#### **Regulations Compliance Report**

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.9 Printed on 28 October 2020 at 14:54:50

Project Information:

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

Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 54.6m<sup>2</sup> Plot Reference: Plot 17 Site Reference : Hermitage Lane

Address:

Client Details:

Name: Address:

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)

Fuel factor: 1.00 (mains gas (c))

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

Dwelling Carbon Dioxide Emission Rate (DER) 12.86 kg/m<sup>2</sup> OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 49.3 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 40.4 kWh/m<sup>2</sup>

OK

2 Fabric U-values

**Element Average Highest** 0.15 (max. 0.70) External wall 0.14 (max. 0.30) OK Floor 0.12 (max. 0.25) 0.12 (max. 0.70) OK Roof (no roof)

1.40 (max. 3.30)

**Openings** 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

1.40 (max. 2.00)

3 Air permeability

Air permeability at 50 pascals 3.00 (design value)

OK Maximum 10.0

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

programmer and at least two room thermostats

No cylinder thermostat Hot water controls:

No cylinder

OK

OK

# **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	OK
MVHR efficiency:	93%	
Minimum	70%	OK
9 Summertime temperature		
Overheating risk (Thames valley):	Medium	oK
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	8.65m²	
Ventilation rate:	4.00	
10 Key features		
Air permeablility	3.0 m³/m²h	
Floors U-value	0.12 W/m <sup>2</sup> K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

		l lea	er Details:						
Access an Names	Zabid Ashrof	USC		- M	<b>b</b> a		CTDO	004000	
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	<b>)</b>	Stroma Softwa	-				001082 on: 1.0.5.9	
Contware Hame.	Ottoma 1 0/11 2012		rty Address:				V 01010	7.0.0.0	
Address :		·	-						
1. Overall dwelling dime	ensions:								
Ground floor		<i>,</i>	Area(m²)	(1a) v		ight(m)	(2a) =	Volume(m³	(3a)
	a) . (4 b) . (4 a) . (4 d) . (4 a)	. (45)		(1a) x		2.5	(2a) =	136.49	(Sa)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)	+(1n)	54.6	(4)	) (O.) (O.)	n (O )	(0.)		_
Dwelling volume				(3a)+(3b)	)+(3c)+(3c	d)+(3e)+	.(3n) =	136.49	(5)
2. Ventilation rate:	main se	condary	other		total			m³ per hou	r
Number of allignments	heating	eating		1 _ [			40 =		_
Number of chimneys			0	] = [	0			0	(6a)
Number of open flues	0 +	0 +	0	] = [	0		20 =	0	(6b)
Number of intermittent fa					0		10 =	0	(7a)
Number of passive vents	<b>;</b>			L	0	X '	10 =	0	(7b)
Number of flueless gas fi	ires				0	X 4	40 =	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimne	vs_flues and fans = (6a	)+(6b)+(7a)+(7	b)+(7c) =	Г	0		÷ (5) =	0	(8)
	peen carried out or is intended			ontinue fr			- (0) =	0	
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber fr resent, use the value corresp			•	uction			0	(11)
deducting areas of openi		oriding to the g	neater wan are	a (anter					
If suspended wooden	floor, enter 0.2 (unseale	ed) or 0.1 (se	ealed), else	enter 0				0	(12)
If no draught lobby, en								0	(13)
· ·	s and doors draught str	ipped						0	(14)
Window infiltration			0.25 - [0.2	, ,	_	. (45)		0	(15)
Infiltration rate	aEO evareaced in cubi	o motroe no	(8) + (10)	, , ,	, , ,	, ,	oroo	0	(16)
If based on air permeabil	q50, expressed in cubi	•	•	•	etre or e	invelope	area	3	(17)
	es if a pressurisation test has				is being u	sed		0.15	(18)
Number of sides sheltere			,	,	Ū			3	(19)
Shelter factor			(20) = 1 -	0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporate	ting shelter factor		(21) = (18)	x (20) =				0.12	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May	Jun Ju	ıl Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7							_	
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2.	2)m ∸ 4								
	1.23 1.1 1.08	0.95 0.9	0.92	1	1.08	1.12	1.18		
					Ц			J	

Adjusted infiltra	ation rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14	]	
Calculate effect		•	rate for t	he appli	cable ca	se	•	•	•	•	•	<b>,</b>	
If mechanica			andiv N. /O	2h) _ (22c	) Em. (	auation (	VEVV otho	muiaa (22h	) - (220)			0.5	(23a
If balanced with		•		, ,		. ,		,	) = (23a)			0.5	(23b
		-	-	_					21. ) (	001.) [	4 (00 -)	79.05	(230
a) If balance						<del>- `</del>	<del>- ^ ` </del>	<del>í `</del>	<del> </del>	<del></del>	<del>- `                                   </del>	) ÷ 100] 1	(24a
(24a)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24	]	(244
b) If balance						<del>-                                    </del>	<del>, ``</del>	ŕ	<del> </del>	<del></del>	Ι ,	1	(2.4h
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	J	(24b
c) If whole he if (22b)m				•	•				5 v (22h	.)			
(24c)m = 0	0.5 x	0	0	0 = (230)	0	0	$\frac{C) = (221)}{0}$	0	0	0	0	1	(240
` '						<u> </u>						J	(= .5
d) If natural v if (22b)m					•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24d
Effective air	change	rate - er	nter (24a	or (24b	o) or (24	c) or (24	d) in box	x (25)				1	
(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)
					l	l	ı.	ı	l	l	ı	1	
3. Heat losses		·			NI a t A a		11 -1	_	A 37.1.1		1 -1		A X I
ELEMENT	Gros area	_	Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²-l		A X k kJ/K
Doors		` ,			2	x	1.4		2.8	,			(26)
Windows					8.651	x1	/[1/( 1.4 )+	0.04] =	11.47	=			(27)
Floor					54.59	_	0.12		6.55152			$\neg \vdash$	(28)
Walls Type1	17.5		8.65		8.93	=	0.12		1.34				(29)
Walls Type2						_		=		북 남		_	
• •	29.2		2		27.26	=	0.14	= [	3.86				(29)
Total area of el		•	effootivo vii	ndou II v	101.4		y formula 1	1/1/1/11	·a) · 0 041 a	a airan in	naraaranl	h 2.0	(31)
* for windows and ** include the area						atea using	j tormula 1	/[(1/ <b>U-</b> vail	ie)+0.04] a	is given in	paragrapr	7 3.2	
Fabric heat los	s, W/K =	= S (A x	U)				(26)(30)	) + (32) =				26.02	(33)
Heat capacity (	Cm = S(	Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	4601.43	3 (34)
Thermal mass	•	•	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For design assess	ments wh	ere the de	tails of the	construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		``
can be used instea	ad of a de	tailed calc	ulation.										
Thermal bridge	•	•			•	<						11.14	(36)
if details of therma		are not kn	own (36) =	= 0.05 x (3	11)			(00)	(00)				
Total fabric hea								, ,	(36) =			37.16	(37)
Ventilation hea			·						= 0.33 × (		i e	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	(00)
(38)m= 11.39	11.26	11.13	10.48	10.35	9.69	9.69	9.56	9.95	10.35	10.61	10.87	J	(38)
Heat transfer c	oefficier	nt, W/K	·			•		(39)m	= (37) + (3	38)m		,	
(39)m= 48.56	48.43	48.3	47.64	47.51	46.86	46.86	46.72	47.12	47.51	47.77	48.03		
									Average =	Sum(39) <sub>1</sub>	12 /12=	47.61	(39)

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.89	0.89	0.88	0.87	0.87	0.86	0.86	0.86	0.86	0.87	0.88	0.88		
	!	!							Average =	Sum(40) <sub>1</sub>	12 /12=	0.87	(40)
Number of day	<u> </u>							-					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ar:	
Assumed occurring TFA > 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		83		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the $a$	lwelling is	designed t			se target c		.64		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i								*F		· · ·			
(44)m= 89.8	86.54	83.27	80.01	76.74	73.47	73.47	76.74	80.01	83.27	86.54	89.8		
									Total = Su	m(44) <sub>112</sub> =		979.65	(44)
Energy content of	f hot water	used - cal	culated mo	onthly = $4$ .	190 x Vd,r	n x nm x C	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 133.17	116.47	120.19	104.79	100.54	86.76	80.4	92.26	93.36	108.8	118.76	128.97		_
If instantaneous v	vator hoati	na at noint	of use (no	n hot water	ctoraga)	enter∩in	hoves (16		Total = Su	m(45) <sub>112</sub> =	= [	1284.48	(45)
			,	ı	,.		, ,	, , , I	1000	1,7,04	40.05		(46)
(46)m= 19.98 Water storage	17.47 loss:	18.03	15.72	15.08	13.01	12.06	13.84	14	16.32	17.81	19.35		(46)
Storage volum		) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	neating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage													
a) If manufact				or is kno	wn (kWł	n/day):					0		(48)
Temperature f											0		(49)
Energy lost from		•			orio not		(48) x (49)	) =		1	10		(50)
<ul><li>b) If manufact</li><li>Hot water stor</li></ul>			-							0	02		(51)
If community h	•			(	,,,,,,	-77				0.	02		(0.7)
Volume factor	from Ta	ble 2a								1.	03		(52)
Temperature f	actor fro	m Table	2b							0	.6		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter (50) or	(54) in (	55)								1.	03		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	(55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	$m = \overline{(56)m}$	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	хН	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit	loss (ar	nnual) fro	m Table	- <del></del>							0		(58)
Primary circuit	,	,			59)m = (	(58) ÷ 36	65 × (41)	m					
(modified by	/ factor f	rom Tab	le H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss calculated for each month $(61)$ m = $(60) \div 365 \times (41)$ m														
(61)m= 0	0	0	0	0	00) +	0 0	)   0		0	0	T 0	0	1	(61)
Total heat requi		-											(50)m + (61)m	(- /
(62)m= 188.45	166.4	175.47	158.28	155.82	140.2		147	_	146.85	164.08	<del>`                                    </del>	184.25	(59)111 + (61)111	(62)
Solar DHW input ca							<u> </u>						l	(- /
(add additional										COLLING	mon to wat	or modung)		
(63)m= 0	0	0	0	0	0	0	0	_	0	0	0	0	1	(63)
Output from wat	ter heat	ter									-1		ı	
(64)m= 188.45	166.4	175.47	158.28	155.82	140.2	135.67	147.	.53	146.85	164.08	172.26	184.25	1	
	•							Outp	out from wa	ater heat	er (annual)₁	12	1935.32	(64)
Heat gains from	water l	heating,	kWh/mo	onth 0.2	3.0] ` č	85 × (45)m	n + (6	1)m	n] + 0.8 x	: [(46)n	n + (57)m	+ (59)m	 . ]	_
(65)m= 88.5	78.67	84.18	77.64	77.65	71.64	70.95	74.	.9	73.84	80.4	82.28	87.1	]	(65)
include (57)m	in calc	ulation o	of (65)m	only if c	ylinde	is in the	dwell	ing (	or hot w	ater is	from com	munity h	neating	
5. Internal gain	ns (see	Table 5	and 5a	):	-									
Metabolic gains	(Table	5), Wat	ts											
Jan	Feb	Mar	Apr	May	Jur	Jul	Aı	ug	Sep	Oct	Nov	Dec		
(66)m= 91.28	91.28	91.28	91.28	91.28	91.28	91.28	91.2	28	91.28	91.28	91.28	91.28		(66)
Lighting gains (	calculat	ed in Ap	pendix	L, equat	ion L9	or L9a), a	lso s	ee 7	Table 5		-			
(67)m= 14.83	13.17	10.71	8.11	6.06	5.12	5.53	7.1	9	9.65	12.25	14.3	15.24		(67)
Appliances gain	ns (calcu	ulated in	Append	dix L, eq	uation	L13 or L1	3a), a	also	see Tal	ole 5	-	-		
(68)m= 159.14	160.8	156.63	147.77	136.59	126.0	3 119.06	117.	.41	121.57	130.43	141.61	152.12		(68)
Cooking gains (	calcula	ted in A	opendix	L, equat	ion L1	5 or L15a	), als	o se	e Table	5	•			
(69)m= 32.13	32.13	32.13	32.13	32.13	32.13	32.13	32.	13	32.13	32.13	32.13	32.13		(69)
Pumps and fans	s gains	(Table 5	āa)								-			
(70)m= 0	0	0	0	0	0	0	0		0	0	0	0		(70)
Losses e.g. eva	poratio	n (negat	ive valu	es) (Tab	le 5)	_					•	•		
(71)m= -73.02	-73.02	-73.02	-73.02	-73.02	-73.0	-73.02	-73.	.02	-73.02	-73.02	-73.02	-73.02		(71)
Water heating g	gains (T	able 5)				-					-	-		
(72)m= 118.95	117.07	113.15	107.83	104.37	99.5	95.37	100	.67	102.55	108.06	114.28	117.08		(72)
Total internal g	gains =				(6	66)m + (67)n	n + (68	3)m +	- (69)m + (	70)m + (	71)m + (72)	)m		
(73)m= 343.31	341.42	330.88	314.09	297.41	281.0	270.34	275	.65	284.15	301.12	320.58	334.82		(73)
6. Solar gains:														
Solar gains are ca	llculated ι	using sola	r flux from	Table 6a	and ass	ociated equa	ations 1	to co	nvert to th	e applica	able orientat	tion.		
Orientation: Ad		actor	Area			lux		_	g_ abla Ch	_	FF		Gains	
	able 6d		m²		'	able 6a			able 6b		Table 6c		(W)	-
Southeast <sub>0.9x</sub>	0.77	X	8.6	55	x	36.79	X		0.63	x	0.7	=	97.28	(77)
Southeast <sub>0.9x</sub>	0.77	Х	8.6	55	X	62.67	X		0.63	x	0.7	=	165.7	(77)
Southeast <sub>0.9x</sub>	0.77	x	8.6	55	x	85.75	X		0.63	x [	0.7	=	226.72	(77)
Southeast <sub>0.9x</sub>	0.77	X	8.6	65	x	106.25	X		0.63	x	0.7	=	280.91	(77)
Southeast <sub>0.9x</sub>	0.77	X	8.6	65	X	119.01	X		0.63	x	0.7	=	314.65	(77)

