap	oplies	, see Ap	pendix	(G)					_	
(63)m=	0	0	0		0	0		0	0	0	C	)	0	0	0		(63)
Output	from w	ater hea	ter														
(64)m=	183.95	162.46	171.4	1	154.74	152.42	1	37.32	132.96	144.4	2 143	3.7	160.4	168.24	179.89	]	
										0	utput fro	m wa	ater heate	er (annual)₁	12	1891.9	(64)
Heat g	ains fro	m water	heating	g, k'	Wh/mo	onth 0.2	5 ´	[0.85	× (45)m	+ (61	)m] + (	).8 x	(46)m	ı + (57)m	+ (59)m	1]	
(65)m=	87	77.36	82.83		76.46	76.52	7	0.67	70.05	73.86	72.	79	79.17	80.95	85.65	]	(65)
inclu	de (57)	m in calo	ulatior	n of	(65)m	only if a	cylii	nder i	s in the c	dwellir	g or ho	ot w	ater is f	rom com	munity ł	neating	
5. Int	ernal ga	ains (see	e Table	5 a	and 5a)	):											
Metabo	olic gair	ns (Table	5) Wa	atts	,												
motab	Jan	Feb	Mar		Apr	May		Jun	Jul	Au	a s	ер	Oct	Nov	Dec	]	
(66)m=	85.76	85.76	85.76	-	85.76	85.76	+	35.76	85.76	85.76	<u> </u>	<u> </u>	85.76	85.76	85.76		(66)
Lightin	g gains	(calcula	ted in A	ı qq/	endix l	L, equat	tion	L9 oi	r L9a), a	lso se	e Table	e 5				1	
(67)m=	13.74	12.2	9.92	<u> </u>	7.51	5.62	-	4.74	5.12	6.66	8.9		11.35	13.25	14.12	]	(67)
Applia	nces da	ins (calc	ulated	in A	Append	dix L. ec	uat	tion L	13 or L1	3a), al	so see	Tab	ble 5	1	ļ	1	
(68)m=	149.44	150.99	147.08	-	138.76	128.26	T	18.39	111.8	110.2			122.47	132.98	142.85	]	(68)
		i (calcula	L			L equa	L tior	1 J 1 5	or I 15a)	also		ahle	5			1	
(69)m=	31.58	31.58	31.58	<u>.</u>	31.58	31.58	-	31.58	31.58	31.58			31.58	31.58	31.58	1	(69)
		ns gains														]	
(70)m=					0	0		0	0	0			0	0	0	1	(70)
		l /aporatio							Ū	0		,	0	Ů	Ů	1	(
(71)m=	-68.6	-68.6	-68.6		-68.6	-68.6	1	68.6	-68.6	-68.6	-68	26	-68.6	-68.6	-68.6	1	(71)
		I			-00.0	-00.0		00.0	-00.0	-00.0	-00	5.0	-00.0	-00.0	-00.0	J	(1)
	116.94	gains (T	able 5	<u></u>	106.19	102.85		98.15	94.15	99.27	· 101	00	106.42	112.43	115.13	1	(72)
(72)m=					100.19	102.05										J	(12)
		gains =	· · · · · ·		004.40	005 40								71)m + (72)	i	1	(73)
(73)m=	328.85	327.04	317.07		301.19	285.46	2	70.01	259.8	264.9	1 272	.91	288.97	307.38	320.82		(13)
	lar gains		usina so	lar fl	lux from	Table 6a	and	associ	iated equa	tions to	convert	to th	e applica	ble orientat	ion		
•		Access F	•		Area		unu	Flu			g_	10 11		FF		Gains	
Onena		Table 6d			m <sup>2</sup>				ole 6a		9_ Table	6b	٦	able 6c		(W)	
Southe	ast <u>o. 9x</u> [	0.77		×Г	8.6	5	x	3	6.79	x	0.63	3	<b>]</b> × [	0.7		97.28	(77)
Southe	L	0.77		ΛL ×Γ	8.6		x		2.67		0.63			0.7		165.7	](77)
Southe	Ļ	0.77		^ L × [	8.6		x		5.75	x [	0.63			0.7		226.72	](77)
Southe	L	0.77		^ L × [			x		06.25	^ _   x [	0.63			0.7	=	220.72	]( <i>77</i> )
Southe	L			F	8.6								듹				-
Journe		0.77		×	8.6	00	x		19.01	×	0.63	5	×	0.7	=	314.65	(77)

													_
Southeast 0	.9x 0.77	x	8.6	5	x	118.15	x	0.63	x	0.7	=	312.37	(77)
Southeast 0	. <mark>9x</mark> 0.77	x	8.6	5	x	113.91	x	0.63	x	0.7	=	301.16	(77)
Southeast 0	. <mark>9x</mark> 0.77	x	8.6	5	x	104.39	x	0.63	x	0.7	=	275.99	(77)
Southeast 0	.9x 0.77	x	8.6	5	x	92.85	x	0.63	x	0.7	=	245.49	(77)
Southeast 0	.9x 0.77	x	8.6	5	x	69.27	x 🗌	0.63	x	0.7	=	183.13	(77)
Southeast 0	.9x 0.77	x	8.6	5	x	44.07	x	0.63	x	0.7	=	116.52	(77)
Southeast 0	.9x 0.77	x	8.6	5	x	31.49	x 🗌	0.63	x	0.7	=	83.25	(77)
									_				
Solar gains in watts, calculated for each month $(83)m = Sum(74)m \dots (82)m$													
$\begin{array}{c c c c c c c c c c c c c c c c c c c $													
Total gains	- internal a	and solar	(84)m =	= (73)m ·	+ (83)m	i, watts				<b>i</b>			
(84)m= 426	.12 492.74	543.79	582.11	600.1	582.38	560.96	540.9	518.4	472.1	423.89	404.07		(84)
7. Mean i	nternal tem	perature	(heating	season	)								
7. Mean internal temperature (heating season)       Temperature during heating periods in the living area from Table 9, Th1 (°C)       21													
Utilisation factor for gains for living area, h1,m (see Table 9a)													
Ja	an Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m= 0.9	92 0.89	0.83	0.75	0.63	0.48	0.36	0.39	0.56	0.77	0.89	0.93		(86)
Mean inte	rnal temper	ature in	living are	ea T1 (fo	ullow st	ens 3 to 3	7 in Tab	le 9c)		!	•		
(87)m= 19		20.04	20.43	20.73	20.91	20.97	20.97	20.86	20.48	19.87	19.33		(87)
			oriodo ir	root of	l du allin	d from To							
(88)m= 20	ure during I	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12		(88)
							I	20.10	20.10	20.12	20.12		(00)
	factor for g	1	()		Ì	T	<u> </u>			T		l	(00)
(89)m= 0.9	91 0.87	0.82	0.72	0.59	0.43	0.29	0.32	0.51	0.74	0.87	0.92		(89)
Mean inte	rnal temper	ature in	the rest	of dwelli	ng T2 (	follow ste	eps 3 to	7 in Tab	le 9c)				
(90)m= 17	97 18.37	18.88	19.44	19.83	20.06	20.12	20.11	19.99	19.51	18.67	17.89		(90)
								1	fLA = Livir	ng area ÷ (4	4) =	0.45	(91)
Mean inte	rnal temper	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1 – f	LA) × T2					
(92)m= 18	61 18.96	19.41	19.89	20.24	20.44	20.51	20.5	20.38	19.95	19.22	18.55		(92)
Apply adj	ustment to t	he mear	internal	temper	ature fr	om Table	e 4e, wh	ere appro	opriate				
(93)m= 18	61 18.96	19.41	19.89	20.24	20.44	20.51	20.5	20.38	19.95	19.22	18.55		(93)
	heating req												
	he mean in		•		ied at s	tep 11 of	Table 9	9b, so tha	ıt Ti,m=(	76)m an	d re-calc	culate	
	tion factor f	<u> </u>			l	1.1	A	Con	Oat	Nev	Dee		
	an Feb factor for g	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m= 0.8		0.8	0.71	0.6	0.45	0.32	0.35	0.53	0.73	0.85	0.9		(94)
	ins, hmGm				0.10	0.02	0.00	0.00	0.10	0.00	0.0		(- )
(95)m= 380		434.11	414.5	357.24	261.55	181.48	188.93	272.64	344.53	361.54	365.47		(95)
	verage exte	rnal tem	perature										
(96)m= 4.		6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss	rate for me	an intern	al tempe	erature,	Lm,W	=[(39)m	x [(93)n	n– (96)m	]	I	1	I	
(97)m= 705	.25 691.05	632.66	532.08	412.47	278.69	186.22	195	301.19	451.33	588.16	699.89		(97)
Space he	ating requir	ement fo	r each m	nonth, k	Nh/moi	hth = 0.02	24 x [(9	7)m – (95	)m] x (4	1)m			
(98)m= 24	1.3 181.54	147.72	84.66	41.09	0	0	0	0	79.46	163.16	248.81		

	Total per year (kWh/y	$(ear) = Sum(98)_{15,912} =$	1187.75	(98)
Space heating requirement in kWh/m²/year			23.36	(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 (Tab		nmunity scheme.	0	(301)
Fraction of space heat from community system $1 - (301) =$			1	(302)
The community scheme may obtain heat from several sources. The procedure allow		our other heat sources; i	the latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See a Fraction of heat from Community boilers	Appendix C.		1	(303a)
Fraction of total space heat from Community boilers		(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community	heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system			1.05	(306)
Space heating			kWh/yea	r
Annual space heating requirement			1187.75	
Space heat from Community boilers	(98) x (304a) x	(305) x (306) =	1247.14	(307a)
Efficiency of secondary/supplementary heating system in % (from T	able 4a or Appen	dix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 1	00 ÷ (308) =	0	(309)
Water heating Annual water heating requirement			1901 0	7
If DHW from community scheme:			1891.9	
Water heat from Community boilers	(64) x (303a) x	(305) x (306) =	1986.49	(310a)
Electricity used for heat distribution	0.01 × [(307a)(307	e) + (310a)(310e)] =	32.34	(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 out	side		176.41	(330a)
warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330l	o) + (330g) =	176.41	(331)
Energy for lighting (calculated in Appendix L)			242.63	(332)
Electricity generated by PVs (Appendix M) (negative quantity)			-518.71	(333)
Electricity generated by wind turbine (Appendix M) (negative quanti	ty)		0	(334)
12b. CO2 Emissions – Community heating scheme				
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) If there is CHP using two	o fuels repeat (363) to	(366) for the second fue	94	(367a)
CO2 associated with heat source 1 [(307b)+(310	b)] x 100 ÷ (367b) x	0.22 =	743.05	(367)
Electrical energy for heat distribution [(313	3) x	0.52 =	16.78	(372)

Total CO2 associated with community s	ystems	(363)(366) + (368)(37	=	759.83	(373)	
CO2 associated with space heating (see	condary)	(309) x	0	=	0	(374)
CO2 associated with water from immers	ion heater or instantar	neous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space and wa	ater heating	(373) + (374) + (375) =			759.83	(376)
CO2 associated with electricity for pump	os and fans within dwe	lling (331)) x	0.52	=	91.56	(378)
CO2 associated with electricity for lightin	ng	(332))) x	0.52	=	125.92	(379)
Energy saving/generation technologies	(333) to (334) as appli	cable	0.52 × 0.	01 =	-269.21	(380)
Total CO2, kg/year	sum of (376)(382) =				708.1	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				13.93	(384)
El rating (section 14)					90.1	(385)

# SAP 2012 Overheating Assessment

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

Property Details: Plot 50

Dwelling type: Located in: Region: Cross ventilation pos Number of storeys: Front of dwelling face Overshading: Overhangs: Thermal mass param Night ventilation: Blinds, curtains, shu Ventilation rate durin	es: eter: tters:	ather (a	ıch):	None Indicative False	5			
Summer ventilation h Transmission heat lo Summer heat loss co	ss coeffi	cient:	ient:	167.8 38.7 206.46				(P1) (P2)
Overhangs:								
Orientation:	Ratio:		Z_overhangs:					
South East (SE)	0		1					
Solar shading:								
Orientation: South East (SE)	<b>Z blind</b> 1	ls:	Solar access: 0.9	<b>Ove</b> 1	erhangs:	<b>Z summer:</b> 0.9		(P8)
Solar gains:								
Orientation South East (SE)	0.9 x	<b>Area</b> 8.65	<b>Flux</b> 119.92	<b>g_</b> 0.63	<b>FF</b> 0.7	Shading 0.9 Total	<b>Gains</b> 370.59 370.59	(P3/P4)
Internal gains:								
Internal gains Total summer gains Summer gain/loss ratio Mean summer externa Thermal mass temperature Likelihood of high internation	l tempera ature incre	ement		3 7 3 1 2	une 68.01 57.04 .67 6 .3 0.97 ilight	<b>July</b> 355.13 725.72 3.52 17.9 1.3 22.72 <b>Medium</b>	August 361.78 707.49 3.43 17.8 1.3 22.53 Medium	(P5) (P6) (P7)
Assessment of likelik	nood of h	igh inte	ernal temperatur	re: <u>N</u>	<u>ledium</u>			

		User E	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	2	Stroma Softwa					001082 n: 1.0.5.9	
			Address:						
Address :									
1. Overall dwelling dime	ensions:								
Ground floor			<b>a(m²)</b> 50.85 (	1a) x		<b>ight(m)</b> 2.5	(2a) =	Volume(m <sup>3</sup> )	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)	)+(1n) <u> </u>	50.85	4)			J I		_
Nelling volume					+(3c)+(3d	l)+(3e)+	.(3n) =	127.12	(5)
2. Ventilation rate:							-		_
		econdary eating	other		total			m <sup>3</sup> per hour	
Number of chimneys			0	=	0	x 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0	=	0	x 2	20 =	0	(6b)
Number of intermittent fa	ins				2	x 1	0 =	20	(7a)
Number of passive vents	3				0	x 1	0 =	0	(7b)
Number of flueless gas f	ires				0	x 4	40 =	0	(7c)
							Air ch	anges per ho	ur
Infiltration due to chimne	vs. flues and fans = $(6a)$	a)+(6b)+(7a)+(7b)+	(7c) =		20	<u> </u>	÷ (5) =	0.16	(8)
	peen carried out or is intende			ontinue fro	-		. (0)	0.10	
Number of storeys in t	he dwelling (ns)							0	(9)
Additional infiltration						[(9)-	1]x0.1 =	0	(10)
	.25 for steel or timber f				uction			0	(11)
If both types of wall are p deducting areas of openi	resent, use the value corresp ngs); if equal user 0.35	oonding to the grea	ter wall area	(after					
	floor, enter 0.2 (unseale	ed) or 0.1 (seale	ed), else e	enter 0				0	(12)
lf no draught lobby, en	ter 0.05, else enter 0						İ	0	(13)
Percentage of window	s and doors draught str	ripped						0	(14)
Window infiltration			0.25 - [0.2 >	k (14) ÷ 10	= [00			0	(15)
Infiltration rate			(8) + (10) +	(11) + (12	2) + (13) -	+ (15) =		0	(16)
	q50, expressed in cubi	•	• •		etre of e	nvelope	area	3	(17)
If based on air permeabil					, .			0.31	(18)
Number of sides sheltere	es if a pressurisation test has	been done or a de	gree air perr	neability is	s being us	sed	1	2	(19)
Shelter factor			(20) = 1 - [0	).075 x (19	9)] =			3 0.78	(19)
Infiltration rate incorporation	ting shelter factor		(21) = (18)	x (20) =				0.24	(21)
Infiltration rate modified f	•						I	0.21	
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	beed 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		

Adjust	ed 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		
		ctive air al ventila	-	rate for t	he appli	cable ca	se							(23a)
				endix N (2	(23a) = (23a	i) x Fmv (e	equation (I	N5)) , othei	rwise (23h	) = (23a)			0	
								n Table 4h)		) = (20u)			0	(23b)
			-	-	-			HR) (24a		$(b)m \perp (b)$	23h) v [*	ا _ (23 c)	0	(23c)
(24a)m=	<b></b>				0	0			0	0		1 - (230)		(24a)
		-	_	-		-		MV) (24b		-	-	Ŭ		
(24b)m=					0				0	0	0	0		(24b)
· · ·								n from c		Ů	Ů	Ŭ	l	
					-	-		c) = (22b		5 × (23b	))			
(24c)m=	· ,	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ventilatio	on or wh	ole hous	se positiv	/e input	ventilatio	on from l	oft				1	
	if (22b)n	n = 1, th	en (24d)	m = (22	o)m othe	rwise (2	4d)m =	0.5 + [(2	2b)m² x	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		(24d)
Effe	ctive air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in boy	(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. He	at losse	s and he	eat loss	paramet	er:									
	<b>IENT</b>	Gros		Openin		Net Ar	ea	U-valı	Je	AXU		k-value	e A	Xk
		area	(m²)	'n		A ,r	m²	W/m2	K	(W/I	<b>&lt;</b> )	kJ/m²₊ł		J/K
Doors						2	x	1.4	=	2.8				(26)
Windo	WS					8.651	x1	/[1/( 1.4 )+	0.04] =	11.47				(27)
Walls <sup>-</sup>	Type1	26.2	26	8.65	5	17.61	x	0.15	=	2.64				(29)
Walls <sup>-</sup>	Type2	23.0	)3	2		21.03	3 X	0.14	=	2.98				(29)
Roof		50.8	35	0		50.85	5 X	0.1	=	5.08	- F		$\exists$ $\square$	(30)
Total a	area of e	lements	, m²			100.1	4							(31)
* for win	ndows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	ated using	g formula 1,	/[(1/U-valu	ie)+0.04] a	ns given in	paragraph	ı 3.2	
				nternal wal	ls and part	titions								
			= S (A x	U)				(26)(30)	+ (32) =				24.97	(33)
		Cm = S(	. ,						((28)	.(30) + (32	2) + (32a).	(32e) =	998.61	(34)
				P = Cm -						tive Value			100	(35)
	-		ere the de tailed calc		construct	ion are not	t known pr	recisely the	e indicative	values of	TMP in Ta	able 1f		
				culated	usina Ap	pendix ł	<						13.68	(36)
	0		,	own (36) =	0.	•							10.00	(00)
	abric he			. ,		,			(33) +	(36) =			38.66	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × (	25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	22.91	22.83	22.76	22.42	22.35	22.05	22.05	21.99	22.17	22.35	22.48	22.62		(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	61.57	61.49	61.42	61.07	61.01	60.71	60.71	60.65	60.82	61.01	61.14	61.27		
										Average =	Sum(39)1	12 /12=	61.07	(39)

Heat lo	oss para	ımeter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.21	1.21	1.21	1.2	1.2	1.19	1.19	1.19	1.2	1.2	1.2	1.21		
Numbe	er of day	/s in mo	nth (Tab	le 1a)					,	Average =	Sum(40)1	.12 /12=	1.2	(40)
- tainio (	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
		1		1	1		1			1				
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
if TF				[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13.	1. <sup>-</sup> .9)	72		(42)
Reduce	the annua	al average	hot water	usage by		lwelling is	designed	(25 x N) to achieve		se target o	78. f	.88		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	·					
(44)m=	86.77	83.61	80.46	77.3	74.15	70.99	70.99	74.15	77.3	80.46	83.61	86.77		
_											m(44) <sub>112</sub> =		946.54	(44)
					· ·			OTm / 3600		-				
(45)m=	128.67	112.54	116.13	101.24	97.14	83.83	77.68	89.14	90.2	105.12	114.75	124.61		
lf instan	taneous w	vater heati	ng at point	of use (no	o hot water	<sup>r</sup> storage),	enter 0 in	boxes (46		Total = Su	m(45) <sub>112</sub> =		1241.06	(45)
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water	storage	loss:												
Storag	e volum	e (litres)	) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel	(	)		(47)
	•	•			/elling, e			· · /						
	vise if no storage		hot wate	er (this ir	ICLUDES I	nstantar	neous co	ombi boil	ers) ente	er '0' in (	47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):					)		(48)
,			m Table			,	• •					)		(49)
Energy	/ lost fro	m water	<sup>.</sup> storage	, kWh/ye	ear			(48) x (49)	) =			)		(50)
				•	loss fact									
		-	factor fi ee secti		le 2 (kW	h/litre/da	ay)				(	)		(51)
	•	from Ta		011 4.5								)		(52)
Tempe	erature f	actor fro	m Table	2b								)		(53)
Energy	/ lost fro	m watei	storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	(	)		(54)
Enter	(50) or	(54) in (8	55)								(	)		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (	55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contain	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)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3						(	)		(58)
Primar	y circuit	loss cal	culated	for each	month (		. ,	65 × (41)						
		· · · · · ·		· · · · · ·	· · · · · ·	1	· · · · · ·	ng and a	· ·	· · · · · ·	<u> </u>			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for ea	ich	month (	(61)m =	(60	)) ÷ 36	65 × (41)	m								
(61)m=	0	0	0		0	0		0	0	0	0	0		0	C	)		(61)
Total h	eat req	uired for	water	' he	ating ca	alculated	l fo	r eacl	n month	(62)m	= 0.85 ×	(45)m	) <b>+</b>	(46)m +	(57)	m +	(59)m + (61)m	
(62)m=	109.37	95.66	98.7	1	86.06	82.57	7	'1.25	66.03	75.77	76.67	89.3	35	97.54	105	.92		(62)
Solar DH	-IW input	calculated	using A	Appe	endix G or	· Appendix	H	(negativ	ve quantity	) (enter	'0' if no sol	ar contr	ibu	tion to wate	er hea	iting)	•	
(add a	dditiona	al lines if	FGHF	RS a	and/or \	WWHRS	ap	plies,	, see Ap	pendix	G)						_	
(63)m=	0	0	0		0	0		0	0	0	0	0		0	C	)		(63)
Output	from w	ater hea	ter															
(64)m=	109.37	95.66	98.7	1	86.06	82.57	7	'1.25	66.03	75.77	76.67	89.3	35	97.54	105	.92		
			•							0	utput from v	vater he	ate	er (annual)₁	12		1054.9	(64)
Heat g	ains fro	m water	heatir	ng,	kWh/m	onth 0.2	5 ´	[0.85	× (45)m	+ (61)	m] + 0.8	x [(46	)m	ı + (57)m	+ (5	9)m	1]	
(65)m=	27.34	23.91	24.6	8	21.51	20.64	1	7.81	16.51	18.94	19.17	22.3	34	24.38	26.	48	1	(65)
inclu	Ide (57)	m in calo	ulatio	n o	f (65)m	only if c	ylir	nder is	s in the c	dwellin	g or hot v	vater i	s f	rom com	mun	ity h	eating	
5. Int	ernal g	ains (see	e Tabl	e 5	and 5a	):					0							
		ns (Table				) -												
Melabi	Jan	Feb	, <u>5), w</u> Ma		Apr	May		Jun	Jul	Aug	Sep	0	ct	Nov	П	ec	1	
(66)m=	85.76	85.76	85.7	-	85.76	85.76		85.76	85.76	85.76	<u> </u>	85.7	-	85.76	85.			(66)
											Table 5						1	
(67)m=	13.74	12.2	9.92	<u> </u>	7.51	5.62	—	4.74	5.12	6.66	8.94	11.3	35	13.25	14.	12	1	(67)
														10.20	14.	12	l	()
	149.44	150.99	147.0	- T	138.76	128.26	r	18.39	111.8	5a), al 110.2	so see Ta		17	132.98	142	05	1	(68)
(68)m=													47	132.96	142	.60	J	(00)
	<u> </u>	<u> </u>				· · ·	_				see Tabl			04.50			1	(00)
(69)m=	31.58	31.58	31.5		31.58	31.58	3	81.58	31.58	31.58	31.58	31.5	8	31.58	31.	58	J	(69)
-		ns gains	·	e 5	-	i	i —										1	()
(70)m=	0	0	0		0	0		0	0	0	0	0		0	C	)	J	(70)
Losses	s e.g. ev	/aporatic	on (neg	gati	ve valu	es) (Tab	le	5)									1	
(71)m=	-68.6	-68.6	-68.6	6	-68.6	-68.6	-	68.6	-68.6	-68.6	-68.6	-68	.6	-68.6	-68	3.6	J	(71)
Water	heating	gains (T	able	5)														
(72)m=	36.75	35.59	33.1	7	29.88	27.75	2	24.74	22.19	25.46	26.62	30.0	)3	33.87	35.	59		(72)
Total i	nterna	gains =				-	_	(66)	m + (67)m	+ (68)n	n + (69)m +	· (70)m ·	+ (7	71)m + (72)	m		_	
(73)m=	248.65	247.51	238.	9	224.88	210.35	1	96.6	187.83	191.09	9 198.44	212.	57	228.81	241	.28		(73)
6. Sol	lar gain	s:																
Solar g	ains are	calculated	using s	olar	flux from	Table 6a	and	associ	ated equa	tions to	convert to t	he appl	ica	ble orientat	ion.			
Orienta		Access F			Area			Flu			g_		-	FF			Gains	
	_	Table 6d			m²				ole 6a		Table 6b	)	ו 	able 6c			(W)	_
Southe	ast <mark>0.9x</mark>	0.77		x	8.6	65	x	3	6.79	x	0.63	x		0.7		=	97.28	(77)
Southe	ast <mark>0.9x</mark>	0.77		x	8.6	65	x	6	2.67	x	0.63	x		0.7		=	165.7	(77)
Southe	ast <mark>0.9x</mark>	0.77		x	8.6	65	x	8	5.75	x	0.63	×		0.7		=	226.72	(77)
Southe	ast <mark>0.9x</mark>	0.77		x	8.6	65	x	10	06.25	x	0.63	x		0.7		=	280.91	(77)
Southe	ast <mark>0.9x</mark>	0.77		x	8.6	65	x	1	19.01	x	0.63	x		0.7		=	314.65	(77)