Southeast 0.9x 0.77	X	8.6	55	x [	118.15	X		0.63	х	0.7	=	312.37	(77)
Southeast 0.9x 0.77	x	8.6	55	× [	113.91	x		0.63	x	0.7	=	301.16	(77)
Southeast 0.9x 0.77	х	8.6	55	x	104.39	X		0.63	x	0.7	=	275.99	(77)
Southeast 0.9x 0.77	х	8.6	55	x [	92.85	X		0.63	x	0.7	=	245.49	(77)
Southeast 0.9x 0.77	х	8.6	55	x	69.27	X		0.63	x	0.7	=	183.13	(77)
Southeast 0.9x 0.77	x	8.6	55	x	44.07	x		0.63	x	0.7	=	116.52	(77)
Southeast 0.9x 0.77	x	8.6	55	x	31.49	x		0.63	×	0.7	=	83.25	(77)
				_		_							
Solar gains in watts, c	alculated	for eacl	n month			(83)m	n = Si	um(74)m .	(82)m				
(83)m= 97.28 165.7	226.72	280.91	314.65	<u> </u>	2.37 301.16	275	5.99	245.49	183.13	116.52	83.25		(83)
Total gains – internal		<u> </u>	, ,	·	<del></del>							1	
(84)m= 440.59 507.12	557.6	595.01	612.05	59:	3.46 571.5	551	.64	529.64	484.26	437.09	418.07		(84)
7. Mean internal tem	perature	(heating	season	)									
Temperature during I	neating p	eriods ir	the livi	ng a	rea from Ta	ble 9	, Th	1 (°C)				21	(85)
Utilisation factor for g	ains for I	iving are	ea, h1,m	(se	e Table 9a)							1	_
Jan Feb	Mar	Apr	May	J	lun Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 0.92 0.89	0.83	0.75	0.62	0.	47 0.35	0.3	38	0.55	0.77	0.89	0.93		(86)
Mean internal tempe	rature in I	iving are	ea T1 (fo	ollov	v steps 3 to	7 in T	Γable	e 9c)					
(87)m= 19.55 19.81	20.15	20.52	20.78	20	0.93 20.98	20.	.98	20.89	20.55	20	19.49		(87)
Temperature during I	neating p	eriods ir	rest of	dwe	elling from Ta	able 9	9, Tł	n2 (°C)		-	-		
(88)m= 20.18 20.18	20.18	20.19	20.19	T	0.2 20.2	20.		20.2	20.19	20.19	20.18		(88)
Utilisation factor for g	iains for r	est of d	welling	h2 r	n (see Table	9a)							
(89)m= 0.91 0.88	0.82	0.72	0.58	T	42 0.29	0.3	32	0.5	0.73	0.87	0.92		(89)
Mean internal tempe	roturo in t	the reet	of dwall	ina -	T2 (fallow et	200.2	· +o 7	7 in Tabl	0.00)				
(90)m= 18.24 18.62	19.09	19.6	19.95	T	0.14 20.19	20.		20.09	19.66	18.9	18.17		(90)
(65)	1					1				ng area ÷ (4		0.48	(91)
Managiatawaltawa		41	-ll	II:	) fl	. /4	£I	۸) <b>T</b> O					` ′
Mean internal tempe (92)m= 18.86 19.19	19.6	20.04	20.35	Ť	0.52  20.57	+ (1		A) × 12 20.47	20.09	19.42	18.8		(92)
Apply adjustment to t										13.42	10.0		(02)
(93)m= 18.86 19.19	19.6	20.04	20.35	1	0.52 20.57	20.		20.47	20.09	19.42	18.8		(93)
8. Space heating req	uirement												
Set Ti to the mean in		nperatur	e obtair	ned a	at step 11 of	Tabl	le 9b	o, so tha	t Ti,m=(	76)m an	d re-calc	culate	
the utilisation factor f	or gains u	using Ta	ble 9a							•			
Jan Feb	Mar	Apr	May	J	lun Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation factor for g					1	1	1			1	1	1	(0.4)
(94)m= 0.9 0.86	0.8	0.71	0.59	0.	44 0.32	0.3	34	0.52	0.73	0.86	0.91		(94)
Useful gains, hmGm	<del> </del>	<u> </u>		00	20 400 00	1 400		070.00	252.45	274.00	270.50	1	(05)
(95)m= 395.4 434.98  Monthly average exte	446.7	423.95	362.76	<u> </u>	3.39 182.22	189	ყ.გ	276.03	353.45	374.09	379.59		(95)
(96)m= 4.3 4.9	6.5	8.9	11.7	_	4.6 16.6	16	<sub>6.4</sub>	14.1	10.6	7.1	4.2		(96)
Heat loss rate for me	1 1			<u> </u>						L	L		(/
(97)m= 707.13 691.94	632.6	530.72	410.86	_	7.35 185.87	194	<del></del> _	300.09	450.69	588.67	701.35		(97)
Space heating requir						24 x	<u> </u> [(97)	m – (95	)m] x (4	1)m	ļ	I	
(98)m= 231.93 172.68	138.31	76.87	35.79		0 0			0	72.35	154.5	239.39		
						<del></del>						İ	

т	otal per year (kWh/year) = Sum(98) <sub>15,912</sub> =	1121.82	(98)
Space heating requirement in kWh/m²/year		20.55	(99)
9b. Energy requirements – Community heating scheme			
This part is used for space heating, space cooling or water heating pro- Fraction of space heat from secondary/supplementary heating (Table		0	(301)
Fraction of space heat from community system 1 – (301) =	, [	1	(302)
The community scheme may obtain heat from several sources. The procedure allows for	ا or CHP and up to four other heat sources; th	ne latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See App			7(2020)
Fraction of heat from Community boilers  Fraction of total space heat from Community boilers	(302) x (303a) =	1	(303a) (304a)
Factor for control and charging method (Table 4c(3)) for community he		1	(305)
	eating system		=
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating Annual space heating requirement	Ī	1121.82	<u></u>
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1177.91	(307a)
Efficiency of secondary/supplementary heating system in % (from Tab	ole 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			_
Annual water heating requirement		1935.32	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2032.09	(310a)
Electricity used for heat distribution 0.	01 × [(307a)(307e) + (310a)(310e)] =	32.1	(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 outside	le [	189.41	(330a)
warm air heating system fans	İ	0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	189.41	(331)
Energy for lighting (calculated in Appendix L)		261.91	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-551.64	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)
12b. CO2 Emissions – Community heating scheme			
	nergy Emission factor   Wh/year kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)  Efficiency of heat source 1 (%)  If there is CHP using two fu	els repeat (363) to (366) for the second fuel	94	(367a)
CO2 associated with heat source 1 [(307b)+(310b)]	x 100 ÷ (367b) x 0.22 =	737.62	(367)
Electrical energy for heat distribution [(313) x	0.52 =	16.66	(372)

Total CO2 associated with community systems	(363)(366) + (368)(372)	=	754.28	(373)
CO2 associated with space heating (secondary)	(309) x	0 =	0	(374)
CO2 associated with water from immersion heater of	or instantaneous heater (312) x 0.	.22 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		754.28	(376)
CO2 associated with electricity for pumps and fans	within dwelling (331)) x	.52 =	98.31	(378)
CO2 associated with electricity for lighting	(332))) x	.52 =	135.93	(379)
Energy saving/generation technologies (333) to (334) ltem 1	4) as applicable 0.52	x 0.01 =	-286.3	(380)
Total CO2, kg/year sum of (376).	(382) =		702.21	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =			12.86	(384)
El rating (section 14)			90.55	(385)

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

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

Property Details: Plot 17

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: No Number of storeys: 1

Front of dwelling faces: North East

Overshading: Average or unknown

Overhangs: None

Thermal mass parameter: Indicative Value Low

**Night ventilation:** False

Blinds, curtains, shutters:

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

Overheating Details:

Summer ventilation heat loss coefficient: 180.17 (P1)

Transmission heat loss coefficient: 37.2

Summer heat loss coefficient: 217.33 (P2)

Overhangs:

Orientation: Ratio: Z\_overhangs:

South East (SE) 0 1

Solar shading:

Orientation:Z blinds:Solar access:Overhangs:Z summer:South East (SE)10.910.9

Solar gains:

Orientation FF Area Flux Shading Gains  $g_{-}$ 119.92 0.9 370.59 South East (SE) 0.9 x0.63 8.65 0.7 **Total** 370.59 (P3/P4)

Internal gains:

June July **August** 378.16 Internal gains 384.77 371.18 773.79 741.77 (P5) Total summer gains 723.87 Summer gain/loss ratio 3.56 3.41 3.33 (P6) Mean summer external temperature (Thames valley) 16 17.9 17.8 Thermal mass temperature increment 1.3 1.3 1.3 (P7) Threshold temperature 20.86 22.61 22.43 Likelihood of high internal temperature Slight Medium Medium