							_						
Southeast 0.9x	0.77	×	8.6	5	x	118.15	x	0.63	x	0.7	=	312.37	(77)
Southeast 0.9x	0.77	x	8.6	5	x	113.91	x	0.63	x	0.7	=	301.16	(77)
Southeast 0.9x	0.77	x	8.6	5	x	104.39	x	0.63	x	0.7	=	275.99	(77)
Southeast 0.9x	0.77	X	8.6	5	x	92.85	<b>x</b>	0.63	x	0.7	=	245.49	(77)
Southeast 0.9x	0.77	x	8.6	5	x	69.27	x	0.63	x	0.7	=	183.13	(77)
Southeast 0.9x	0.77	x	8.6	5	x	44.07	x	0.63	x	0.7	=	116.52	(77)
Southeast 0.9x	0.77	x	8.6	5	x	31.49	x [	0.63	x	0.7	=	83.25	(77)
Solar gains in	watts, ca	alculated	for eacl	n month		_	(83)m =	Sum(74)m	(82)m	-	-		
(83)m= 97.28	165.7	226.72	280.91	314.65	312.37	301.16	275.99	245.49	183.13	116.52	83.25		(83)
Total gains –	internal a	nd solar	(84)m =	: (73)m ·	+ (83)n	n, watts		_		<b>i</b>			
(84)m= 345.93	413.2	465.62	505.8	525	508.97	488.99	467.09	443.93	395.71	345.33	324.53		(84)
7. Mean inte	rnal temp	oerature	(heating	season	)								
Temperature	e during h	eating p	eriods ir	the livi	ng area	from Tal	ble 9, T	ĥ1 (°C)				21	(85)
Utilisation fa	ctor for g	ains for I	iving are	a, h1,m	(see T	able 9a)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m= 0.96	0.93	0.9	0.84	0.75	0.62	0.49	0.52	0.7	0.86	0.94	0.96		(86)
Mean interna	al temper	ature in	living are	ea T1 (fr	ullow st	ens 3 to 3	7 in Tal						
(87)m= 18.6	18.92	19.37	19.91	20.39	20.74	20.9	20.88		19.98	19.18	18.53		(87)
					ماليده الأنه								
Temperature	19.91	19.91	19.92	19.92	19.92	19.92	19.93		19.92	19.92	19.92		(88)
								19.92	19.92	13.32	19.92		(00)
Utilisation fa					,	1	T		1	r —		l	(00)
(89)m= 0.95	0.92	0.88	0.81	0.7	0.54	0.39	0.42	0.63	0.83	0.93	0.96		(89)
Mean interna	al temper	ature in	the rest	of dwelli	ng T2 (	follow ste	eps 3 to	7 in Tab	le 9c)				
(90)m= 17.74	18.05	18.49	19.01	19.46	19.76	19.88	19.87	19.67	19.09	18.32	17.67		(90)
									fLA = Livir	ng area ÷ (4	4) =	0.45	(91)
Mean interna	al temper	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1 –	fLA) × T2					
(92)m= 18.13	18.44	18.89	19.42	19.88	20.21	20.34	20.32	20.1	19.5	18.71	18.06		(92)
Apply adjust	ment to t	he mear	internal	temper	ature fr	om Table	e 4e, wl	nere appr	opriate				
(93)m= 18.13	18.44	18.89	19.42	19.88	20.21	20.34	20.32	20.1	19.5	18.71	18.06		(93)
8. Space he	ating requ	uirement											
Set Ti to the			•		ed at s	tep 11 of	Table	9b, so tha	nt Ti,m=(	76)m an	d re-calc	ulate	
the utilisation	1				luna	1 1.1	A	Can	Ort	Nev	Dee		
Jan Utilisation fa	Feb	Mar ains hm	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(94)m= 0.94	0.91	0.86	0.8	0.7	0.56	0.43	0.46	0.64	0.82	0.91	0.94		(94)
Useful gains						1							
(95)m= 323.97	-	402.41	403.26	367.22	287.27	208.75	215.06	286.3	324.48	314.49	306.45		(95)
Monthly ave		rnal tem					I			I		I	
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rat	te for mea	an intern	al tempe	erature,	Lm , W	- =[(39)m	x [(93)ı	m– (96)m	]				
(97)m= 851.34	832.78	760.97	642.45	499.17	340.41	227.17	238.04	365	542.86	709.85	849.11		(97)
Space heati	ng require	ement fo	r each m	nonth, k	Nh/mo	h = 0.02	24 x [(9	7)m – (95	j)m] x (4	1)m			
(98)m= 392.37	307.87	266.77	172.22	98.17	0	0	0	0	162.47	284.66	403.74		

								Tota	l per year	(kWh/year	) = Sum(9	8)15,912 =	2088.26	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								41.07	(99)
8c. Sp	bace co	oling req	quiremer	nt								-		
Calcu	lated fo	r June, J	July and	August.	See Tal	ole 10b								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	oss rate	e Lm (ca	lculated	using 2	5°C inter	nal temp	perature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	570.63	449.22	460.94	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	oss hm											
(101)m=	0	0	0	0	0	0.77	0.83	0.81	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	Vatts) =	(100)m x	(101)m									
(102)m=	0	0	0	0	0	438.44	372.43	373.68	0	0	0	0		(102)
Gains	(solar o	gains ca	lculated	for appli	cable we	eather re	egion, se	e Table	10)					
(103)m=	0	0	0	0	0	659.72	635.17	610.55	0	0	0	0		(103)
						lwelling,	continue	ous ( kW	(h) = 0.0	24 x [(10	)3)m – (	102)m]>	x (41)m	
· · ·	04)m to	zero if (	(104)m <	: 3 × (98	)m									
(104)m=	0	0	0	0	0	159.32	195.48	176.24	0	0	0	0		_
										= Sum(	,	=	531.04	(104)
	I fractior								f C =	cooled	area ÷ (4	+) =	1	(105)
		actor (Ta	r	ŕ										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
-					<i>( i</i> = <i>i</i> )	( ( )	( ( )		Total	l = Sum(	104)	=	0	(106)
•		· ·	r	month =	r`´´	· ,	<u>`</u>							
(107)m=	0	0	0	0	0	39.83	48.87	44.06	0	0	0	0		_
									Total	= Sum(	107)	=	132.76	(107)
Space	cooling	requirer	ment in k	(Wh/m²/y	/ear				(107)	) ÷ (4) =			2.61	(108)
8f. Fab	ric Ener	gy Effici	iency (ca	alculated	l only un	der spec	cial cond	litions, s	ee sectio	on 11)				
Fabric	Energy	/ Efficier	псу						(99) ·	+ (108) =	=		43.68	(109)

# SAP Input

Property Details: Pl	ot 50							
Address: Located in: Region: UPRN: Date of assessm Date of certifica Assessment type Transaction type Tenure type: Related party di Thermal Mass Pa Water use <= 12 PCDF Version:	te: e: e: sclosure: arameter:	New dv New dv Unknov No rela Indicati	s valley 2020 ober 2020 velling design stag velling	ge				
Property description	า:							
Dwelling type:		Flat						
Detachment: Year Completed:		2020						
Floor Location:		Floor	area:					
Floor 0		50.849	m2		Storey height 2.5 m	:		
Living area:			m <sup>2</sup> (fraction 0.4	54)	2.5 11			
Front of dwelling f	aces:	North V						
Opening types:								
Name: NW	Source: Manufacturer	-	/pe: lid	Glazing:		Argon:	Fram	e:
SE	Manufacturer		indows	double-glaze	ed	Yes		
Name: NW SE	<b>Gap:</b> mm 16mm c	or more	<b>Frame Facto</b> 0 0.7	<b>or: g-value:</b> 0 0.63	<b>U-value:</b> 1.4 1.4	<b>Area:</b> 2 8.651	<b>No. o</b> 1 1	f Openings:
Name: NW SE	Type-Nam	Co	ocation: rridor Wall ternal Wall	Orient: North West South East		Width: 0 0	Heigl 0 0	nt:
Overshading:		Average	e or unknown					
Opaque Elements:		rivoragi						
Type: External Elements	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain	wall:	Kappa:
External Wall	26.262	8.65	17.61	0.15	0	False		N/A
Corridor Wall Flat Roof	23.03 50.849	2 0	21.03 50.85	0.15 0.1	0.4 0	False		N/A N/A
Internal Elements Party Elements	00.017	J.	00.00	0.1	U U			
Thermal bridges:								
Thermal bridges:				PSI-values) Y-Valu	ue = 0.1367			
		<b>Lengt</b> 4.795	h <b>Psi-valu</b> 0.289		r lintels (including o	other steel lintel	ls)	
		13.2	0.047	E4 Jamb	)			
		18.602	0.064	E7 Party	floor between dwe	ellings (in blocks	s of flats)	

# **SAP Input**

10.9	0.109	E25	Staggered party wall between dwellings
13.625	0.08	E16	Corner (normal)
8.175	-0.072	E17	Corner (inverted internal area greater than external area)
8.69	0.062	E14	Flat roof
9.912	0.56	E15	Flat roof with parapet
11.287	0	P3	Intermediate floor between dwellings (in blocks of flats)
11.287	0.24	P4	Roof (insulation at ceiling level)

Ventilation:	
Pressure test: Ventilation:	Yes (As designed) Balanced with heat recovery Number of wet rooms: Kitchen + 1 Ductwork: Insulation, rigid Approved Installation Scheme: True
Number of chimneys: Number of open flues: Number of fans: Number of passive stacks: Number of sides sheltered: Pressure test:	0 0 0 0 0 3 3 3
Main heating system:	
Main heating system:	Community heating schemes Heat source: Community boilers heat from boilers – mains gas, heat fraction 1, efficiency 94 Piping>=1991, pre-insulated, low temp, variable flow Central heating pump : 2013 or later Design flow temperature: Unknown Boiler interlock: Yes
Main heating Control:	
Main heating Control:	Charging system linked to use of community heating, programmer and at least two room thermostats Control code: 2312
Secondary heating system:	
Secondary heating system: Water heating:	None
Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Solar panel: False
Others:	
Electricity tariff: In Smoke Control Area: Conservatory: Low energy lights: Terrain type: EPC language: Wind turbine: Photovoltaics:	Standard Tariff Unknown No conservatory 100% Low rise urban / suburban English No <u>Photovoltaic 1</u> Installed Peak power: 0.63 Tilt of collector: 30° Overshading: None or very little Collector Orientation: South West
Assess Zero Carbon Home:	No

			User D	etails:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2	2012		Stroma Softwa					001082 on: 1.0.5.9	
		P	roperty A	Address:	Plot 50					
Address :										
1. Overall dwelling dimen	sions:		<u>.</u>							
Ground floor			Area 5	. ,	(1a) x	<b></b>	<b>ight(m)</b> 2.5	(2a) =	Volume(m <sup>3</sup> ) 127.12	(3a)
Total floor area TFA = (1a)	)+(1b)+(1c)+(1d)+	(1e)+(1n	) 5	0.85	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3d	l)+(3e)+	.(3n) =	127.12	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m <sup>3</sup> per hou	•
Number of chimneys	0 +	0	+	0	] = [	0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	-   +   -	0	] = [	0	x	20 =	0	(6b)
Number of intermittent fan	s				' L	2	x /	10 =	20	(7a)
Number of passive vents						0	x /	10 =	0	 (7b)
Number of flueless gas fire	es					0	x 4	40 =	0	(7c)
, i i i i i i i i i i i i i i i i i i i					L	-		A :=		
					_			AIr Ch	anges per ho	ur
Infiltration due to chimneys If a pressurisation test has be					ontinue fro	20 om (9) to (		÷ (5) =	0.16	(8)
Number of storeys in the	e dwelling (ns)								0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2 if both types of wall are pre deducting areas of opening	sent, use the value co				•	uction			0	(11)
If suspended wooden flo	oor, enter 0.2 (uns	ealed) or 0.	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter	0							0	(13)
Percentage of windows	and doors draugh	t stripped							0	(14)
Window infiltration				0.25 - [0.2					0	(15)
Infiltration rate	50 ann an an dùn			(8) + (10) ·					0	(16)
Air permeability value, q If based on air permeabilit			•	•	•	etre of e	nvelope	area	5	(17)
Air permeability value applies						s beina u	sed		0.41	(18)
Number of sides sheltered				<b>,</b>	,	<b>J</b>			3	(19)
Shelter factor				(20) = 1 - [	0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporatir	ng shelter factor			(21) = (18)	x (20) =				0.32	(21)
Infiltration rate modified fo	r monthly wind spe	eed								
Jan Feb M	/lar Apr Ma	ay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7									
(22)m= 5.1 5 4	.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22)	ım ÷ 4									
(22a)m= 1.27 1.25 1.	23 1.1 1.08	8 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjust	ed infiltr	ation rat	e (allowi	ng for sł	nelter an	d wind s	speed) =	: (21a) x	(22a)m			_		
	0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37		
		<i>ctive air</i> al ventila	-	rate for t	he appli	cable ca	se							
				andix N (2	(23a) – (23a	) × Emv (e	acuation (1	N5)) , othe	rwise (23h	) – (23a)			0	(23a)
		• •	0 11		, (	, (	• •	n Table 4h		) = (200)			0	(23b)
			-	-	-			HR) (24a		2b)m i (f	22h) v [/	1 (22a)	0	(23c)
(24a)m=	r								a) = (22)	20)11 + ( <i>1</i>	23D) X [	0	- 100j	(24a)
	-	-		-		-		-	-	-	÷	0		(210)
(24b)m=								MV) (24b 0	0 $1$ $1$ $1$ $1$ $1$ $1$ $1$ $1$ $1$ $1$	0	230)	0		(24b)
									_	0	0	0		(2-10)
,					•	-		on from c c) = (22b		5 × (23b	)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,								on from I 0.5 + [(2		0.51				
(24d)m=	<u> </u>	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(24d)
Effe	ctive air	change	rate - er	nter (24a	) or (24b	) or (24	L c) or (24	ld) in boy	(25)					
(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
							1	1	I				l	
				paramet										A )/ I
ELEN	IENT	Gros area		Openin rr		Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²∙ł		A X k ⟨J/K
Doors						2	x	1	=	2				(26)
Windo	WS					8.651	1 x1	/[1/( 1.4 )+	0.04] =	11.47				(27)
Walls	Type1	26.2	26	8.65	;	17.61	I X	0.18	=	3.17				(29)
Walls <sup>-</sup>	Type2	23.0	)3	2		21.03	3 X	0.18	=	3.79				(29)
Roof		50.8	35	0		50.85	5 X	0.13	=	6.61			$\neg$	(30)
Total a	area of e	lements	, m²			100.1	4							(31)
* for win	idows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	lated using	g formula 1	/[(1/U-valu	e)+0.04] a	s given in	paragraph	3.2	
				nternal wal	ls and part	titions			()					
		s, W/K		U)				(26)(30)	) + (32) =				27.03	(33)
		Cm = S(	. ,						((28)	.(30) + (32	2) + (32a).	(32e) =	998.61	(34)
		•	•	P = Cm -	,					tive Value:			250	(35)
	-	sments wh ad of a de			construct	ion are noi	t known pr	recisely the	e indicative	values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix I	K						10.95	(36)
if details	s of therma	al bridging	are not kr	iown (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			37.98	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y			-	(38)m	= 0.33 × (	25)m x (5)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	24.37	24.24	24.11	23.5	23.39	22.86	22.86	22.76	23.07	23.39	23.62	23.86		(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	62.35	62.22	62.09	61.49	61.37	60.84	60.84	60.75	61.05	61.37	61.6	61.84		
							-			Average =	Sum(39)1		61.49	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m=	1.23	1.22	1.22	1.21	1.21	1.2	1.2	1.19	1.2	1.21	1.21	1.22		
Numbe	er of dav	/s in mo	nth (Tab	le 1a)	•	•	•	•	,	Average =	Sum(40)1.	<sub>12</sub> /12=	1.21	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
if TF				(1 - exp	0(-0.0003	349 x (TI	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13.		72		(42)
Reduce	the annua	al average	hot water	usage by		welling is	designed	(25 x N) to achieve		se target o		.93		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	<u>.</u>		•			
(44)m=	82.43	79.43	76.43	73.44	70.44	67.44	67.44	70.44	73.44	76.43	79.43	82.43		
_											m(44) <sub>112</sub> =		899.21	(44)
				·	· ·			OTm / 3600		-	. <u> </u>		I	
(45)m=	122.24	106.91	110.32	96.18	92.29	79.64	73.8	84.68	85.69	99.87	109.01	118.38		
lf instan	taneous w	vater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46		Total = Su	m(45) <sub>112</sub> =	=	1179	(45)
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)
· · ·	storage	loss:						-						
Storag	e volum	e (litres)	) includir	ng any s	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
	•	-			velling, e			. ,						
			hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (	47)			
	storage anufact		eclared I	oss fact	or is kno	wn (kWł	n/dav):					0		(48)
,			m Table			,	, , ,					0		(49)
				e, kWh/ye	ear			(48) x (49)	) =			0		(50)
			•		loss fact	or is not	known:					•		()
		-			le 2 (kW	h/litre/da	ay)					0		(51)
	•	from Ta	ee secti	on 4.3								0	l	(52)
		-	m Table	2b								0 0		(52) (53)
				e, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
		(54) in (5	-	,,,,,	oui				( (- / (	,		0		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (	55) × (41)ı	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
	er contains	s dedicate	l d solar sto	I orage, (57)	n = (56)m	x [(50) – (	I [H11)] ÷ (5	60), else (5	7)m = (56)	n where (	H11) is fro	m Append	l lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
	-	•	,			59)m =	(58) ÷ 36	65 × (41)	m					
(mo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wa	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi	loss ca	lculated	for ea	ch	month (	(61)m =	(60	)) ÷ 36	65 × (41)	m									
(61)m=	0	0	0		0	0		0	0	0		0	0		0	C	)		(61)
Total h	eat req	uired for	water	he	ating ca	alculated	l fo	r eacl	n month	(62)m	) =	0.85 × (	(45)m	+ (	46)m +	(57)	m +	(59)m + (61)m	
(62)m=	103.9	90.87	93.77	'	81.75	78.44	6	67.69	62.73	71.9	в	72.84	84.89	9	92.66	100	.62		(62)
Solar DH	- W input	calculated	using A	ppe	ndix G or	Appendix	(H)	(negativ	ve quantity	) (ente	r '0'	if no sola	r contril	butio	on to wate	er hea	iting)		
(add a	dditiona	al lines if	FGHR	Sa	and/or \	WWHRS	ap	plies	, see Ap	pendi	x G	i)	-			-		_	
(63)m=	0	0	0		0	0		0	0	0		0	0		0	C	)		(63)
Output	from w	ater hea	ter																
(64)m=	103.9	90.87	93.77	,	81.75	78.44	6	67.69	62.73	71.9	в	72.84	84.89	9	92.66	100	.62		
										С	utpu	ut from wa	ater hea	ater	(annual)1	12		1002.15	(64)
Heat g	ains fro	m water	heatin	g,	kWh/m	onth 0.2	5 ´	[0.85	× (45)m	+ (61	)m]	] + 0.8 ×	c [(46)	m -	+ (57)m	+ (5	9)m	]	
(65)m=	25.98	22.72	23.44	Ļ	20.44	19.61	1	6.92	15.68	17.9	9	18.21	21.22	2	23.17	25.	16		(65)
inclu	de (57)	m in calo	culation	n o	f (65)m	only if c	: ylir	nder is	s in the c	dwellir	ng c	or hot w	ater is	s fro	om com	mun	ity h	leating	
5. Int	ernal a	ains (see	e Table	e 5	and 5a	):	-				-						-	-	
		ns (Table																	
metab	Jan	Feb	 Ma		Apr	May		Jun	Jul	Au	a	Sep	Oc	t	Nov	D	ec		
(66)m=	85.76	85.76	85.76	-	85.76	85.76	-	35.76	85.76	85.7	<u> </u>	85.76	85.76	-	85.76	85.			(66)
Liahtin	u a aains	(calcula	I ted in	L Api	pendix	l equat	ion	190	19a) a	lso se	e T	able 5						1	
(67)m=	13.74	12.2	9.92		7.51	5.62	-	4.74	5.12	6.66	-	8.94	11.3	5	13.25	14.	12		(67)
		I iins (calc		 in														I	
(68)m=	149.44	150.99	147.0	- T	138.76	128.26	<b></b>	18.39	111.8	110.2	- T	114.15	122.4	17	132.98	142	85	]	(68)
				_										"	102.00	142		l	()
(69)m=	31.58	(calcula 31.58	31.58	-i	31.58	L, equal 31.58	<u> </u>	1 L 15 81.58	31.58	, also 31.5	-	31.58	31.58	。	31.58	31.	59	1	(69)
						51.50		51.50	51.50	51.5	5	31.50	51.50	0	51.50	51.	50	J	(00)
-		ns gains	r –	9 5a	-		<u> </u>		-		-	0		-				1	( <b>70</b> )
(70)m=	0	0	0		0	0		0	0	0		0	0		0	C	)		(70)
	-	/aporatio	<u> </u>				r –						1					1	
(71)m=	-68.6	-68.6	-68.6		-68.6	-68.6	-	68.6	-68.6	-68.6	5	-68.6	-68.6	5	-68.6	-68	3.6		(71)
		gains (T		ŕ			-											1	
(72)m=	34.91	33.81	31.51		28.39	26.36		23.5	21.08	24.19	9	25.29	28.52	2	32.17	33.	81		(72)
Total i	nterna	gains =	:					(66)	m + (67)m	+ (68)	m +	(69)m + (	(70)m +	· (71	)m + (72)	m			
(73)m=	246.82	245.73	237.2	4	223.39	208.96	1	95.36	186.73	189.8	32	197.11	211.0	)7	227.12	239	9.5		(73)
	lar gain																		
•		calculated	•	olar			and			tions to	cor	nvert to th	e applie	cabl		ion.			
Orienta		Access F Table 6d			Area m <sup>2</sup>			Flu	x ble 6a			g_ able 6b		Та	FF able 6c			Gains (W)	
								- 1 ai			10		_					(VV)	-
Southe		0.77		x	8.6	65	x	3	6.79	×		0.63	×		0.7		=	97.28	(77)
Southe	Ļ	0.77		x	8.6	65	x	6	2.67	x		0.63	×		0.7		=	165.7	(77)
Southe	ast <mark>0.9</mark> x	0.77		x	8.6	65	x	8	5.75	x		0.63	×		0.7		=	226.72	(77)
Southe	ast <mark>0.9x</mark>	0.77		x	8.6	65	x	1(	06.25	x		0.63	x		0.7		=	280.91	(77)
Southe	ast <mark>0.9x</mark>	0.77		x	8.6	65	x	1	19.01	x		0.63	x		0.7		=	314.65	(77)