Assessment of likelihood of high internal temperature: Medium

		l lea	er Details:						
Access an Names	Zabid Ashrof	USC		- M	<b>b</b> a		CTDO	004000	
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	<b>)</b>	Stroma Softwa					001082 on: 1.0.5.9	
Contware Hame.	Ottoma 1 0/11 2012		rty Address:				V 01010	7.0.0.0	
Address :		·							
1. Overall dwelling dime	ensions:								
Crayed flags		<i>,</i>	Area(m²)	<i>(4.</i> )		ight(m)	<b>1</b> 1	Volume(m <sup>3</sup>	<u>-</u>
Ground floor				(1a) x	2	2.5	(2a) =	136.49	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)	+(1n)	54.6	(4)					
Dwelling volume				(3a)+(3b)	)+(3c)+(3c	d)+(3e)+	.(3n) =	136.49	(5)
2. Ventilation rate:	main	oondom.	other		40401			m³ nor hou	
	heating he	condary eating	other	, –	total			m³ per hou	_
Number of chimneys	0 +	0 +	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	<b>X</b> '	10 =	20	(7a)
Number of passive vents	<b>;</b>				0	x '	10 =	0	(7b)
Number of flueless gas fi	ires			Ī	0	X 4	40 =	0	(7c)
				_					
							Air ch	nanges per ho	our —
Infiltration due to chimne	•				20		÷ (5) =	0.15	(8)
Number of storeys in the	peen carried out or is intended he dwelling (ns)	a, proceea to (1	7), otnerwise o	ontinue tr	om (9) to (	(16)		0	(9)
Additional infiltration	ine arreining (ine)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber fr	ame or 0.35	for masonr	y constr	uction			0	(11)
	resent, use the value corresp	onding to the g	reater wall are	a (after					
deducting areas of openii	ngs);	ed) or 0.1 (se	ealed), else	enter 0				0	(12)
If no draught lobby, en		, a, o. o (o.	<i>saida</i> ), <i>didd</i>	011101 0				0	(13)
• •	s and doors draught str	ipped						0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	2) + (13)	+ (15) =		0	(16)
•	q50, expressed in cubi	•	•	•	etre of e	envelope	area	3	(17)
If based on air permeabil	•				. , .	,		0.3	(18)
Number of sides sheltere	es if a pressurisation test has	been done or a	a degree air pei	meability	is being u	sea	1	3	(19)
Shelter factor	,		(20) = 1 -	0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporate	ting shelter factor		(21) = (18)	x (20) =				0.23	(21)
Infiltration rate modified f	or monthly wind speed						'		
Jan Feb	Mar Apr May	Jun Ju	ıl Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7							_	
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2.	2)m ∸ 4								
	1.23 1.1 1.08	0.95 0.9	0.92	1	1.08	1.12	1.18		
					L			J	

Adjusted infiltr	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m				_	
0.29	0.29	0.28	0.25	0.25	0.22	0.22	0.21	0.23	0.25	0.26	0.27	]	
<i>Calcul<mark>ate effe</mark></i> If mechanic		_	rate for t	he appli	cable ca	se	-	-	-	-	-	-	
If exhaust air h			endix N. (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) . othe	rwise (23b	) = (23a)			0	()
If balanced wit									, (200)			0	
a) If balance		•	•	J		`		,	Dh\m ı (	23h) v [	1 (220)	0 : 1001	(
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	] — 100j ]	(:
b) If balance					<u> </u>				<u> </u>			J	·
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(
c) If whole h					<u> </u>		<u> </u>					J	·
,	n < 0.5 ×				•				5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(:
d) If natural	ventilatio	n or wh	ole hous	e positiv	/e input	ventilatio	n from l	oft				1	
,	n = 1, the				•				0.5]				
24d)m= 0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54	]	(
Effective air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in box	(25)				-	
25)m= 0.54	0.54	0.54	0.53	0.53	0.52	0.52	0.52	0.53	0.53	0.53	0.54	]	(
3. Heat losse	e and he	at loce i	naramete	or.								_	
LEMENT	Gros		Openin		Net Ar	<b>A</b> 2	U-valı	IA	AXU		k-value	۵	ΑΧk
LEWEN	area		m		A ,r		W/m2		(W/	K)	kJ/m²-	-	kJ/K
oors					2	х	1.4	_ = [	2.8				(:
/indows					8.651	x1.	/[1/( 1.4 )+	0.04] =	11.47				(:
loor					54.59	6 x	0.12	i	6.5515	<u></u>			(
/alls Type1	17.5	58	8.65		8.93	x	0.15	<u> </u>	1.34	<b>=</b>		<b>7</b> F	(
/alls Type2	29.2	26	2	=	27.26		0.14	<b>=</b>	3.86	<b>=</b>		<b>=</b>	(
otal area of e	<u> </u>				101.4	=	0		0.00				) ` (;
for windows and		•	effective wi	ndow U-va			ı formula 1	/[(1/U-valu	ie)+0.041 a	as aiven in	paragrapl	h 3.2	· ·
include the are								2(	, ]	<b>J</b>	7		
abric heat lo	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				26.0	2
eat capacity	Cm = S(	(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	4601	43
hermal mass	parame	ter (TMF	= Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(:
or design asses				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
an be used inste					P I	,							
hermal bridg	•	,		• .	•	<b>(</b>						11.1	4
details of therm otal fabric he		are not kn	10WN (36) =	= 0.05 X (3	11)			(33) +	(36) =			27.1	6 (
entilation he		alculated	1 monthly	ı					$= 0.33 \times ($	25\m v (5)	١	37.1	0 (
Jan	Feb	Mar		May	Jun	Jul	Διια	Sep	Oct	Nov	Dec	1	
8)m= 24.45	24.38	24.31	Apr 23.96	23.9	23.59	23.59	Aug 23.54	23.71	23.9	24.03	24.16	1	(:
,	ļ	<u> </u>	25.90	20.8	25.58	20.08	20.04	<u> </u>		<u> </u>	24.10	]	(
eat transfer	1							<del>- `                                   </del>	= (37) + (	·		1	
(1) c ( C ( C )	I G1 E1	61.47	61.12	61.06	60.76	60.76	60.7	60.87	61.06	61.19	61.33	1	
9)m= 61.62	61.54	01.47	01.12	01.00		00.70		<u> </u>	Average =		<u> </u>	61.1	2 (

at loss para	meter (H	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
m= 1.13	1.13	1.13	1.12	1.12	1.11	1.11	1.11	1.11	1.12	1.12	1.12		
mber of day	e in mor	oth (Tabl	la 1a)		•	•		,	Average =	Sum(40) <sub>1.</sub>	12 /12=	1.12	(4
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
Water heat	ing ener	gy requi	rement:								kWh/yea	ar:	
sumed occu f TFA > 13.9 f TFA £ 13.9	, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)	)2)] + 0.0	0013 x (¯	TFA -13		83		(4.
nual averago duce the annua more that 125	l average	hot water	usage by t	5% if the a	lwelling is	designed t			se target o		.64		(4
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
water usage in	litres per	day for ea	nch month	Vd,m = fa	ctor from T	Table 1c x	(43)						
m= 89.8	86.54	83.27	80.01	76.74	73.47	73.47	76.74	80.01	83.27	86.54	89.8		<b></b> ,
ergy content of	hot water	used - cal	culated mo	onthly = $4$ .	190 x Vd,r	n x nm x D	0Tm / 3600			ım(44) <sub>112</sub> = ables 1b, 1		979.65	(4
m= 133.17	116.47	120.19	104.79	100.54	86.76	80.4	92.26	93.36	108.8	118.76	128.97		
									I Total = Su	ım(45) <sub>112</sub> =	=	1284.48	(4
stantaneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46 <sub>,</sub>	) to (61)					
m= 0	0	0	0	0	0	0	0	0	0	0	0		(4
iter storage orage volum		includin	n anv so	olar or W	/WHRS	storage	within sa	ame ves	ച		0		(4
ommunity h	, ,		•			_					<u> </u>		
nerwise if no	_			_				ers) ente	er '0' in (	(47)			
iter storage													
If manufacti	urer's de	eclared l	oss facto	or is kno	wn (kWh	n/day):					0		(-
mperature fa	actor fro	m Table	2b								0		(-
ergy lost from		_	-				(48) x (49)	) =			0		(
If manufactors t water stora			•										(
ommunity h	-			C Z (KVV	ii/iiti e/ua	iy <i>)</i>					0		(:
ume factor	•										0		(
mperature fa	actor fro	m Table	2b							-	0		(
ergy lost fro	m water	storage	. kWh/ve	ear			(47) x (51)	) x (52) x (	53) =		0		(
ter (50) or (		-	, .,							-	0		(:
iter storage	loss cal	culated f	or each	month			((56)m = (	55) × (41):	m				
m= 0	0	0	0	0	0	0	0	0	0	0	0		(
linder contains		-	-			_						Н	
m= 0	0	0	0	0	0	0	0	0	0	0	0		(!
mary circuit	loss (an	nual) fro	m Table	3							0		( !
	(	, -											
mary circuit	loss cal	culated f	or each	month (	59)m = (	(58) ÷ 36	55 × (41)	m					
mary circuit modified by				,	•	. ,	, ,		r thermo	ostat)			

Combi loss ca	alculated	for each	month (	(61)m =	(60) ÷ '	365 🗴 (41	)m							
(61)m= 0	0	0	0	0	0	0	)   0	)	0	0	0	0	]	(61)
	uired for	water h	eating ca	alculated	l for ea	 ch month	(62)	 m =	0.85 × (	(45)m +	(46)m +	(57)m +	י - (59)m + (61)m	
(62)m= 113.2	99	102.16	89.07	85.46	73.75	68.34	78.		79.36	92.48	100.95	109.63	1	(62)
Solar DHW input	: calculated	using App	endix G o	r Appendix	H (nega	tive quantit	y) (ent	er '0'	if no sola	r contribu	tion to wate	er heating)	)	
(add additiona	al lines if	FGHRS	and/or \	WWHRS	applie	s, see Ap	pend	dix C	3)					
(63)m= 0	0	0	0	0	0	0	0	)	0	0	0	0		(63)
Output from v	vater hea	ter	-				-			-			_	
(64)m= 113.2	99	102.16	89.07	85.46	73.75	68.34	78.	42	79.36	92.48	100.95	109.63	]	_
								Outp	out from wa	ater heate	er (annual)	112	1091.81	(64)
Heat gains fro	om water	heating,	kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	ı + (6	(1)m	n] + 0.8 x	([(46)m	+ (57)m	+ (59)m	<u> ]</u>	
(65)m= 28.3	24.75	25.54	22.27	21.37	18.44	17.08	19.	.6	19.84	23.12	25.24	27.41		(65)
include (57	)m in cald	culation of	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal g	jains (see	Table 5	and 5a	):										
Metabolic gai	ns (Table	5), Wat	ts											
Jan	Feb	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec	]	
(66)m= 91.28	91.28	91.28	91.28	91.28	91.28	91.28	91.	28	91.28	91.28	91.28	91.28	]	(66)
Lighting gains	s (calcula	ted in Ap	pendix	L, equat	ion L9	or L9a), a	lso s	ee -	Table 5			_	_	
(67)m= 14.83	13.17	10.71	8.11	6.06	5.12	5.53	7.1	19	9.65	12.25	14.3	15.24	]	(67)
Appliances ga	ains (calc	ulated ir	Append	dix L, eq	uation	L13 or L1	3a), a	also	see Tal	ble 5			-	
(68)m= 159.14	160.8	156.63	147.77	136.59	126.08	119.06	117	.41	121.57	130.43	141.61	152.12	]	(68)
Cooking gain	s (calcula	ted in A	ppendix	L, equa	ion L1	or L15a	), als	o se	e Table	5			-	
(69)m= 32.13	32.13	32.13	32.13	32.13	32.13	32.13	32.	13	32.13	32.13	32.13	32.13	1	(69)
Pumps and fa	ans gains	(Table 5	<del></del> ба)										-	
(70)m= 0	0	0	0	0	0	0	0	)	0	0	0	0	]	(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)					=		-	_	
(71)m= -73.02	-73.02	-73.02	-73.02	-73.02	-73.02	-73.02	-73.	.02	-73.02	-73.02	-73.02	-73.02	]	(71)
Water heating	g gains (T	able 5)	-	-	-					-	-	-	_	
(72)m= 38.04	36.83	34.33	30.93	28.72	25.61	22.96	26.	35	27.55	31.08	35.05	36.84	]	(72)
Total interna	l gains =				(6	6)m + (67)n	า + (68	3)m +	- (69)m + (	(70)m + (7	71)m + (72)	)m	-	
(73)m= 262.39	261.18	252.06	237.19	221.75	207.19	197.93	201	.33	209.15	224.14	241.34	254.58	]	(73)
6. Solar gair	ns:													
Solar gains are	calculated	using sola	r flux from	Table 6a	and asso	ciated equa	ations	to co	nvert to th	e applica	ble orienta	tion.		
Orientation:			Area			ux able 6a		_	g_ able 6b	-	FF		Gains	
	Table 6d		m²			able ba	,		able ob	_ '	able 6c		(W)	,
Southeast 0.9x		X	8.6	S5	x	36.79	X		0.63	x	0.7	=	97.28	(77)
Southeast 0.9x		X	8.6	S5	x	62.67	X		0.63	x	0.7	=	165.7	(77)
Southeast 0.9x	<u> </u>	X	8.6	S5	x	85.75	X		0.63	x	0.7	=	226.72	(77)
Southeast 0.9x		Х	8.6	S5	x	106.25	X	<u> </u>	0.63	x	0.7	=	280.91	(77)
Southeast 0.9x	0.77	X	8.6	35	X	119.01	X		0.63	X	0.7	=	314.65	(77)

Southeast 0.9x	0.77	X	8.6	5	x	11	18.15	x		0.63	x	0.7	=	312.37	(77)
Southeast 0.9x	0.77	X	8.6	5	x	11	13.91	x		0.63	x	0.7	=	301.16	(77)
Southeast 0.9x	0.77	X	8.6	5	x	10	)4.39	x		0.63	x	0.7	=	275.99	(77)
Southeast 0.9x	0.77	X	8.6	5	x [	9:	2.85	x		0.63	x	0.7	=	245.49	(77)
Southeast 0.9x	0.77	X	8.6	5	x	6	9.27	x		0.63	×	0.7	_ =	183.13	(77)
Southeast 0.9x	0.77	X	8.6	5	х	4	4.07	x		0.63	×	0.7	-	116.52	(77)
Southeast 0.9x	0.77	X	8.6	5	x	3	1.49	x		0.63	x [	0.7	=	83.25	(77)
					-			-							
Solar gains in w	atts, ca	lculated	for each	n month				(83)m	n = Si	um(74)m .	(82)m	_	_		
(83)m= 97.28	165.7	226.72	280.91	314.65		2.37	301.16	275	.99	245.49	183.13	116.52	83.25		(83)
Total gains – int	ternal ar	nd solar	<del>`                                    </del>	(73)m	<u>`</u>	<del></del>	watts							•	
(84)m= 359.67	426.88	478.78	518.11	536.4	51	9.56	499.09	477	.32	454.64	407.27	357.86	337.83		(84)
7. Mean interna	al temp	erature	(heating	season	)										
Temperature d	luring he	eating p	eriods ir	the livi	ng a	area f	rom Tab	ole 9	, Th	1 (°C)				21	(85)
Utilisation factor	or for ga	ins for I	iving are	a, h1,m	(se	ee Ta	ble 9a)								_
Jan	Feb	Mar	Apr	May	,	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m= 0.96	0.94	0.9	0.84	0.75	0	.62	0.48	0.5	52	0.7	0.86	0.94	0.96		(86)
Mean internal	tempera	ature in I	iving are	ea T1 (fo	ollo	w step	os 3 to 7	7 in T	able	e 9c)					
(87)m= 18.74	19.05	19.48	19.99	20.45	20	0.77	20.91	20.	89	20.66	20.06	19.3	18.67		(87)
Temperature d	lurina he	eating p	eriods ir	rest of	dw	ellina	from Ta	hle 9	 9 Th	n2 (°C)		•	•	•	
(88)m= 19.98	19.98	19.98	19.98	19.99	_	9.99	19.99	19.		19.99	19.99	19.98	19.98		(88)
· · · <u> </u>	or for an	ing for r	oot of di	allina	Ь Ь	l	o Toblo	00)							
Utilisation factors (89)m= 0.95	0.93	0.89	0.82	0.7	_	.55 S	0.39	9a) 0.4	12	0.64	0.84	0.93	0.96		(89)
` '												0.00	0.00		(00)
Mean internal t		T			Ť	Ť		<del>i                                     </del>				T 40.40	47.00	1	(90)
(90)m= 17.92	18.22	18.64	19.14	19.56		9.85	19.95	19.	94	19.76	19.22	18.48	17.86	0.40	¬``
										'	LA - LIVI	ng area ÷ (4	<del>-</del> )	0.48	(91)
Mean internal t	<del></del>	<del>`</del>			<del>`</del>	<del>"</del>		<del>`</del>						Ī	
(92)m= 18.31	18.62	19.04	19.55	19.98		0.29	20.41	20.		20.19	19.62	18.87	18.25		(92)
Apply adjustme		r			_			1			·	10.07	40.05	1	(02)
(93)m= 18.31	18.62	19.04	19.55	19.98	20	0.29	20.41	20.	39	20.19	19.62	18.87	18.25		(93)
8. Space heati	•		on orotur	o obtoir		ot oto	n 11 of	Tabl	ام ۸	o a tha	t Tim	(76)m on	d ro oole	vulata	
Set Ti to the m the utilisation fa					iea	ai sie	p ii oi	rabi	ie st	o, so ma	t 11,111=	(76)III an	u re-caic	uiale	
Jan	Feb	Mar	Apr	May	Γ	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec		
Utilisation factor	or for ga	ins, hm	:											ı	
(94)m= 0.94	0.91	0.87	0.8	0.7	0	.57	0.43	0.4	16	0.65	0.83	0.91	0.95		(94)
Useful gains, h	mGm ,	W = (94)	)m x (84	4)m										•	
(95)m= 338.01	388.9	416.31	416.09	378.07	29	5.21	214.42	221	.06	295.11	336.03	327.31	320.03		(95)
Monthly average				from T	able	8 =			-					Ī	
(96)m= 4.3	4.9	6.5	8.9	11.7	<u> </u>	4.6	16.6	16		14.1	10.6	7.1	4.2		(96)
Heat loss rate					_		- ,	<del></del>	_		Ī	<b></b>	001 - 1	Ī	(07)
` '	844.14	771.03	650.81	505.83		5.55	231.47	242		370.61	550.72	720.13	861.34		(97)
Space heating	require 305.92	263.91		95.06	/vn/	mont 0	h = 0.02	24 x [		m – (95 <sub>0</sub>		11)m 282.83	402.72	Ī	
(98)m= 390.98	505.82	203.91	168.99	30.00	<u> </u>	U	U		<u>'</u>	U	159.73	202.03	402.73		

								Tota	l per year	(kWh/yeaı	r) = Sum(9	08)15,912 =	2070.16	(98)
Space	e heating	g require	ement in	kWh/m²	<sup>2</sup> /year								37.92	(99)
8c. Sp	oace co	oling req	uiremer	nt										
Calcu	lated for	r June, J	July and	August.	See Tal	ole 10b					_			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	loss rate	Lm (ca	lculated	using 25	5°C inter	nal temp	erature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	571.12	449.61	461.33	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm									-		
(101)m=	0	0	0	0	0	0.79	0.84	0.83	0	0	0	0		(101)
Usefu	ıl loss, h	mLm (V	/atts) = (	(100)m x	(101)m									
(102)m=	0	0	0	0	0	448.41	379.67	381.54	0	0	0	0		(102)
Gains	(solar g	gains ca	lculated	for appli	cable we	eather re	gion, se	e Table	10)		•	•		
(103)m=	0	0	0	0	0	675.98	650.78	626.43	0	0	0	0		(103)
						lwelling,	continu	ous ( kW	h = 0.0	24 x [(10	03)m – (	102)m]:	x (41)m	
set (1	04)m to	zero if (	104)m <	3 × (98	)m									
(104)m=	0	0	0	0	0	163.85	201.71	182.2	0	0	0	0		
										= Sum(	'	=	547.76	(104)
	fraction								f C =	cooled	area ÷ (4	4) =	1	(105)
ı			able 10b	í –				1			ı	<u> </u>	I	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
					(404)	(40=)	(400)		Total	l = Sum(	(104)	=	0	(106)
· .				month =				1		l _	Ι -	Γ -	1	
(107)m=	0	0	0	0	0	40.96	50.43	45.55	0	0	0	0		_
									Total	= Sum(	107)	=	136.94	(107)
Space	cooling	requirer	ment in k	kWh/m²/y	/ear				(107)	$\div$ (4) =			2.51	(108)
8f. Fab	ric Ener	gy Effici	ency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabrio	c Energy	/ Efficier	псу						(99)	+ (108) =	=		40.43	(109)

#### **SAP Input**

Property Details: Plot 17

Address:

Located in: England Region: Thames valley

**UPRN:** 

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

Assessment type: New dwelling design stage

Transaction type:

Tenure type:

Related party disclosure:

Thermal Mass Parameter:

New dwelling
Unknown

No related party
Indicative Value Low

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

PCDF Version: 466

Property description:

Dwelling type: Flat

Detachment:

Year Completed: 2020

Floor Location: Floor area:

Storey height:

Floor 0 54.596 m<sup>2</sup> 2.5 m

Living area: 26.035 m<sup>2</sup> (fraction 0.477)

Front of dwelling faces: North East

Opening types:

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

NE Manufacturer Solid

SE Manufacturer Windows double-glazed Yes

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

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

NECorridor WallNorth East00SEExternal WallSouth East00

Overshading: Average or unknown

Opaque Elements:

Type: Gross area: Openings: Net area: U-value: Ru value: Curtain wall: Kappa: **External Elements External Wall** 17.584 8.65 8.93 0.15 0 False N/A Corridor Wall 29.262 2 27.26 0.15 0.4 False N/A 54.596 N/A **Exposed Floor** 0.12

Internal Elements
Party Elements

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1099

LengthPsi-value4.7950.289E2Other lintels (including other steel lintels)13.20.047E4Jamb17.1910.062E7Party floor between dwellings (in blocks of flats)

#### **SAP Input**

[Approved]	2.725	0.06	E18	Party wall between dwellings
	8.175	0.106	E25	Staggered party wall between dwellings
[Approved]	5.45	0.09	E16	Corner (normal)
[Approved]	2.725	-0.09	E17	Corner (inverted internal area greater than external area)
	17.191	0.284	E20	Exposed floor (normal)
	2.618	0.107	E21	Exposed floor (inverted)
	10.22	0	P3	Intermediate floor between dwellings (in blocks of flats)
	10.22	0.16	P7	Exposed floor (normal)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery

Number of wet rooms: Kitchen + 1

Ductwork: Insulation, rigid

Approved Installation Scheme: True

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

Main heating system:

Main heating system: Community heating schemes

Heat source: Community boilers

heat from boilers – mains gas, heat fraction 1, efficiency 94

Piping>=1991, pre-insulated, low temp, variable flow

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

Boiler interlock: Yes

Main heating Control

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

thermostats

Control code: 2312

Secondary heating system:

Secondary heating system: None

Water heating

Water heating: From main heating system

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

Others:

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

Low energy lights: 100%

Terrain type: Low rise urban / suburban

EPC language: English Wind turbine: No

Photovoltaics: Photovoltaic 1

Installed Peak power: 0.67 Tilt of collector: 30°

Overshading: None or very little Collector Orientation: South West

Assess Zero Carbon Home: No

# **SAP Input**

Stroma Name:   Stroma FSAP 2012   Stroma Number:   STR0001082			User_[	Details:						
## Arca(m²)   Av. Height(m)   Volume(m²)										
Area(m²)			Property	Address	: Plot 17	,				
Area(m²)   Av. Height(m)   Volume(m²)										
Second floor   S4.6   (1a) x   2.5   (2a)   = 136.49   (3a)	1. Overall dwelling dime	ensions:	Λ να	a(m2)		۸۰، ۵۰	iaht/m	`	Valuma/m³	81
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)	Ground floor		Aie		(1a) x			_		<u>`</u>
Dwelling volume	Total floor area TFA – (1	a)+(1h)+(1c)+(1d)+(1e)+ (1	n)		<u> </u>				100.10	(227)
2. Ventilation rate:    main   heating   heating   heating   heating		a)1(10)1(10)1(10)1(10)1(1	'''	54.0	J	V (30) (30	4) 1 (30) 1	(2n) -		<b>7</b>
Number of chimneys					(3a)+(3b	1)+(30)+(30	a)+(3e)+	(311) =	136.49	(5)
Number of chimneys	2. Ventilation rate:	main seconda	rv	other		total			m³ per hou	ır
Number of open flues  0 + 0 + 0 = 0 x20 = 0 (6b)  Number of intermittent fans  0 x10 = 20 (7a)  Number of passive vents  0 x10 = 0 (7b)  Number of flueless gas fires  0 x40 = 0 (7c)   Air changes per hour  Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20 + (5) = 0.15 (8)  If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)  Number of storeys in the dwelling (ns)  Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  If both types of well are present, use the value corresponding to the greater well area (after deducting areas of openings); if equal use 0.35  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0 25 - [0.2 × (14) + 100] = 0 (15)  Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (15)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)  If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Q0 113  Are permeability value, applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Q1 19 - [0.075 × (19)] = 0.78 (20)  Infiltration rate modified for monthly wind speed  Q2 - [0.2] - [0.075 × (19)] = 0.78 (20)  Infiltration rate modified for monthly wind speed  And permeability value applies of the man and an analysis of the man	Number of alligners	heating heating	· -		- 		<u> </u>	, 10 <b>–</b>	-	_
Number of intermittent fans    2	·		ᆜᅟ닏	0	╛╘	0			0	╡` ′
Number of passive vents	·		+	0	」 <u> </u>	0		(20 =	0	(6b)
Number of flueless gas fires    0	Number of intermittent fa	ins				2	· ·	< 10 =	20	(7a)
Air changes per hour	Number of passive vents	3				0	)	c 10 =	0	(7b)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20	Number of flueless gas f	ires				0	)	< 40 =	0	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 20								Air ch	angos nor ha	NIIP.
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)	lafituation due to altique	fluor and form (60) (6b) (	7a\./7b\.	(70)	_					_
Number of storeys in the dwelling (ns)		•			continue fi	_	(16)	÷ (5) =	0.15	(8)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 × (14) $\div$ 100] =  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) =  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) $\div$ 20] + (8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 × (19)] =  0.31  (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			50 to (11),	ourier wide (	oonanao n	0111 (0) 10	(10)		0	(9)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 × (14) ÷ 100] =  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) =  O (15)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 × (19)] =  0.78  (20)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4	Additional infiltration						[(9	9)-1]x0.1 =	0	(10)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0   0 (12)					•	ruction			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) = 0  (16)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 x (19)] = 0.78  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4	• • • • • • • • • • • • • • • • • • • •	, ,	to the grea	iter wall are	a (after					
Percentage of windows and doors draught stripped  Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0.25 - [0.2 \times$	=	= : :	).1 (seal	ed), else	enter 0				0	(12)
Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0.015$ Infiltration rate $(8) \div (10) \div (11) \div (12) \div (13) \div (15) = 0.016$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area $5.017$ If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered $(20) = 1 - [0.075 \times (19)] = 0.78$ Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.31$ Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= $5.1$ $5$ $4.9$ $4.4$ $4.3$ $3.8$ $3.8$ $3.8$ $3.7$ $4$ $4.3$ $4.5$ $4.7$ Wind Factor $(22a)m = (22)m \div 4$	If no draught lobby, en	ter 0.05, else enter 0							0	(13)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ 0.4 (18)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78$ (20)  Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.31$ (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 $(22a)m = (22)m \div 4$	•	s and doors draught stripped							0	(14)
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 $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] = $ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = $ Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7 $(22)m = 5.1  5  4.9  4.4  4.3  3.8  3.8  3.7  4  4.3  4.5  4.7$ Wind Factor $(22a)m = (22)m \div 4$							(4-)		0	= ' '
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] =$ $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ $(21) = (18) \times (20) =$ 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 $(22a)m = (22)m \div 4$										= ' '
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78  (20)$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.31  (21)$ 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 $(22a)m = (22)m \div 4$		• •	•	•	•	etre of e	envelop	e area		=
Number of sides sheltered Shelter factor $ (20) = 1 - [0.075 \times (19)] = 0.78 $ (20) Infiltration rate incorporating shelter factor $ (21) = (18) \times (20) = 0.31 $ (21) Infiltration rate modified for monthly wind speed	•	•				is being u	sed		0.4	(10)
Infiltration rate incorporating shelter factor									3	(19)
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	Shelter factor			(20) = 1 -	[0.075 x (	19)] =			0.78	(20)
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           Monthly average wind speed from Table 7           (22)m=         5.1         5         4.9         4.4         4.3         3.8         3.7         4         4.3         4.5         4.7           Wind Factor (22a)m = (22)m ÷ 4	·			(21) = (18	s) x (20) =				0.31	(21)
Monthly average wind speed from Table 7 (22)m= $\begin{bmatrix} 5.1 & 5 & 4.9 & 4.4 & 4.3 & 3.8 & 3.8 & 3.7 & 4 & 4.3 & 4.5 & 4.7 \end{bmatrix}$ Wind Factor (22a)m = (22)m $\div$ 4		<del></del>	1	1 .	Ι _	T -	1	i _	1	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		1 ' 1 ' 1	Jul	Aug	Sep	Oct	Nov	Dec		
Wind Factor (22a)m = (22)m ÷ 4	<del> </del>	<del> </del>	1	T	1 .	1	1	<u> </u>	1	
	(22)m= 5.1 5	4.9   4.4   4.3   3.8	3.8	3.7	<u> </u>	4.3	4.5	4.7	J	
(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	Wind Factor (22a)m = (2	2)m ÷ 4								
	(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18	]	

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m						
0.39	0.38	0.38	0.34	0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36	]		
Calculate effect		•	rate for t	he appli	cable ca	se	•	•	•	•	•			٦,,,,
If mechanica			andiv N. /O	2h) _ (22c	) Em. (	auation (N	JE)) otho	muiaa (22h	) - (22a)				0	(23a)
If balanced with									) = (23a)				0	(23b)
		-	-	_					Ola ) (	001.)	4 (00)		0	(23c)
a) If balance						<del>- ` `                                 </del>	<del>-                                    </del>	<del>í `</del>	<del>,                                    </del>	<del></del>	<del>``</del>	) ÷ 100] 1		(24a)
(24a)m= 0	0		0	0	0	0	0	0	0	0	0	]		(24a)
b) If balance						<del>-                                    </del>	<del>ÉÉÉ</del>	<del>í `</del>	<del>r ´     `</del>	<del></del>	Ι ,	1		(24b)
(24b)m= 0	0	0	0	0		0	0	0	0	0	0	]		(240)
c) If whole he if (22b)m				•	•				5 v (23h	<b>.</b> )				
(24c)m = 0	0.5 x	0	0	0	0	0	C) = (ZZI)	0	0	0	0	1		(24c)
d) If natural v					<u> </u>			ļ				]		(= 10)
if (22b)m				•	•				0.5]					
(24d)m= 0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	]		(24d)
Effective air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in box	x (25)	•	•	•	•		
(25)m= 0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	]		(25)
3. Heat losses	and be	ot loss r	ooromote	or:				•	•	•	•	-		
ELEMENT	Gros	•	Openin		Net Ar	A2	U-valı	ПΩ	AXU		k-value	۵	ΑX	( k
ELEWIENI	area	_	m		A ,r		W/m2		(W/I	K)	kJ/m².		kJ/l	
Doors					2	х	1		2					(26)
Windows					8.651	x1,	/[1/( 1.4 )+	0.04] =	11.47					(27)
Floor					54.59	6 x	0.13	i	7.09748	<u>=</u> 8 [				(28)
Walls Type1	17.5	8	8.65		8.93	x	0.18	╡┇	1.61	F i		<b>=</b>		] (29)
Walls Type2	29.2		2		27.26	=	0.18	≓ ₌¦	4.91	=		=		(29)
Total area of e					101.4	=	00							(31)
* for windows and		,	effective wi	ndow U-va			ı formula 1	/[(1/U-valu	ıe)+0.041 a	as aiven in	paragrapl	h 3.2		(01)
** include the area		•							., , .	3	7			
Fabric heat los	s, W/K =	= S (A x	U)				(26)(30)	) + (32) =				27	'.08	(33)
Heat capacity (	Cm = S(	Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	460	1.43	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		2	50	(35)
For design assess				construct	ion are no	t known pr	ecisely the	e indicative	e values of	TMP in Ta	able 1f			
can be used instead				ioina An	nandiy l	/								٦,,,,,,
Thermal bridge if details of therma	,	,		• .	•	`						10	.98	(36)
Total fabric hea		ait iiUl KII	- (30 <i>)</i>	- U.UU X (3	1)			(33) +	(36) =			38	3.06	(37)
Ventilation hea		alculated	l monthly	/					= 0.33 × (	(25)m x (5)	)			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]		
(38)m= 25.98	25.84	25.71	25.09	24.98	24.44	24.44	24.34	24.65	24.98	25.21	25.46	1		(38)
Heat transfer of	nefficier	nt W/K		<u> </u>	ı		ı	(39)m	= (37) + (37)	38)m	1	1		
(39)m= 64.04	63.9	63.77	63.15	63.04	62.5	62.5	62.4	62.71	63.04	63.27	63.52	1		
31107	-0.0		L		L		L	<u> </u>	Average =	L	L	63	3.15	(39)
									J	· · · /·				