Southeast 0.9x 0.77 x 8.65 x 118.15 x 0.63 x 0.7 = 312	
Southeast 0.9x 0.77 X 8.65 X 118.15 X 0.63 X 0.7 = 312.	37 <mark>(77)</mark>
Southeast 0.9x 0.77 x 8.65 x 113.91 x 0.63 x 0.7 = 301.	16 <mark>(77)</mark>
Southeast 0.9x 0.77 x 8.65 x 104.39 x 0.63 x 0.7 = 275.	99 (77)
Southeast 0.9x 0.77 x 8.65 x 92.85 x 0.63 x 0.7 = 245.	49 <mark>(77)</mark>
Southeast 0.9x 0.77 x 8.65 x 69.27 x 0.63 x 0.7 = 183.	13 <mark>(77)</mark>
Southeast 0.9x 0.77 x 8.65 x 44.07 x 0.63 x 0.7 = 116.	52 (77)
Southeast 0.9x 0.77 x 8.65 x 31.49 x 0.63 x 0.7 = 83.2	25 (77)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m	
(83)m= 97.28 165.7 226.72 280.91 314.65 312.37 301.16 275.99 245.49 183.13 116.52 83.25	(83)
Total gains – internal and solar (84)m = (73)m + (83)m , watts	
(84)m=       344.09       411.43       463.96       504.3       523.61       507.74       487.88       465.81       442.6       394.21       343.64       322.75	(84)
7. Mean internal temperature (heating season)	
Temperature during heating periods in the living area from Table 9, Th1 (°C) 21	(85)
Utilisation factor for gains for living area, h1,m (see Table 9a)	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(86)m= 1 0.99 0.98 0.95 0.86 0.7 0.53 0.58 0.81 0.96 0.99 1	(86)
Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)	
(87)m= 19.73 19.92 20.19 20.51 20.78 20.94 20.99 20.98 20.88 20.53 20.06 19.69	(87)
Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)	
(88)m=       19.9       19.9       19.91       19.91       19.92       19.92       19.92       19.92       19.91       19.91	(88)
	()
Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)	(80)
(89)m=       1       0.99       0.97       0.93       0.81       0.61       0.41       0.45       0.73       0.94       0.99       1	(89)
Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)	
(90)m= 18.75 18.94 19.21 19.53 19.77 19.9 19.92 19.92 19.86 19.55 19.09 18.72	(90)
$fLA = Living area \div (4) = 0.4$	5 <b>(91)</b>
Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$	
(92)m= 19.19 19.38 19.65 19.97 20.23 20.37 20.4 20.4 20.32 19.99 19.53 19.16	(92)
Apply adjustment to the mean internal temperature from Table 4e, where appropriate	
(93)m= 19.19 19.38 19.65 19.97 20.23 20.37 20.4 20.4 20.32 19.99 19.53 19.16	(93)
8. Space heating requirement	
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Utilisation factor for gains, hm:	
(94)m= 0.99 0.99 0.97 0.93 0.83 0.65 0.47 0.51 0.76 0.94 0.99 1	(94)
Useful gains, hmGm , W = (94)m x (84)m	
(95)m= 342.2 406.11 450.09 467.16 433.83 330.82 228.2 238.09 336.57 371.93 339.62 321.42	(95)
Monthly average external temperature from Table 8	
(96)m=       4.3       4.9       6.5       8.9       11.7       14.6       16.6       16.4       14.1       10.6       7.1       4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]	
(97)m= 928.73 901.26 816.66 680.9 523.47 351.13 231.46 243.08 379.94 576.38 765.71 925.26	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m	
(98)m= 436.38 332.74 272.73 153.89 66.7 0 0 0 0 152.11 306.79 449.26	

														(98)
Space	e heatin	ng require	ement in	kWh/m²	²/year								42.69	(99)
8c. Sr	pace cooling requirement Jalated for June, July and August. See Table 10b Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec toss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10) a 0 0 0 0 0 571.93 450.24 461.66 0 0 0 0 0 ation factor for loss hm a 0 0 0 0 0 0 0 0 88 0.94 0.92 0 0 0 0 a 1 loss, hmLm (Watts) = (100)m x (101)m a 0 0 0 0 0 504.66 421.78 425.7 0 0 0 0 a 0 0 0 0 0 658.48 634.06 609.28 0 0 0 0 a 0 0 0 0 0 658.48 634.06 609.28 0 0 0 0 a 0 0 0 0 0 0 110.75 157.94 136.59 0 0 0 0 a 0 0 0 0 0 0 110.75 157.94 136.59 0 0 0 0 a 0 0 0 0 0 0 110.75 157.94 136.59 0 0 0 0 a 0 0 0 0 0 0 110.75 157.94 136.59 0 0 0 0 0 a 0 0 0 0 0 0 0 0 0 0 0 0 0 a 0 0 0 0 0 0 0 0 0 0 0 0 0 0 a 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 a 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 a 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 a 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 a 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0													
		Ŭ			See Tal	ole 10b								
							Jul	Aug	Sep	Oct	Nov	Dec		
Heat	oss rat	e Lm (ca	lculated		5°C inter	nal temp	berature	and exte		nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	571.93	450.24	461.66	0	0	0	0		(100)
Utilisa	tion fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.88	0.94	0.92	0	0	0	0		(101)
Usefu	l loss, ł	nmLm (V	/atts) = (	(100)m x	(101)m		•							
(102)m=	0	0	0	0	0	504.66	421.78	425.7	0	0	0	0		(102)
Gains	(solar	gains ca	lculated	for appli	cable we	eather re	egion, se	e Table	10)					
(103)m=	0	0	0	0	0	658.48	634.06	609.28	0	0	0	0		(103)
Space cooling requirement for month, whole dwelling, continuous ( $kWh$ ) = 0.024 x [(103)m – (102)m] x (41)m														
· · ·	,	1	, 	<u>```</u>	Í	110.75	157.04	100 50	0	0	0	0		
(104)m=	0	0	0	0	0	110.75	157.94	136.59	_	-	-	_		
Coolor	l fractio	n								•	,			(104) (105)
			able 10b	)					10 -	coolea	alea - (-	+) —	I	
(106)m=		r È		ŕ	0	0.25	0.25	0.25	0	0	0	0		
				1	1		1		Total	= Sum(	104)	=	0	(106)
Space	cooling	requirer	nent for	month =	: (104)m	× (105)	× (106)r	n			,			
(107)m=	0	0	0	0	0	27.69	39.48	34.15	0	0	0	0		
I									Total	= Sum(	107)	=	101.32	(107)
Space	cooling	requirer	nent in k	(Wh/m²/y	/ear				(107)	÷ (4) =			1.99	(108)
8f. Fab	ric Ene	rgy Effici	ency (ca	alculated	l only un	der spec	cial cond	litions, se	ee sectio	on 11)				
8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)       Fabric Energy Efficiency     (99) + (108) =												44.68	(109)	
Targe	et Fabri	c Energ	y Efficie	ency (TF	EE)								51.38	(109)

User Details:	
Assessor Name: Zahid Ashraf Stroma Number: STRO	001082
Software Name: Stroma FSAP 2012 Software Version: Versio	n: 1.0.5.9
Property Address: Plot 50	
Address :	
1. Overall dwelling dimensions:	
Area(m²)       Av. Height(m)         Ground floor       50.85       (1a) x       2.5       (2a) =	Volume(m <sup>3</sup> ) 127.12 (3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ [4]	
Dwelling volume $(3a)+(3c)+(3c)+(3d)+(3e)+(3n) =$	127.12 (5)
2. Ventilation rate:	
main secondary other total	m <sup>3</sup> per hour
Number of chimneys       0       +       0       =       0       × 40 =	0 (6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 =$	0 (6b)
Number of intermittent fans 0 x 10 =	0 (7a)
Number of passive vents 0 x 10 =	0 (7b)
Number of flueless gas fires 0 x 40 =	0 (7c)
Air ch	anges per hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 0$ $\div$ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)	
Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration [(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction if both types of wall are present, use the value corresponding to the greater wall area (after	0 (11)
deducting areas of openings); if equal user 0.35	
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
If no draught lobby, enter 0.05, else enter 0	0 (13)
Percentage of windows and doors draught stripped	0 (14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$	0 (15)
	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area If based on air permeability value, then $(18) = [(17) \div 20]+(8)$ , otherwise $(18) = (16)$	3 (17)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used	0.15 (18)
Number of sides sheltered	3 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$	0.12 (21)
Infiltration rate modified for monthly wind speed	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Monthly average wind speed from Table 7	
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	
Wind Factor (22a)m = (22)m $\div$ 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	

Adjust	ed infiltr	ation rat	e (allowi	ng for sł	nelter an	d wind s	speed) =	(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		
		<i>ctive air</i> al ventila	0	rate for t	ne appli	cable ca	se						0.5	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)), othei	wise (23b	) = (23a)			0.5	(23b)
			0 11		, (	, ,	• •	n Table 4h		/ ( /			79.05	(23c)
			-	-	-			HR) (24a		2h)m + (	23h) x ['	l – (23c)		(200)
(24a)m=	r	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24	. 100]	(24a)
		l d mech	I anical ve	Intilation	without	heat rec	L coverv (N	I MV) (24b	m = (22)	L 2b)m + (;	23b)			
(24b)m=		0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	u ouse ex	ract ver	ntilation of	or positiv	re input v	ventilatio	n from c	outside					
,					•			c) = (22b		5 × (23b	)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	/e input	ventilatio	on from l	oft					
	if (22b)n	n = 1, th	en (24d)	m = (22	o)m othe	erwise (2	4d)m =	0.5 + [(2	2b)m² x	0.5]			I	
(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24d)
		<u> </u>	i	· · ·		r i	<u>, , ,</u>	d) in boy	· /				I	
(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)
3. He	at losse	s and he	eat loss	paramet	er:									
ELEN	/IENT	Gros		Openin	-	Net Ar		U-valu		AXU	_	k-value		Xk
<b>D</b>		area	(m²)	rr	1 <sup>2</sup>	A ,r		W/m2	К г	(W/I	<)	kJ/m²∙ł	K K.	J/K
Doors						2	x	1.4	= [	2.8				(26)
Windo						8.651	x1.	/[1/( 1.4 )+	0.04] =	11.47				(27)
Walls	Type1	26.2	26	8.65		17.61	x	0.15	= [	2.64				(29)
Walls	Type2	23.0	3	2		21.03	3 X	0.14	=	2.98				(29)
Roof		50.8	85	0		50.85	5 X	0.1	=	5.08				(30)
Total a	area of e	elements	, m²			100.1	4							(31)
							ated using	g formula 1	/[(1/U-valu	e)+0.04] a	s given in	paragraph	3.2	
		ss, W/K :		nternal wal	is and part	llions		(26)(30)	+ (32) =				04.07	(33)
		Cm = S(		0)				()()		.(30) + (32	(32a)	(32e) -	24.97	(33)
			. ,	<sup>-</sup> = Cm -	TFA) ir	n k l/m²K				tive Value:		(020) -	998.61	(35)
		•			,			recisely the				able 1f	100	(33)
	•	ad of a de						, , , , , , , , , , , , , , , , , , , ,						
Therm	al bridg	es : S (L	x Y) cal	culated	using Ap	pendix ł	<						13.68	(36)
			are not kn	own (36) =	= 0.05 x (3	1)			()					_
	abric he									(36) =			38.66	(37)
Ventila		r	i	monthly						= 0.33 × (			l	
(00)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(20)
(38)m=	10.61	10.49	10.37	9.76	9.64	9.03	9.03	8.91	9.27	9.64	9.88	10.12		(38)
		coefficie	1			<b></b>		<b></b>	. ,	= (37) + (3	38)m		l	
(39)m=	49.27	49.15	49.02	48.41	48.29	47.68	47.68	47.56	47.93	48.29	48.54	48.78		<b>—</b> ()
									/	Average =	Sum(39)1	12 /12=	48.38	(39)

Heat lo	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.97	0.97	0.96	0.95	0.95	0.94	0.94	0.94	0.94	0.95	0.95	0.96		
Numb			nth (Tab					I	,	Average =	Sum(40)1.	12 /12=	0.95	(40)
Numb	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)
()												0.		
4. Wa	ater hea	ting ene	rgy requ	irement:								kWh/ye	ear:	
if TF				[1 - exp	0(-0.0003	849 x (TF	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13		72		(42)
Reduce	the annua	al average		usage by	5% if the a	lwelling is	designed	(25 x N) to achieve		se target o		.88		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from 7	Table 1c x	(43)						
(44)m=	86.77	83.61	80.46	77.3	74.15	70.99	70.99	74.15	77.3	80.46	83.61	86.77		
Energy	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	m x nm x L	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1		946.54	(44)
(45)m=	128.67	112.54	116.13	101.24	97.14	83.83	77.68	89.14	90.2	105.12	114.75	124.61		
If in a tau								haven (40		Total = Su	m(45) <sub>112</sub> =		1241.06	(45)
			- ·		1			boxes (46)	1	4	47.04	40.00	1	(46)
(46)m= Water	19.3 storage	16.88 IOSS:	17.42	15.19	14.57	12.57	11.65	13.37	13.53	15.77	17.21	18.69		(46)
	-		) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	-	-	and no ta		-									
	vise if no storage		hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (	(47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
			m Table			,	• •					0		(49)
Energ	y lost fro	m water	r storage	, kWh/ye	ear			(48) x (49)	) =		1	10		(50)
			eclared (	•										(= .)
		-	factor fi see secti		ie 2 (kvv	n/litre/da	ay)				0.	02		(51)
	-	from Ta									1.	03		(52)
Tempe	erature f	actor fro	m Table	2b							0	.6		(53)
Energ	y lost fro	m watei	r storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
	. ,	(54) in (5	•								1.	03		(55)
Water	storage	loss cal	culated	for each	month	-	-	((56)m = (	55) × (41)ı	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylind	er contain:	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	i0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(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)
	•		nnual) fro									0		(58)
	•				,	,	• •	65 × (41)		r tharma	vetat)			
(mo (59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	ng and a 23.26	22.51	r thermo 23.26	22.51	23.26		(59)
(00)11=	20.20	21.01	20.20	22.01	20.20	22.01	20.20	20.20	22.01	20.20	22.01	20.20		(00)