eat loss para	meter (F	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
))m= 1.17	1.17	1.17	1.16	1.15	1.14	1.14	1.14	1.15	1.15	1.16	1.16		
ımber of day	s in moi	oth (Tah	le 1a)		-				Average =	Sum(40) <sub>1</sub>	12 /12=	1.16	(4
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
. Water heat	ing ener	gy requi	irement:								kWh/yea	ar:	
sumed occu	pancy, I	N								1.	83		(4
if TFA > 13.9	N = 1		[1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13				`
if TFA £ 13.9 Inual averag	•	ater usac	ae in litre	s per da	av Vd.av	erage =	(25 x N)	+ 36		77	7.56		(4
duce the annua	l average	hot water	usage by	5% if the c	lwelling is	designed t			se target o		.50		(
more that 125	litres per p	person per	r day (all w r	ater use, i	hot and co	ld) 							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
t water usage ir			1			1	· <i>'</i>		ı				
)m= 85.31	82.21	79.11	76	72.9	69.8	69.8	72.9	76	79.11	82.21	85.31		<b>—</b> ,
ergy content of	hot water	used - cal	culated mo	onthly = $4$ .	190 x Vd,r	n x nm x D	OTm / 3600			ım(44) <sub>112</sub> = ables 1b, 1		930.67	(4
)m= 126.51	110.65	114.18	99.55	95.52	82.42	76.38	87.64	88.69	103.36	112.83	122.52		
7	110.00	111110	00.00	00.02	02.12	7 0.00	07.01			ım(45) <sub>112</sub> =	<u> </u>	1220.26	(4
nstantaneous w	ater heatii	ng at point	of use (no	hot water	r storage),	enter 0 in	boxes (46		· otal	(10)112	L		`
)m= 0	0	0	0	0	0	0	0	0	0	0	0		(4
ater storage					I.			I.					
orage volum	e (litres)	includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(4
community h	-			_			' '		(0) ! (	(47)			
herwise if no ater storage		not wate	er (triis ir	iciudes i	nstantar	ieous co	ווטם ומוזוי	ers) ente	er o in (	(47)			
If manufact		eclared le	oss facto	or is kno	wn (kWł	n/day):					0		(4
mperature fa					•	• ,					0		(4
ergy lost fro				ear			(48) x (49)	) =			0		` (5
If manufact		_	-		or is not	known:							`
t water stora	_			e 2 (kW	h/litre/da	ıy)					0		(5
community h	•		on 4.3										(5
mperature fa			2h								0		(5 (5
•							(47) v (54)	۱ × (E2) × (	E2\ -				
ergy lost fro nter (50) or (		_	, KVVII/yt	dai			(47) x (51)	) X (32) X (	JJ) =	-	0		( <u>t</u>
ater storage	, ,	•	for each	month			((56)m = (	55) × (41)	m		<u> </u>		(
						ı	· · · · · · · · · · · · · · · · · · ·	1	ı	1 0			(F
)m= 0 ylinder contains	0 dedicate	0 d solar sto	0 rage, (57)ı	0 m = (56)m	0 x [(50) – (	0 H11)] ÷ (5	0 0), else (5	0 7)m = (56)	0 m where (	0 (H11) is fro	0 m Appendix	ίΗ	(5
	0	0	0	0	0	0	0	0	0	0	0		(5
)m= 0					ь								
<i>'</i>	loss (on	nual\ fra	m Table	. 3							o I		(5
mary circuit	•	•			59)m = (	′58) ± 36	65 × (41)	m			0		(5
	loss cal	culated f	for each	month (	•	. ,	, ,		r thermo		0		(ξ

				<b>(- 1)</b>	<b></b>								
Combi loss ca	1			<del>`</del>		<del>- ` ` </del>	<del></del>	<del></del>	<u> </u>	T .	<u> </u>	1	(04)
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(61)
							<del>`</del>		ì	<del>ì ´</del>	<del>`</del>	· (59)m + (61)m	
(62)m= 107.54	94.05	97.05	84.61	81.19	70.06	64.92	74.5		87.86	95.9	104.14	J	(62)
Solar DHW input									ır contribu	tion to wate	er heating)		
(add additiona						<del> </del>	<del>.</del>	<del></del>		_	1	1	
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(63)
Output from w	_									,		1	
(64)m= 107.54	94.05	97.05	84.61	81.19	70.06	64.92	74.5		87.86	95.9	104.14		٦
							C	output from w	ater heate	er (annual)	112	1037.22	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	+ (61	)m] + 0.8	x [(46)m	+ (57)m	+ (59)m	]	
(65)m= 26.88	23.51	24.26	21.15	20.3	17.52	16.23	18.6	2 18.85	21.96	23.98	26.04	]	(65)
include (57)	m in calc	culation o	of (65)m	only if c	ylinder i	s in the	dwellir	ng or hot w	ater is f	rom com	munity h	neating	
5. Internal ga	ains (see	Table 5	and 5a	):									
Metabolic gair	ns (Table	5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	]	
(66)m= 91.28	91.28	91.28	91.28	91.28	91.28	91.28	91.28	8 91.28	91.28	91.28	91.28	1	(66)
Lighting gains	(calculat	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	ılso se	e Table 5	•		•	•	
(67)m= 14.83	13.17	10.71	8.11	6.06	5.12	5.53	7.19	9.65	12.25	14.3	15.24	]	(67)
Appliances ga	ins (calc	ulated in	Append	dix L, eq	uation L	.13 or L1	3a), a	lso see Ta	ble 5			1	
(68)m= 159.14	160.8	156.63	147.77	136.59	126.08	119.06	117.4	ı	130.43	141.61	152.12	1	(68)
Cooking gains	(calcula	ted in A	opendix	L. eguat	ion L15	or L15a	). also	see Table	· 5	·	!	1	
(69)m= 32.13	32.13	32.13	32.13	32.13	32.13	32.13	32.1	_	32.13	32.13	32.13	1	(69)
Pumps and fa	ns dains	(Table 5	[ [a]			<u>I</u>				Į		1	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(70)
Losses e.g. ev	vanoratio	n (negat		<u> </u>	lo 5)	1						J	, ,
(71)m= -73.02	-73.02	-73.02	-73.02	-73.02	-73.02	-73.02	-73.0	2 -73.02	-73.02	-73.02	-73.02	1	(71)
Water heating	<u> </u>		70.02	70.02	70.02	70.02	70.0	2 70.02	70.02	70.02	70.02	J	()
(72)m= 36.13	34.99	32.61	29.38	27.28	24.33	21.81	25.0	3 26.18	29.52	33.3	34.99	1	(72)
			29.30	27.20		<u> </u>	l .	m + (69)m +	l			]	(12)
<b>Total internal</b> (73)m= 260.49		250.34	235.65	220.32	205.91	196.79		<del></del>	·	•	252.74	1	(73)
` '		250.34	233.03	220.32	205.91	196.79	200.0	207.78	222.58	239.59	252.74	J	(13)
6. Solar gains		usina sala	r flux from	Table 6a	and assoc	riated equa	ations to	convert to th	ne annlical	hle orienta	tion		
Orientation:		•	Area		Flu	•	ations to	g_	то аррпоат	FF		Gains	
	Table 6d	actor	m <sup>2</sup>			ble 6a		9_ Table 6b	Т	able 6c		(W)	
Southeast 0.9x	0.77	x	8.6	25	x :	36.79	1 x [	0.63	x [	0.7		97.28	(77)
Southeast 0.9x					-		1 +		<b>≓</b>				](77)
Southeast 0.9x	0.77	×	8.6		-	62.67	」	0.63	×	0.7	=	165.7	_
Southeast 0.9x	0.77	X	8.6		<b>—</b>	85.75	] × <u>[</u> ] , Г	0.63	×	0.7	=	226.72	](77) ] <sub>(77)</sub>
<u>L</u>	0.77	X	8.6	==	<b>-</b>	06.25	]	0.63	X	0.7	=	280.91	(77)
Southeast <sub>0.9x</sub>	0.77	X	8.6	35	x 1	19.01	X	0.63	X	0.7	=	314.65	(77)

Southeast 0.9x	0.77	X	8.6	5	x	118.1	5	x		0.63	x	0.7	=	312.37	(77)
Southeast 0.9x	0.77	X	8.6	5	x $\lceil$	113.9	)1	x		0.63	x	0.7		301.16	(77)
Southeast <sub>0.9x</sub>	0.77	X	8.6	5	x $\lceil$	104.3	9	x		0.63	x	0.7		275.99	(77)
Southeast <sub>0.9x</sub>	0.77	X	8.6	5	x [	92.85	5	x		0.63	×	0.7	=	245.49	(77)
Southeast <sub>0.9x</sub>	0.77	X	8.6	5	x $\lceil$	69.27	7	x		0.63	x	0.7		183.13	(77)
Southeast <sub>0.9x</sub>	0.77	X	8.6	5	x T	44.07	7	x		0.63	x	0.7	=	116.52	(77)
Southeast 0.9x	0.77	X	8.6	5	x [	31.49	9	x		0.63	×	0.7		83.25	(77)
Solar gains in w	atts, ca	lculated	for eacl	n month	_	_		(83)m	ı = Sı	um(74)m .	(82)m	_			
(83)m= 97.28	165.7	226.72	280.91	314.65	312	2.37 30	)1.16	275	.99	245.49	183.13	116.52	83.25		(83)
Total gains – int		nd solar		(73)m ·	+ (83	<del></del>							1	•	
(84)m= 357.77	425.04	477.06	516.56	534.96	518	3.28 49	97.95	47	6	453.26	405.72	356.11	335.99		(84)
7. Mean interna	al temp	erature	(heating	season	)										
Temperature d	luring he	eating p	eriods ir	the livi	ng a	rea fron	n Tab	ole 9,	, Th	1 (°C)				21	(85)
Utilisation facto	or for ga	ains for I	iving are	a, h1,m	(se	e Table	9a)								
Jan	Feb	Mar	Apr	May	J	un 、	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99	0.98	0.95	0.87	0.	71 0	).54	0.5	8	0.81	0.96	0.99	1		(86)
Mean internal t	tempera	ature in I	living are	ea T1 (fo	ollow	steps :	3 to 7	' in T	able	e 9c)					
(87)m= 19.78	19.96	20.22	20.53	20.79	20	.95 20	0.99	20.9	98	20.89	20.55	20.1	19.74		(87)
Temperature d	urina he	eating p	eriods ir	rest of	dwe	llina fro	m Ta	ble 9	 7 Th	n2 (°C)		•	•	•	
·	19.94	19.95	19.95	19.96	r	<u> </u>	9.96	19.9		19.96	19.96	19.95	19.95		(88)
	or for ac	ing for r	oot of d	allina	h2 n			00)	!						
Utilisation facto	0.99	0.98	0.93	0.82	ī	<u> </u>	).42	9a) 0.4	16	0.74	0.95	0.99	1		(89)
	<u> </u>					!						0.00			(55)
Mean internal t		T			Ť	<u> </u>		i –				T 40.40	1,004	Ī	(00)
(90)m= 18.84	19.02	19.27	19.58	19.82	19	.94 19	9.96	19.9	96	19.9	19.6	19.16	18.81		(90)
										Į.	LA = LIVI	ng area ÷ (4	+) =	0.48	(91)
Mean internal t	<del></del>	<u>`</u>			lling	) = fLA :	× T1	+ (1	– fL	A) × T2			1	i	
` ′	19.47	19.72	20.03	20.28	<u> </u>		0.45	20.4		20.37	20.05	19.61	19.25		(92)
Apply adjustme		r			1							1		İ	(00)
` ′	19.47	19.72	20.03	20.28	20	.42 20	0.45	20.4	45	20.37	20.05	19.61	19.25		(93)
8. Space heati					- ا	-4 -4 4	44 - 4	T_LI	- 01-		. T:	(70)	-11-		
Set Ti to the me the utilisation fa					iea a	at step	11 01	rabi	e 90	), so tha	t 11,m=	(76)m an	a re-caic	culate	
Jan	Feb	Mar	Apr	May	J	un .	Jul	Aı	ug	Sep	Oct	Nov	Dec		
Utilisation facto		!		,		!			<u> </u>	<u> </u>		1	!		
(94)m= 1	0.99	0.97	0.93	0.84	0.	66 0	).48	0.5	52	0.77	0.95	0.99	1		(94)
Useful gains, h	mGm ,	W = (94	l)m x (84	1)m											
(95)m= 356.06	420.25	464.38	481.79	448.43	343	3.13 23	37.5	247	.71	349.06	384.76	352.45	334.8		(95)
Monthly average	ge exter	nal tem	perature	from T	able	8							1	1	
(96)m= 4.3	4.9	6.5	8.9	11.7			6.6	16.		14.1	10.6	7.1	4.2		(96)
Heat loss rate					_	<u></u>		<u> </u>		· ,		1		Ī	(07)
` '	930.85	843.27	703.13	540.99			10.72	252		393.42	595.83	791.4	956.18		(97)
Space heating					r				1			T	460.04		
(98)m= 449.07	343.13	281.89	159.37	68.87	<u></u>	0	0	0	<u>'                                    </u>	0	157.04	316.05	462.31		

								Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	2237.72	(98)
Space	e heating	g require	ement in	kWh/m²	<sup>2</sup> /year								40.99	(99)
8c. Sp	pace cod	oling req	uiremen	it										
Calcu	lated for	r June, J	luly and	August.	See Tab	ole 10b								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	oss rate	Lm (ca	lculated	using 25	5°C inter	nal temp	perature	and exte	ernal ten	nperatur	e from T	able 10)	•	
(100)m=	0	0	0	0	0	587.49	462.49	474.23	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm										•	
(101)m=	0	0	0	0	0	0.89	0.94	0.93	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = (	100)m x	(101)m								•	
(102)m=	0	0	0	0	0	520.84	434.96	439.3	0	0	0	0		(102)
Gains	(solar g	gains cal	culated	for appli	cable we	eather re	egion, se	e Table	10)				•	
(103)m=	0	0	0	0	0	674.7	649.63	625.12	0	0	0	0		(103)
			ement fo. 104)m <			lwelling,	continue	ous ( kW	h = 0.0	24 x [(10	03)m – (	102)m ] :	x (41)m	
(104)m=		0	0	0	0	110.78	159.72	138.24	0	0	0	0		
` '	ļ						l		Total	= Sum(	104)	=	408.75	(104)
Cooled	I fraction	1									area ÷ (4	1) =	1	(105)
Intermi	ttency fa	actor (Ta	able 10b	)										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
•									Total	= Sum(	104)	=	0	(106)
Space	cooling	requirer	nent for	month =	(104)m	× (105)	× (106)r	n						
(107)m=	0	0	0	0	0	27.7	39.93	34.56	0	0	0	0		
									Total	= Sum(	1.0.7)	=	102.19	(107)
Space	cooling	requirer	nent in k	:Wh/m²/y	/ear				(107)	÷ (4) =			1.87	(108)
8f. Fab	ric Ener	gy Effici	ency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabrio	Energy	/ Efficier	псу						(99) -	+ (108) =	=		42.86	(109)
Targe	et Fabrio	Energ	y Efficie	ncy (TF	EE)								49.29	(109)

Sasessor Name:   Zahid Ashraf   Stroma Number:   STRO001082   Software Version:   Version: 1,0,5,9			l Iser I	)etails: _						
## Address:   1. Overall dwelling dimensions:			<del>- 036</del> FL	Strom						
Area(m²)		F	roperty	Address	: Plot 17					
Area(m/r)										
Structural infiltration   Color   Co	1. Overall dwelling dime	ensions:	<b>A</b>	- ( 2)		A 11-	'arla ((ara)		Malaura (m.	.\
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)	Ground floor				l <sub>(1a) x</sub>			(2a) =	·	<u> </u>
Dwelling volume		3)+(1b)+(1c)+(1d)+(1a)+ (1			] •				130.49	(00)
2. Ventilation rate:    main   heating   heati		a)+(1b)+(16)+(10)+(16)+(1	'''	54.6	J	) . (20) . (26	4) . (20) .	(2n) -		<b>–</b>
Number of chimneys					(3a) <del>+</del> (3b	)+(30)+(30	ı)+(3e)+	.(311) =	136.49	(5)
Number of chimneys	2. Ventilation rate:	main seconda	ry	other		total			m³ per hou	ır
Number of open flues  0 + 0 + 0 = 0	Number of chimneys	heating heating		0	_ _ = _	0	x 4	40 =	_	_
Number of intermittent fans    0	·		<u> </u>		╛╘					╡``
Number of passive vents	·				┙┟					╡`´
Number of flueless gas fires					Ļ			_		Ⅎ``
Air changes per hour	·				Ļ					=======================================
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	Number of flueless gas f	ires				0	X 4	40 =	0	(7c)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)   Number of storeys in the dwelling (ns)								Air ch	nanges per ho	our
Number of storeys in the dwelling (ns)	Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(	7a)+(7b)+	(7c) =	Γ	0		÷ (5) =	0	(8)
Additional infiltration	If a pressurisation test has b	peen carried out or is intended, procee	ed to (17),	otherwise o	continue fr	rom (9) to				
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 x (14) ÷ 100] =  0.15  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) =  0.16  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) + 20] + (8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 x (19)] =  0.12  (21)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4	•	he dwelling (ns)					7/0)		-	_
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 × (14) ÷ 100] = 0  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) = 0  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 × (19)] = 0.78  (20)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4		25 for steel or timber frame o	r 0 35 fo	r maconi	ny coneti	ruction	[(9)	-1]x0.1 =		=
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  Unifiltration rate  (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) (18)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 x (19)] = (21)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4					•	uction			0	(11)
If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 × (14) ± 100] = 0 (15)  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) = 0 (16)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) ± 20]+(8), otherwise (18) = (16) (18)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 × (19)] = 0.78 (20)  Infiltration rate incorporating shelter factor  (21) = (18) × (20) = 0.12 (21)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4	,	<b>3</b> /·	4 (aaal	مما المم	antar 0					<b></b>
Percentage of windows and doors draught stripped  Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0.25 - [0.2 \times$	•	,	. i (seai	ea), eise	enter 0					=
Window infiltration $0.25 - [0.2 \times (14) + 100] = 0.015$ Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0.016$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area $3.017$ If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered $(20) = 1 - [0.075 \times (19)] = 0.78$ Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.12$ Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= $5.1$ $5$ $4.9$ $4.4$ $4.3$ $3.8$ $3.8$ $3.8$ $3.7$ $4$ $4.3$ $4.5$ $4.7$ Wind Factor $(22a)m = (22)m \div 4$	•									=
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 $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] = $ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = $ Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7 $(22)m = 5.1  5  4.9  4.4  4.3  3.8  3.8  3.7  4  4.3  4.5  4.7$ Wind Factor $(22a)m = (22)m \div 4$	•			0.25 - [0.2	2 x (14) ÷ 1	100] =				= ' '
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] =$ $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ $(21) = (18) \times (20) =$ Monthly average wind speed from Table 7 $(22)m = 5.1  5  4.9  4.4  4.3  3.8  3.8  3.7  4  4.3  4.5  4.7$ Wind Factor $(22a)m = (22)m \div 4$	Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78  (20)$ 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 $(22a)m = (22)m \div 4$	,	·	-		•	etre of e	envelope	area	3	(17)
Number of sides sheltered Shelter factor $ (20) = 1 - [0.075 \times (19)] = 0.78 $ (20) $ [10,075] = 0.78 $ (20) $ [21] = (18) \times (20) = 0.12 $ (21) $ [10,075] = 0.78 $ (20) $ [21] = (18) \times (20) = 0.12 $ (21) $ [10,075] = 0.78 $ (20) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (22) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (22) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (22) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (22) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (22) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (22) $ [21] = 0.78 $ (23) $ [21] = 0.78 $ (24) $ [21] = 0.78 $ (25) $ [21] = 0.78 $ (26) $ [21] = 0.78 $ (27) $ [21] = 0.78 $ (28) $ [21] = 0.78 $ (29) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (22) $ [21] = 0.78 $ (23) $ [21] = 0.78 $ (24) $ [21] = 0.78 $ (25) $ [21] = 0.78 $ (26) $ [21] = 0.78 $ (27) $ [21] = 0.78 $ (28) $ [21] = 0.78 $ (29) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (22) $ [21] = 0.78 $ (23) $ [21] = 0.78 $ (24) $ [21] = 0.78 $ (25) $ [21] = 0.78 $ (26) $ [21] = 0.78 $ (27) $ [21] = 0.78 $ (28) $ [21] = 0.78 $ (29) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (22) $ [21] = 0.78 $ (23) $ [21] = 0.78 $ (24) $ [21] = 0.78 $ (25) $ [21] = 0.78 $ (26) $ [21] = 0.78 $ (27) $ [21] = 0.78 $ (28) $ [21] = 0.78 $ (28) $ [21] = 0.78 $ (29) $ [21] = 0.78 $ (29) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (21) $ [21] = 0.78 $ (22) $ [21] = 0.78 $ (23) $ [21] = 0.78 $ (24) $ [21] = 0.78 $ (25) $ [21] = 0.78 $ (26) $ [21] = 0.78 $ (27) $ [21] = 0.78 $ (28) $ [21] = 0.78 $ (28) $ [21] = 0.78 $ (28) $ [21] = 0.78 $ (28) $ [21] = 0.78 $ (28) $ [21] = 0.78 $ (28) $ [21] = 0.78 $ (28) $ [21] = 0.$	•	•				. , .	,		0.15	(18)
Shelter factor $ (20) = 1 - [0.075 \times (19)] = 0.78                                   $			ne or a de	gree air pe	rmeability	is being u	sea		3	(19)
Infiltration rate modified for monthly wind speed    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec				(20) = 1 -	[0.075 x (	19)] =				<b>→</b> ' '
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           Monthly average wind speed from Table 7           (22)m=         5.1         5         4.9         4.4         4.3         3.8         3.7         4         4.3         4.5         4.7           Wind Factor (22a)m = (22)m ÷ 4	Infiltration rate incorpora	ting shelter factor		(21) = (18	) x (20) =				0.12	(21)
Monthly average wind speed from Table 7 (22)m= $\begin{bmatrix} 5.1 & 5 & 4.9 & 4.4 & 4.3 & 3.8 & 3.8 & 3.7 & 4 & 4.3 & 4.5 & 4.7 \end{bmatrix}$ Wind Factor (22a)m = (22)m $\div$ 4	Infiltration rate modified f	for monthly wind speed								
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind Factor (22a)m = (22)m ÷ 4	Monthly average wind sp	peed from Table 7			•				1	
	(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								
		<del></del>	0.95	0.92	11	1.08	1.12	1.18		