Combi	loss ca	alculated	for eac	h m	nonth (	61)m =	= (60	D) ÷ 36	65 × (41)	)m								
(61)m=	0	0	0		0	0		0	0	0		0	0	0	(	0		(61)
Total h	eat req	uired for	water	hea	iting ca	alculate	ed fo	or eac	h month	(62)ı	n =	0.85 × (	(45)m	+ (46)m +	+ (57)	m +	- (59)m + (61)m	
(62)m=	183.95	162.46	171.4	1	154.74	152.42	1	37.32	132.96	144.	42	143.7	160.4	168.24	179	9.89		(62)
Solar DH	-IW input	calculated	using Ap	pen	dix G or	Append	ix H	(negati	ve quantity	/) (ent	er '0'	' if no sola	r contrib	ution to wa	ter hea	ating)	•	
(add a	dditiona	al lines if	FGHR	S ar	nd/or V	VWHR	S a	pplies	, see Ap	pend	ix G	3)						
(63)m=	0	0	0		0	0		0	0	0		0	0	0	(	0		(63)
Output	from w	ater hea	ter											-			-	
(64)m=	183.95	162.46	171.4	1	154.74	152.42	1	37.32	132.96	144.	42	143.7	160.4	168.24	179	9.89		
											Outp	out from wa	ater hea	ter (annual)	112		1891.9	(64)
Heat g	ains fro	m water	heating	g, k'	Wh/mo	onth 0.2	25 ´	[0.85	× (45)m	ı + (6	1)m	n] + 0.8 x	(46)r	n + (57)n	n + (5	59)m	1]	
(65)m=	87	77.36	82.83	T	76.46	76.52	7	70.67	70.05	73.8	36	72.79	79.17	80.95	85	.65		(65)
inclu	de (57)	m in calo	culation	of	(65)m	only if	cyli	nder i	s in the o	dwell	ing	or hot w	ater is	from con	nmun	nity h	eating	
		ains (see				-					-						-	
	Ŭ	ns (Table			,													
metab	Jan	Feb	Mar		Apr	May	,	Jun	Jul	A	Ja	Sep	Oct	Nov		ec	1	
(66)m=	102.91	102.91	102.91	-	, 102.91	102.91	-	02.91	102.91	102.	Ŭ	102.91	102.9	-	-	2.91		(66)
Lightin	n dains	i (calcula	i ted in A		endix l	equa	tion	190	rl9a)a	lso s	ee T	Table 5					1	
(67)m=	34.35	30.51	24.81	<u> </u>	18.78	14.04	-	11.85	12.81	16.0		22.34	28.37	33.11	35	5.3	1	(67)
		ains (calc												1			I	
(68)m=	223.04	225.36	219.52	-	207.11	191.43	<u>.</u>	176.7	166.86	164.		170.38	182.8	198.47	21	3.2	1	(68)
				_										190.47	21	5.2	J	(00)
	<u> </u>	s (calcula		<u> </u>			_		· · · · · ·					47.04	47	04	1	(60)
(69)m=	47.01	47.01	47.01		47.01	47.01		47.01	47.01	47.0	)	47.01	47.01	47.01	47	.01	J	(69)
•		ins gains	r`	5a)		-									-		1	(70)
(70)m=	0	0	0		0	0		0	0	0		0	0	0	(	0	J	(70)
		vaporatic	<u> </u>	-		es) (Ta	ble	5)	r								1	
(71)m=	-68.6	-68.6	-68.6		-68.6	-68.6		-68.6	-68.6	-68	.6	-68.6	-68.6	-68.6	-68	8.6	J	(71)
Water		gains (T	able 5	)											_		•	
(72)m=	116.94	115.12	111.34	1	106.19	102.85	ę	98.15	94.15	99.2	27	101.09	106.4	2 112.43	115	5.13		(72)
Total i	nterna	l gains =	:	_				(66)	m + (67)m	n + (68	)m +	+ (69)m + (	(70)m +	(71)m + (72	2)m		_	
(73)m=	455.64	452.29	436.98	4	413.39	389.64	3	68.01	355.13	361.	78	375.13	398.8	9 425.32	444	1.94		(73)
6. So	lar gain	s:																
Solar g	ains are	calculated	using so	lar fl	ux from	Table 6a	a and	assoc	iated equa	itions t	0 00	nvert to th	e applic	able orienta	ation.			
Orienta		Access F			Area			Flu			Ŧ	g_		FF			Gains	
		Table 6d		_	m²				ble 6a			able 6b		Table 6c			(W)	_
Southe		0.77		×	8.6	5	x	3	86.79	x		0.63	x	0.7		=	97.28	(77)
Southe		0.77		×	8.6	5	x	6	62.67	x		0.63	×	0.7		=	165.7	(77)
Southe	ast <mark>0.9x</mark>	0.77		×	8.6	5	x	8	85.75	x		0.63	x	0.7		=	226.72	(77)
Southe	ast <mark>0.9x</mark>	0.77	:	×	8.6	5	x	1	06.25	x		0.63	×	0.7		=	280.91	(77)
Southe	ast <mark>0.9x</mark>	0.77	:	×[	8.6	5	x	1	19.01	x		0.63	x	0.7		=	314.65	(77)

Southeast $0.9x$ 0.77 x 8.65 x 118.15 x 0.63 x 0.7 = 312.37 (77)														
Southeast 0.9x	0.77	x	8.6	5	x	118.15	×		0.63	×	0.7	=	312.37	(77)
Southeast 0.9x	0.77	x	8.6	5	x	113.91	×		0.63	×	0.7	=	301.16	(77)
Southeast 0.9x	0.77	x	8.6	5	x	104.39	×		0.63	×	0.7	=	275.99	(77)
Southeast 0.9x	0.77	x	8.6	5	x	92.85	x		0.63	×	0.7	=	245.49	(77)
Southeast 0.9x	0.77	x	8.6	5	x	69.27	x		0.63	×	0.7	=	183.13	(77)
Southeast 0.9x	0.77	x	8.6	5	x	44.07	x		0.63	×	0.7	=	116.52	(77)
Southeast 0.9x	0.77	×	8.6	5	x	31.49	x		0.63	_ × [	0.7	=	83.25	(77)
										_				
Solar gains in	watts, calcu	ulated	for eacl	n month			(83)r	n = Sı	um(74)m .	(82)m		-		
(83)m= 97.28	165.7 22	26.72	280.91	314.65	3	12.37 301.16	275	5.99	245.49	183.13	116.52	83.25		(83)
Total gains –	internal and	solar	(84)m =	= (73)m ·	+ (8	33)m , watts					-			
(84)m= 552.92	617.99 6	63.7	694.3	704.28	6	80.39 656.29	637	7.77	620.61	582.03	541.84	528.19		(84)
7. Mean inte	rnal tempera	ature (	(heating	season	)									
Temperature	e during heat	ting pe	eriods ir	n the livi	ng	area from Ta	able 9	), Th	1 (°C)				21	(85)
Temperature during heating periods in the living area from Table 9, Th1 (°C)     21     (85)       Utilisation factor for gains for living area, h1,m (see Table 9a)     21     (85)														
Jan	Feb	Mar	Apr	May	Ĺ	Jun Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 0.87	0.83 0	).77	0.68	0.56		0.42 0.31	0.	33	0.49	0.69	0.82	0.88		(86)
Mean interna	l temperatu	re in l	iving ar		مالد	w steps 3 to	7 in <sup>-</sup>	Table	- 9c)					
(87)m= 19.72	т <sup>і</sup> г	0.25	20.57	20.8	<u> </u>	0.94 20.98	-	.98	20.9	20.62	20.13	19.67		(87)
							-							
Temperature	т <sup>—</sup> т —	ting pe 0.11	20.12	20.13	<b></b>	20.14 20.14	<b>_</b>	9, Ir .14	12 (°C) 20.13	20.13	20.12	20.12		(88)
							_		20.13	20.13	20.12	20.12		(00)
Utilisation fa	T T				<u> </u>		<u> </u>				1		I	
(89)m= 0.86	0.81 0	).75	0.65	0.52		0.37 0.25	0.	27	0.44	0.65	0.8	0.87		(89)
Mean interna	al temperatu	re in t	he rest	of dwelli	ng	T2 (follow s	teps 3	3 to 7	in Tabl	e 9c)	_			
(90)m= 18.43	18.76 1	9.17	19.61	19.91	2	0.08 20.12	20	.12	20.04	19.69	19.03	18.36		(90)
									f	LA = Livi	ng area ÷ (4	4) =	0.45	(91)
Mean interna	al temperatu	re (foi	r the wh	ole dwe	llin	$g) = fLA \times T^{-1}$	1 + (1	– fL	A) x T2					
(92)m= 19.01	19.3 1	9.66	20.05	20.32	2	0.47 20.51	20	.51	20.43	20.11	19.53	18.95		(92)
Apply adjust	ment to the	mean	internal	temper	atu	re from Tabl	e 4e,	whe	re appro	priate	•			
(93)m= 19.01	19.3 1	9.66	20.05	20.32	2	0.47 20.51	20	.51	20.43	20.11	19.53	18.95		(93)
8. Space hea	ating require	ment												
Set Ti to the			•		ned	at step 11 c	of Tab	le 9b	o, so tha	t Ti,m=	(76)m an	d re-calo	culate	
the utilisation	1 I I	-			<u> </u>				0	0.1		Du	l	
Jan Utilization fo		Mar	Apr	May		Jun Jul		ug	Sep	Oct	Nov	Dec		
Utilisation factors (94)m= 0.83		).73	0.65	0.53		0.39 0.28		.3	0.46	0.65	0.78	0.85		(94)
Useful gains						0.20	Ů	.0	0.40	0.00	0.70	0.00		()
(95)m= 461.64	1 1	37.34	448.82	374.92	2	67.81 183.38	19	1.43	283.64	379.98	425.22	447.51		(95)
Monthly ave											-			
(96)m= 4.3	1 1	6.5	8.9	11.7	<u> </u>	14.6 16.6	16	6.4	14.1	10.6	7.1	4.2		(96)
Heat loss rat	e for mean i	interna	al tempe	erature,	L Lm	, W =[(39)m	n x [(9	13)m-	– (96)m	]	1	1	I	
(97)m= 724.9	1 1	45.14	539.69	416.14	<u> </u>	79.9 186.57		5.47	303.37	459.21	603.29	719.75		(97)
Space heatir	ng requireme	ent for	r each m	honth, k	Wh	/month = 0.0	)24 x	[(97)	m – (95	)m] x (4	41)m			
(98)m= 195.86	146.34 1	17.4	65.43	30.67		0 0		0	0	58.94	128.2	202.54		
	· · · ·				-		-					-	•	

		Total per year (kWh/year) = Sum(98) <sub>15,912</sub> =	945.38	(98)
Space heating requirement in kWh/m²/yea	ır		18.59	(99)
9b. Energy requirements – Community hea	ting scheme			
This part is used for space heating, space of Fraction of space heat from secondary/sup			0	(301)
Fraction of space heat from community sys			1	(302)
The community scheme may obtain heat from several		s for CHP and up to four other heat sources; t	he latter	
includes boilers, heat pumps, geothermal and waste h Fraction of heat from Community boilers	neat from power stations. See A	Appendix C.	1	(303a)
Fraction of total space heat from Communit	ty boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Ta	ble 4c(3)) for community	heating system	1	(305)
Distribution loss factor (Table 12c) for comm	munity heating system		1.05	(306)
Space heating			kWh/year	
Annual space heating requirement			945.38	
Space heat from Community boilers		(98) x (304a) x (305) x (306) =	992.65	(307a)
Efficiency of secondary/supplementary hea	ting system in % (from T	able 4a or Appendix E)	0	(308
Space heating requirement from secondary	v/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement			1891.9	٦
If DHW from community scheme: Water heat from Community boilers		(64) x (303a) x (305) x (306) =	1986.49	(310a)
Electricity used for heat distribution		0.01 × [(307a)(307e) + (310a)(310e)] =	29.79	(313)
Cooling System Energy Efficiency Ratio			0	(314)
Space cooling (if there is a fixed cooling sys	stem, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwellin mechanical ventilation - balanced, extract of	<b>-</b> · · · · · · · · · · · · · · · · · · ·	side	176.41	(330a)
warm air heating system fans			0	 (330b)
pump for solar water heating			0	 (330g)
Total electricity for the above, kWh/year		=(330a) + (330b) + (330g) =	176.41	(331)
Energy for lighting (calculated in Appendix	L)		242.63	(332)
Electricity generated by PVs (Appendix M)	(negative quantity)		-518.71	(333)
Electricity generated by wind turbine (Appe	ndix M) (negative quantit	у)	0	(334)
10b. Fuel costs - Community heating sche	eme			
	<b>Fuel</b> kWh/year	<b>Fuel Price</b> (Table 12)	<b>Fuel Cost</b> £/year	
Space heating from CHP	(307a) x	4.24 × 0.01 =	42.09	(340a)
Water heating from CHP	(310a) x	4.24 × 0.01 =	84.23	(342a)

			Fuel Pric	e			
Pumps and fans	(331)		13.19	x 0.01 =		23.27	(349)
Energy for lighting	(332)		13.19	x 0.01 =		32	(350)
Additional standing charges (Table 12)						120	(351)
Energy saving/generation technologies Total energy cost	= (340a)(342e) + (3	445)(354) =				301.59	(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] =				1.32	(357)
SAP rating (section12)						81.56	(358)
12b. CO2 Emissions – Community heat	ing scheme						
		Energy kWh/year		sion factor O2/kWh		issions CO2/year	
CO2 from other sources of space and v Efficiency of heat source 1 (%)		CHP) P using two fuels repeat	(363) to (366) fo	r the second fue	el [	94	(367a)
CO2 associated with heat source 1	[(:	307b)+(310b)] x 100 ÷ (3	67b) x	0.22	- [	684.57	(367)
Electrical energy for heat distribution		[(313) x		0.52	- [	15.46	(372)
Total CO2 associated with community s	systems	(363)(366) + (36	68)(372)	=	- [	700.03	(373)
CO2 associated with space heating (se	condary)	(309) x		0	- [	0	(374)
CO2 associated with water from immers	sion heater or insta	ntaneous heater (	312) x	0.22	- [	0	(375)
Total CO2 associated with space and w	ater heating	(373) + (374) + (3	75) =			700.03	(376)
CO2 associated with electricity for pum	ps and fans within	dwelling (331)) x		0.52	- [	91.56	(378)
CO2 associated with electricity for lighti	ng	(332))) x		0.52	- [	125.92	(379)
Energy saving/generation technologies Item 1	(333) to (334) as a	pplicable	0.52	x 0.01 =		-269.21	(380)
Total CO2, kg/year	sum of (376)(382) =	=				648.3	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =					12.75	(384)
El rating (section 14)						90.94	(385)
13b. Primary Energy – Community heat	ing scheme						
		Energy kWh/year	Prim facto	•		Energy /h/year	
Energy from other sources of space and Efficiency of heat source 1 (%)		ot CHP) P using two fuels repeat	(363) to (366) fo	r the second fue	el [	94	(367a)
Energy associated with heat source 1	[(	307b)+(310b)] x 100 ÷ (3	67b) x	1.22	- [	3866.55	(367)
Electrical energy for heat distribution		[(313) x		=	- F	91.46	(372)
Total Energy associated with communit	y systems	(363)(366) + (36	68)(372)		- [	3958.01	(373)
if it is negative set (373) to zero (unle	ss specified otherv	vise, see C7 in Appe	endix C)		Γ	3958.01	(373)
Energy associated with space heating (	secondary)	(309) x		0	- [	0	(374)

Total Primary Energy, kWh/year sum of (37)	6)(382) =				3652.03	(383)
Energy saving/generation technologies Item 1		3.0	)7 ×	0.01 =	-1592.44	(380)
Energy associated with electricity for lighting	(332))) x		3.07	=	744.86	(379)
Energy associated with electricity for pumps and fans within o	dwelling (33	31)) x	3.07	=	541.59	(378)
Energy associated with space cooling	(315) x		3.07	=	0	(377)
Total Energy associated with space and water heating	(373) + (374) + (375	5) =			3958.01	(376)
Energy associated with water from immersion heater or insta	ntaneous heater(31	12) x	1.22	=	0	(375)

			User D	etails:						
Assessor Name:	Zahid Ashraf			Strom	a Num	ber:		STRO	001082	
Software Name:	Stroma FSAP	2012		Softwa	are Ver	sion:		Versic	on: 1.0.5.9	
		Р	roperty <i>i</i>	Address:	: Plot 50					
Address :										
1. Overall dwelling dimer	nsions:									
				a(m²)			ight(m)	1	Volume(m <sup>3</sup> )	
Ground floor				0.85	(1a) x	2	2.5	(2a) =	127.12	(3a)
Total floor area TFA = (1a	)+(1b)+(1c)+(1d)-	+(1e)+(1r	I) 5	0.85	(4)					
Dwelling volume					(3a)+(3b)	)+(3c)+(3c	l)+(3e)+	.(3n) =	127.12	(5)
2. Ventilation rate:				_						
	main heating	secondar heating	у	other		total			m <sup>3</sup> per hou	r
Number of chimneys			+	0	] = [	0	X	40 =	0	(6a)
Number of open flues	0	- 0	<u> </u> + [	0	-   -	0	x	20 =	0	(6b)
Number of intermittent far	IS				- L	2	x .	10 =	20	(7a)
Number of passive vents						0	x ·	10 =	0	(7b)
Number of flueless gas fir	es					0	x.	40 =	0	(7c)
i de la la de la d						0			0	
								Air ch	anges per ho	ur
Infiltration due to chimney	s, flues and fans	= (6a)+(6b)+(7	a)+(7b)+(	7c) =	Г	20		÷ (5) =	0.16	(8)
If a pressurisation test has be		tended, procee	d to (17), c	otherwise o	continue fr	om (9) to (	(16)			
Number of storeys in the	e dwelling (ns)								0	(9)
Additional infiltration	DE for staal or tim	har frama ar	0.25 for		n / oo potr	uction	[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.2 if both types of wall are pre					•	uction			0	(11)
deducting areas of opening										_
If suspended wooden flo		,	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ente									0	(13)
Percentage of windows	and doors draugi	nt stripped		0.25 - [0.2	$\mathbf{v}(1\mathbf{A}) \pm 1$	001 -			0	(14)
Window infiltration Infiltration rate				(8) + (10)		-	+ (15) -		0	(15)
Air permeability value, o	150 expressed in	cubic metre						area	0	(16) (17)
If based on air permeabilit			•	•	•		invelope	arca	5 0.41	(17)
Air permeability value applies	-					is being u	sed		0.41	
Number of sides sheltered	k								3	(19)
Shelter factor				(20) = 1 -	[0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporation	ng shelter factor			(21) = (18)	) x (20) =				0.32	(21)
Infiltration rate modified for	r monthly wind sp	eed								
Jan Feb I	Var Apr M	lay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7								L	
(22)m= 5.1 5	4.9 4.4 4.	3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	)m ÷ 4									
	.23 1.1 1.(	0.95	0.95	0.92	1	1.08	1.12	1.18		
	I								I	

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m					
	0.4	0.39	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37		
		<i>ctive air</i> al ventila	change	rate for t	he appli	cable ca	se							(220)
				endix N (2	(23a) – (23a	a) x Emv (e	equation (I	N5)) , othe	rwise (23h	) – (23a)			0	(23a)
		• •	0 11		, ,	, ,	• •	n Table 4h		) = (200)			0	(23b)
			-	-	-			HR) (24a		2b)m + ('	23h) v [·	1 _ (23c)	0 · 1001	(23c)
(24a)m=	<b></b>			0						0	0	1 - (230)	÷ 100]	(24a)
		-		-		-		I MV) (24b	-	-		Ŭ		
(24b)m=				0	0				0	0	0	0		(24b)
								n from c	_	•	•	Ŭ		
,					•	•		c) = (22t		5 × (23b	)			
(24c)m=	, <i>,</i>	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) lf	natural	ventilatio	on or wh	ole hous	se positiv	ve input	ventilatio	on from l	oft					
	if (22b)n	n = 1, th	en (24d)	m = (22	o)m othe	erwise (2	24d)m =	0.5 + [(2	2b)m² x	0.5]				
(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(24d)
Effe	ctive air	change	rate - er	nter (24a	) or (24t	o) or (24	c) or (24	ld) in boy	(25)					
(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3. He	at losse	s and he	eat loss i	paramete	er:									
	<b>IENT</b>	Gros		Openin		Net Ar	ea	U-valı	ue	AXU		k-value	9	AXk
		area	(m²)	r	2 <sup>2</sup>	A ,r	m²	W/m2	:Κ,	(W/I	<)	kJ/m²∙ł	<	kJ/K
Doors						2	x	1	=	2				(26)
Windo	WS					8.651	ı x1	/[1/( 1.4 )+	0.04] =	11.47				(27)
Walls	Type1	26.2	26	8.65	5	17.61	1 X	0.18	=	3.17				(29)
Walls	Type2	23.0	)3	2		21.03	3 X	0.18	=	3.79				(29)
Roof		50.8	35	0		50.85	5 X	0.13	=	6.61				(30)
Total a	area of e	lements	, m²			100.1	4							(31)
							lated using	g formula 1	/[(1/U-valu	e)+0.04] a	s given in	paragraph	3.2	
			sides of ir		ls and pari	titions		(26)(30)	1 + (32) -					
			= S (A x	0)				(20)(30)		(20) - (20		(220)	27.03	(33)
		Cm = S(	eter (TMF	2 _ Cm ·		k l/m 2k				.(30) + (32 tive Value:		(32e) =	998.61	
		•	•		,			recisely the				abla 1f	250	(35)
	-		tailed calc		construct	ion ale no	t known pi	ecisely life	, muicative	values of				
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix l	K						10.95	(36)
			are not kn	own (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			37.98	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y		i	i	(38)m	= 0.33 × (	25)m x (5)	)	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	24.37	24.24	24.11	23.5	23.39	22.86	22.86	22.76	23.07	23.39	23.62	23.86		(38)
Heat ti	ransfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m		L	
(39)m=	62.35	62.22	62.09	61.49	61.37	60.84	60.84	60.75	61.05	61.37	61.6	61.84		
										Average =	Sum(39)1	12 /12=	61.49	(39)

Heat l	oss para	meter (I	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	1.23	1.22	1.22	1.21	1.21	1.2	1.2	1.19	1.2	1.21	1.21	1.22		
Numb	er of day		nth (Tab					Į	,	Average =	Sum(40)1.	12 /12=	1.21	(40)
Numb	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(,														
4. Wa	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
if TF	ned occu FA > 13.9 FA £ 13.9	9, N = 1		(1 - exp	o(-0.0003	349 x (TF	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13.		72		(42)
Reduce	the annua	al average	hot water	usage by		welling is	designed	(25 x N) to achieve		se target o		.93		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	-					
(44)m=	82.43	79.43	76.43	73.44	70.44	67.44	67.44	70.44	73.44	76.43	79.43	82.43		
Energy	content of	hot water	used - cal	lculated m	onthly = 4.	190 x Vd,r	m x nm x L	) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) ) )			m(44) <sub>112</sub> = ables 1b, 1		899.21	(44)
(45)m=	122.24	106.91	110.32	96.18	92.29	79.64	73.8	84.68	85.69	99.87	109.01	118.38		
			1	1	1	1	1	1		Total = Su	m(45) <sub>112</sub> =	-	1179	(45)
lf instar		ater heati	ng at point	t of use (no	o hot water	r storage),	enter 0 in	boxes (46	) to (61)					
(46)m= Water	18.34 storage	16.04	16.55	14.43	13.84	11.95	11.07	12.7	12.85	14.98	16.35	17.76		(46)
	-		) includir	ng any s	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If com	munity h	eating a	and no ta	ank in dv	velling, e	nter 110	) litres in	ı (47)						
			hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (	47)			
	storage		aclarad I	oss fact	or is kno	wn (k\//	n/dav).					20		(48)
	erature f						i/uay).					39 54		(48)
	y lost fro				ear			(48) x (49)	) =			54 75		(50)
-	-		-	•	loss fact	or is not	known:	(,,	/		0.	75		(00)
		-			le 2 (kW	h/litre/da	ay)					0		(51)
	munity h le factor	-		on 4.3								0		(52)
	erature f			2b								0		(52)
	y lost fro				ear			(47) x (51)	) x (52) x (	53) =		0		(54)
-	(50) or (		-									75		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (	55) × (41)ı	m				
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(56)
If cylind	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (	[H11)] ÷ (5	50), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	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)
Prima	ry circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
	•						. ,	65 × (41)						
			r	1	1	· · · · · ·		ng and a		1	, 			
(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 ca	lculated	for ea	ch	month (	(61)m =	(60	D) ÷ 36	65 × (41)	)m								
(61)m=	0	0	0		0	0		0	0	0		0	0	0	0			(61)
Total h	eat req	uired for	water	he	ating ca	alculated	d fo	or eacl	h month	(62)n	n =	0.85 × (	(45)m +	+ (46)m +	(57)m	ι + (	59)m + (61)m	
(62)m=	168.83	149	156.9	2	141.27	138.88	1	24.73	120.39	131.	28	130.78	146.46	5 154.1	164.9	98		(62)
Solar DH	IW input	calculated	using A	ppe	ndix G o	Appendi	ίΗ	(negativ	ve quantity	/) (ente	er '0'	if no sola	r contrib	ution to wat	er heatir	ng)		
(add a	dditiona	al lines if	FGHF	RS a	and/or \	WWHRS	S ap	plies,	, see Ap	pendi	хG	G)						
(63)m=	0	0	0		0	0		0	0	0		0	0	0	0			(63)
Output	from w	ater hea	ter															
(64)m=	168.83	149	156.9	2	141.27	138.88	1	24.73	120.39	131.	28	130.78	146.46	5 154.1	164.9	98		
			•							(	Dutp	out from wa	ater heat	er (annual)	112		1727.62	(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=	77.92	69.22	73.96	3	68.05	67.96	6	62.55	61.81	65.4	3	64.57	70.48	72.32	76.64	4		(65)
inclu	de (57)	m in calo	ulatio	n o	f (65)m	only if c	ylir	nder is	s in the c	dwelli	ng	or hot w	ater is	from com	munity	y he	ating	
5. Int	ernal g	ains (see	e Table	e 5	and 5a	):					Ū				-			
		ns (Table																
Melab	Jan	Feb	<u>, 5), W</u> Ma		Apr	May	Γ	Jun	Jul	Au	a	Sep	Oct	Nov	De	c		
(66)m=	85.76	85.76	85.76	-	85.76	85.76	-	35.76	85.76	85.7	<u> </u>	85.76	85.76	85.76	85.76			(66)
		I (calcula													I			
(67)m=	13.74	12.2	9.92	<u> </u>	7.51	5.62	-	4.74	5.12	6.66	- 1	8.94	11.35	13.25	14.12	2		(67)
														10.20				
(68)m=	149.44	ins (calc 150.99	147.0	- T	138.76	128.26	<b>1</b>	18.39	111.8	3a), a		114.15	122.47	132.98	142.8	5		(68)
							L							132.90	142.0	55		(00)
	<u> </u>	s (calcula		-i	•	· ·	-				-		· · · · · ·	04.50	04.50			(60)
(69)m=	31.58	31.58	31.58		31.58	31.58	3	81.58	31.58	31.5	8	31.58	31.58	31.58	31.58	8		(69)
-		ns gains	·		-		-							-		_		
(70)m=	3	3	3		3	3		3	3	3		3	3	3	3			(70)
Losses		/aporatic	<u> </u>	- -	ve valu	es) (Tab	1	-					r		-	_		
(71)m=	-68.6	-68.6	-68.6	5	-68.6	-68.6	-	68.6	-68.6	-68.	6	-68.6	-68.6	-68.6	-68.6	6		(71)
Water		gains (T	able t	5)									-					
(72)m=	104.73	103	99.4	1	94.52	91.35	8	36.88	83.08	87.9	5	89.68	94.73	100.44	103.0	)1		(72)
Total i	nterna	gains =	-					(66)	m + (67)m	n <mark>+ (68</mark> )	m +	- (69)m + (	(70)m +	(71)m + (72	)m			
(73)m=	319.64	317.92	308.1	4	292.52	276.95	2	61.74	251.73	256.	58	264.5	280.28	298.39	311.7	7		(73)
6. So	lar gain	s:																
			0	olar	flux from	Table 6a	and			tions to	0 00	nvert to th	e applica	able orienta	tion.			
Orienta		Access F			Area			Flu	x ole 6a		т	g_ abla Ch		FF Tabla Ga			Gains	
		Table 6d			m²			1 au				able 6b		Table 6c		_	(VV)	-
Southe		0.11		x	8.65		x	36.79		×		0.63	X	0.7		=	97.28	(77)
Southe	ast <mark>0.9x</mark>	0.77		x	8.65		x	62.67		x		0.63	x	0.7		=	165.7	(77)
Southe	ast <mark>0.9</mark> x	0.77		x	8.6	65	x	8	5.75	x		0.63	x	0.7	:	=	226.72	(77)
Southe	ast <mark>0.9x</mark> [	0.77		x	8.6	65	x	10	06.25	x		0.63	x	0.7		= [	280.91	(77)
Southe	ast <mark>0.9x</mark>	0.77		x	8.6	65	x	1 <sup>.</sup>	19.01	x		0.63	x	0.7	:	= [	314.65	(77)

		_						_							
Southeast 0.9x	0.77	x	8.6	55	x	118	3.15	x		0.63	×	0.7	=	312.37	(77)
Southeast 0.9x	0.77	x	8.6	65	x 113.91		3.91	x		0.63	x	0.7	=	301.16	(77)
Southeast 0.9x	0.77	x	8.6	65	× 104.3		4.39	x		0.63	x	0.7	=	275.99	(77)
Southeast 0.9x	0.77	x	8.6	65	x	92.	.85	x		0.63	<b>x</b>	0.7	=	245.49	(77)
Southeast 0.9x	0.77 × 8.65		65	x	69.	.27	x		0.63	<b>x</b>	0.7	=	183.13	(77)	
Southeast 0.9x	utheast 0.9x 0.77 x		8.6	65		44.	.07	x		0.63	<b>x</b>	0.7	=	116.52	(77)
Southeast 0.9x	0.77	x	8.6	65	x	31.	.49	x		0.63	<b>x</b>	0.7	=	83.25	(77)
Solar gains in	watts, calcul	lated	for eacl	h month				(83)m	= Sur	m(74)m	(82)m	_	-	_	
(83)m= 97.28		6.72	280.91	314.65		-	301.16	275.	99	245.49	183.13	116.52	83.25		(83)
Total gains –	internal and s	solar	(84)m =	= (73)m ·	+ (8	83)m , v	watts							-	
(84)m= 416.91	483.62 534	4.86	573.44	591.6	5	74.11	552.89	532.	57	509.98	463.42	414.91	394.95		(84)
7. Mean inte	rnal tempera	ture (	(heating	season	)										
Temperature	e during heati	ing p	eriods ir	n the livi	ng	area fro	om Tab	ole 9,	Th1	(°C)				21	(85)
Utilisation fa	ctor for gains	for li	iving are	ea, h1,m	(s	ee Tab	le 9a)								
Jan	Feb N	/lar	Apr	May		Jun	Jul	Αι	ıg	Sep	Oct	Nov	Dec		
(86)m= 0.99	0.98 0.	96	0.92	0.81	(	0.64	0.48	0.5	1	0.74	0.93	0.98	0.99		(86)
Mean interna	al temperatur	e in l	iving are	ea T1 (fo	Sllo	w steps	s 3 to 7	' in Ta	able	9c)		•		•	
(87)m= 19.86		).3	20.6	20.84	<u> </u>	i	20.99	20.9	_	20.92	20.62	20.18	19.82	]	(87)
Tomporature	during heati	ing n	oriode ir	roct of	L dw	ulling f	rom To			2 (°C)				J	
(88)m= 19.9	1 1	9.9	19.91	19.91	r		19.92	19.9	1	19.92	19.91	19.91	19.91	1	(88)
									-	10.02	10.01	10.01	10.01		()
	ctor for gains	1			<u> </u>	<u> </u>		,						1	(00)
(89)m= 0.99	0.98 0.	95	0.89	0.76		0.55	0.36	0.4		0.66	0.9	0.98	0.99		(89)
Mean interna	al temperatur	e in t	he rest	of dwell	ng	T2 (fol	low ste	ps 3	to 7	in Table	e 9c)	_	r	1	
(90)m= 18.41	18.67 19	.04	19.47	19.76	·	19.9	19.92	19.9	92	19.86	19.5	18.89	18.36		(90)
										fl	LA = Livi	ing area ÷ (4	4) =	0.45	(91)
Mean interna	al temperatur	e (fo	r the wh	ole dwe	llin	g) = fLA	4 × T1 ·	+ (1 -	– fLA	A) × T2					
(92)m= 19.06	19.29 19	.61	19.98	20.25	2	20.38	20.41	20.4	1	20.34	20.01	19.47	19.02		(92)
Apply adjust	ment to the n	nean	internal	temper	atu	ire from	n Table	4e, v	wher	e appro	priate			-	
(93)m= 19.06	19.29 19	.61	19.98	20.25	2	20.38	20.41	20.4	1	20.34	20.01	19.47	19.02		(93)
8. Space hea	ating requirer	nent													
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a															
	1 1				<u> </u>	lun	11	۸.		San	Oct	Nev	Dee	1	
Jan Utilisation fa	ctor for gains	/lar	Apr	May		Jun	Jul	Αι	ig [	Sep	Oct	Nov	Dec		
(94)m= 0.99	1 1	95	0.89	0.78		0.59	0.42	0.4	5	0.69	0.91	0.98	0.99	1	(94)
	, hmGm , W :								-			1		J	
(95)m= 411.67	T T	7.99	511.12	458.76	3	38.44	229.65	240.	37	352.52	419.77	404.54	390.99	1	(95)
	rage external											_		1	
(96)m= 4.3	<del>1 1 1</del>	.5	8.9	11.7	<u> </u>	14.6	16.6	16.4	4	14.1	10.6	7.1	4.2	]	(96)
Heat loss rat	te for mean ir	nterna	al tempe	erature,	Lm	i , W =[	(39)m >	x [(93	)m–	(96)m ]			1	1	
(97)m= 920.58	895.63 814	4.21	681.3	524.72	3	51.72	231.61	243.	.3	381.12	577.59	762.24	916.6	]	(97)
Space heating	ng requireme	nt foi	r each m	nonth, k	Nh	/month	= 0.02	4 x [(	(97)r	n – (95)	)m] x (4	41)m		_	
(98)m= 378.63	284.94 227	7.82	122.53	49.08		0	0	0		0	117.42	257.54	391.05		
														_	

								Tota	l per year	(kWh/year	<sup>.</sup> ) = Sum(9	8)15,912 =	1829.03	(98)
Spac	e heatin	g require	ement in	n kWh/m²	/year								35.97	(99)
9a. En	ergy reo	quiremer	nts – Ind	lividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
•	e heati	0			, .									٦
				econdar		mentary			(224)				0	(201)
Fraction of space heat from main system(s) $(202) = 1 - (201) =$ Fraction of total heating from main system 4 $(202) \times [1 - (202)] =$													1	(202)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$ Efficiency $(204) = (202) \times [1 - (203)] =$												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/yea	ar
Spac		ř ·	·`		,				0	447.40	057.54	204.05		
( <b>-</b> / /)	378.63	284.94	227.82	122.53	49.08	0	0	0	0	117.42	257.54	391.05		
(211)n	$1 = \{[(98) \\ 404.96 ]$	304.75 m x	4)] } x 1 243.66	100 ÷ (20 131.05	)6) 52.49	0	0	0	0	125.59	275.45	418.24		(211)
	404.90	304.75	243.00	131.05	52.49	0	0			ar) =Sum(2			1956.18	(211)
Snac	a haatin	a fuol (e	econdar	·y), kWh/	month				(		- 7 715,1012	2	1930.10	
•		01)] } x 1		• /	monun									
(215)m=		0	0	0	0	0	0	0	0	0	0	0		
		•					•	Tota	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	<u>_</u>	0	(215)
	heating													_
Output	from w	ater hea	ter (calc 156.92	ulated a		124.73	120.39	131.28	130.78	146.46	154.1	164.98		
Efficie		ater hea		141.27	138.88	124.73	120.39	131.20	130.78	140.40	154.1	164.96	79.8	(216)
(217)m=	-	86.52	85.81	84.44	82.34	79.8	79.8	79.8	79.8	84.23	86.17	87.04	79.0	(217)
` '		heating,												. ,
		<u>m x 100</u>											I	
(219)m=	194.27	172.22	182.87	167.31	168.67	156.3	150.87	164.51	163.89	173.88	178.83	189.55		-
								lota	I = Sum(2		,		2063.15	(219)
	I totals		ed main	system	1					K	Wh/year	•	kWh/year 1956.18	1
•		fuel use		oyotom	•									J
													2063.15	
		•		electric	keep-no	t							L	
centra	al heatir	ng pump	:									30		(230c)
boiler	with a	fan-assis	sted flue									45		(230e)
Total electricity for the above, kWh/year sum of (230a)(230g) =										75	(231)			
Electri	city for I	ighting											242.63	(232)
12a. (	CO2 err	nissions -	– Individ	lual heati	ing syste	ems inclu	uding mi	cro-CHP	)					
							<b>ergy</b> /h/year			Emiss kg CO	<b>ion fac</b> 2/kWh	tor	<b>Emissions</b> kg CO2/yea	ır
Space	heating	ı (main s	ystem 1	)		(21	1) x			0.2	16	=	422.53	(261)

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	445.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			868.17	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	125.92	(268)
Total CO2, kg/year	sum	of (265)(271) =		1033.02	(272)

TER =

20.32 (273)