Adjusted infiltr	ation rat	e (allowi	ng for sh	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	]	
Calculate effe		_	rate for t	he appli	cable ca	se	!	ļ.	<u>l</u>	!	!		<b>_</b>
If mechanic  If exhaust air h			andiv N (2	3h) - (23a	) × Fmv (e	aguation (I	VSV) othe	rwica (23h	) = (23a)			0.5	(23a)
If balanced wit									) = (23a)			0.5	(23b)
a) If balance			•	· ·		,		,	2h\m . (	22h) v [4	1 (22a)	79.05	(23c)
(24a)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24	]	(24a)
b) If balance	<u> </u>				<u> </u>						0.21	]	( -7
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If whole h	nouse ex	tract ver	tilation o	r positiv	e input v	L ventilatio	n from o	L outside	<u> </u>	!	!	J	
,	n < 0.5 ×			•	•				.5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24c)
d) If natural if (22b)r	ventilation $n = 1$ , the				•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in box	x (25)	-	-	-	_	
(25)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24	]	(25)
3. Heat losse	es and he	eat loss r	paramete	er:									
ELEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/		k-value		X k I/K
Doors		` ,			2	х	1.4	=	2.8	,			(26)
Windows					8.651	x1	/[1/( 1.4 )+	0.04] =	11.47	=			(27)
Floor					54.59	6 X	0.12		6.5515	<u> </u>			(28)
Walls Type1	17.5	58	8.65		8.93	x	0.15	<u> </u>	1.34	<b>=</b>			(29)
Walls Type2	29.2	26	2		27.26	3 x	0.14	<u> </u>	3.86	F i		<b>-</b>	(29)
Total area of e	elements	, m²			101.4	4							(31)
* for windows and ** include the are						lated using	g formula 1	/[(1/U-valu	ıe)+0.04] á	as given in	paragrapl	h 3.2	
Fabric heat lo	ss, W/K :	= S (A x	U)				(26)(30)	) + (32) =				26.02	(33)
Heat capacity	Cm = S	(Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	4601.43	(34)
Thermal mass	parame	eter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For design asses can be used inste				construct	ion are no	t known pi	recisely the	e indicative	values of	TMP in Ta	able 1f		_
Thermal bridg	es : S (L	x Y) cal	culated (	using Ap	pendix l	K						11.14	(36)
if details of therm		are not kn	own (36) =	= 0.05 x (3	1)								_
Total fabric he									(36) =			37.16	(37)
Ventilation he	i	i	· ·				Ι .	<del>``</del>		25)m x (5)		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(38)
(38)m= 11.39	11.26	11.13	10.48	10.35	9.69	9.69	9.56	9.95	10.35	10.61	10.87	J	(30)
Heat transfer	r	· · · · ·	47.6	47.5:	40.00	10.00	10=-		= (37) + (		10.55	1	
(39)m= 48.56	48.43	48.3	47.64	47.51	46.86	46.86	46.72	47.12	47.51	47.77 Sum(39) <sub>1</sub>	48.03	47.61	(39)
								,	rveraye =	Juiii(38)1	12 / 14=	47.01	(09)

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.89	0.89	0.88	0.87	0.87	0.86	0.86	0.86	0.86	0.87	0.88	0.88		
	!	!							Average =	Sum(40) <sub>1</sub>	12 /12=	0.87	(40)
Number of day	<u> </u>							-					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ar:	
Assumed occurring TFA > 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		83		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the $a$	lwelling is	designed t			se target c		.64		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i								*F		· · · ·			
(44)m= 89.8	86.54	83.27	80.01	76.74	73.47	73.47	76.74	80.01	83.27	86.54	89.8		
									Total = Su	m(44) <sub>112</sub> =		979.65	(44)
Energy content of	f hot water	used - cal	culated mo	onthly = $4$ .	190 x Vd,r	n x nm x C	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 133.17	116.47	120.19	104.79	100.54	86.76	80.4	92.26	93.36	108.8	118.76	128.97		_
If instantaneous v	vator hoati	na at noint	of use (no	n hot water	ctoraga)	enter∩in	hoves (16		Total = Su	m(45) <sub>112</sub> =	= [	1284.48	(45)
			,	ı	,.		, ,	, , , I	1000	1,7,04	40.05		(46)
(46)m= 19.98 Water storage	17.47 loss:	18.03	15.72	15.08	13.01	12.06	13.84	14	16.32	17.81	19.35		(46)
Storage volum		) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	neating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage													
a) If manufact				or is kno	wn (kWł	n/day):					0		(48)
Temperature f											0		(49)
Energy lost from		•			orio not		(48) x (49)	) =		1	10		(50)
<ul><li>b) If manufact</li><li>Hot water stor</li></ul>			-							0	02		(51)
If community h	•			(	,,,,,,	-77				0.	02		(0.7)
Volume factor	from Ta	ble 2a								1.	03		(52)
Temperature f	actor fro	m Table	2b							0	.6		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter (50) or	(54) in (	55)								1.	03		(55)
Water storage	loss cal	culated 1	or each	month			((56)m = (	(55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	$m = \overline{(56)m}$	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	хН	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit	loss (ar	nnual) fro	m Table	- <del></del>							0		(58)
Primary circuit	,	,			59)m = (	(58) ÷ 36	65 × (41)	m					
(modified by	/ factor f	rom Tab	le H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$														
(61)m= 0	0	0	0	0	0	0	)   0		0	0	0	0	]	(61)
	uired for	water he	eating ca	alculated	l for ea	ch month	(62)	— m =	0.85 × (	′45)m +	(46)m +	(57)m +	ו · (59)m + (61)m	
(62)m= 188.45	166.4	175.47	158.28	155.82	140.26		147	_	146.85	164.08	172.26	184.25	]	(62)
Solar DHW input	<b>L</b> calculated	using App	endix G oı	· Appendix	H (nega	tive quantit	y) (ent	er '0'	if no sola	r contribu	tion to wate	r heating)	1	
(add additiona												0,		
(63)m= 0	0	0	0	0	0	0	0	)	0	0	0	0	]	(63)
Output from w	ater hea	ter				•						•	•	
(64)m= 188.45	166.4	175.47	158.28	155.82	140.26	135.67	147	.53	146.85	164.08	172.26	184.25	]	
						•		Outp	out from wa	ater heate	er (annual)	l12	1935.32	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	า + (6	1)m	n] + 0.8 x	((46)m	+ (57)m	+ (59)m	n ]	
(65)m= 88.5	78.67	84.18	77.64	77.65	71.64	70.95	74.	.9	73.84	80.4	82.28	87.1	]	(65)
include (57)	m in cald	culation of	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal ga	ains (see	Table 5	and 5a	):										
Metabolic gair	ns (Table	5), Wat	ts											
Jan	Feb	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec	]	
(66)m= 109.53	109.53	109.53	109.53	109.53	109.53	109.53	109	.53	109.53	109.53	109.53	109.53	]	(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9	or L9a), a	ılso s	ee -	Table 5				-	
(67)m= 37.08	32.93	26.78	20.27	15.16	12.8	13.83	17.	97	24.12	30.63	35.75	38.11	]	(67)
Appliances ga	ins (calc	ulated in	Append	dix L, eq	uation I	_13 or L1	3a), a	also	see Tal	ble 5			•	
(68)m= 237.53	239.99	233.78	220.56	203.87	188.18	177.7	175	.23	181.45	194.67	211.36	227.05	]	(68)
Cooking gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a	), als	0 SE	e Table	5		•	•	
(69)m= 47.78	47.78	47.78	47.78	47.78	47.78	47.78	47.	78	47.78	47.78	47.78	47.78	]	(69)
Pumps and fa	ns gains	(Table 5	ōa)										•	
(70)m= 0	0	0	0	0	0	0	0	)	0	0	0	0	]	(70)
Losses e.g. ev	/aporatio	n (nega	tive valu	es) (Tab	le 5)	•				•	•		•	
(71)m= -73.02	-73.02	-73.02	-73.02	-73.02	-73.02	-73.02	-73.	.02	-73.02	-73.02	-73.02	-73.02	]	(71)
Water heating	gains (T	able 5)				•				•			•	
(72)m= 118.95	117.07	113.15	107.83	104.37	99.5	95.37	100	.67	102.55	108.06	114.28	117.08	]	(72)
Total internal	gains =				(60	6)m + (67)n	n + (68	3)m +	- (69)m + (	(70)m + (7	71)m + (72)	)m	-	
(73)m= 477.85	474.28	458	432.95	407.68	384.77	371.18	378	.16	392.41	417.65	445.68	466.52	]	(73)
6. Solar gains	s:													
Solar gains are	calculated	using sola	r flux from	Table 6a	and asso	ciated equa	ations	to co	nvert to th	e applica	ble orientat	tion.		
Orientation: /			Area			ux		_	g_ able 6b	-	FF		Gains	
_	Table 6d		m²			able 6a	, ,		able ob	_ '	able 6c		(W)	,
Southeast 0.9x	0.77	X	8.6	55	x	36.79	X		0.63	x	0.7	=	97.28	(77)
Southeast 0.9x	0.77	х	8.6	65	x	62.67	X		0.63	x	0.7	=	165.7	(77)
Southeast 0.9x	0.77	X	8.6	65	x	85.75	X		0.63	x	0.7	=	226.72	(77)
Southeast 0.9x	0.77	X	8.6	65	X	106.25	X		0.63	x	0.7	=	280.91	(77)
Southeast 0.9x	0.77	X	8.6	55	X	119.01	X		0.63	X	0.7	=	314.65	(77)

Southeast <sub>0.9x</sub>	0.77	x 8.	65	x	118.15	X		0.63	x	0.7	=	312.37	(77)
Southeast <sub>0.9x</sub>	0.77	x 8.	65	x	113.91	x		0.63	x	0.7		301.16	(77)
Southeast <sub>0.9x</sub>	0.77	x 8.	65	x	104.39	X		0.63	x	0.7	=	275.99	(77)
Southeast <sub>0.9x</sub>	0.77	x 8.	65	x	92.85	X		0.63	x	0.7	=	245.49	(77)
Southeast <sub>0.9x</sub>	0.77	× 8.	65	х	69.27	x		0.63	x	0.7	_ =	183.13	(77)
Southeast <sub>0.9x</sub>	0.77	× 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		83.25	(77)
Solar gains in wat	ts, calculate	ed for eac	h month			(83)m	n = S	um(74)m .	(82)m	_			
(	5.7 226.72		314.65	312		275	5.99	245.49	183.13	116.52	83.25		(83)
Total gains – inter		<del>_ ` ´ </del>	= (73)m	+ (83	)m , watts							ı	
(84)m= 575.12 63	9.98 684.72	713.86	722.33	697	.14 672.34	654	l.16	637.89	600.78	562.19	549.77		(84)
7. Mean internal	temperatur	e (heating	g season	)									
Temperature dur	ing heating	periods i	n the livi	ng ar	ea from Tal	ole 9	, Th	1 (°C)				21	(85)
Utilisation factor	for gains fo	r living ar	ea, h1,m	(see	Table 9a)								_
Jan I	eb Mar	Apr	May	Ju	ın Jul	А	ug	Sep	Oct	Nov	Dec		
(86)m= 0.87 0	82 0.76	0.67	0.55	0.4	1 0.3	0.3	32	0.48	0.68	0.82	0.88		(86)
Mean internal ter	nperature ii	n living aı	ea T1 (f	ollow	steps 3 to 7	7 in T	Γable	e 9c)					
	.09 20.36	20.65	20.85	20.	i	20.		20.93	20.69	20.26	19.83		(87)
Temperature dur	ing heating	neriods i	n rest of	dwel	ling from Ta	hle (	——' 9 ТІ	n2 (°C)					
·	.18 20.18	20.19	20.19	20.	<u> </u>	20.		20.2	20.19	20.19	20.18		(88)
` '			l	L	/a.a. Tabla	0-/					ļ		
Utilisation factor (89)m= 0.85 0	81 0.74	0.64	0.51	n∠,m 0.3	<u> </u>	9a) 0.2	27	0.43	0.65	0.8	0.87		(89)
` '		<u> </u>	<u> </u>		<u> </u>					0.0	0.07		(00)
Mean internal ter	<del>'</del> ,	1	1	Ť	<u> </u>	<del>i                                      </del>							(00)
(90)m= 18.7	19.38	19.77	20.02	20.	16 20.19	20.	.19	20.13	19.83	19.25	18.64		(90)
								I	LA = LIVII	ng area ÷ (4	+) =	0.48	(91)
Mean internal ter	<del> `</del>	for the wi		lling)	= fLA × T1	+ (1	– fL	A) × T2			1		
` ′	.52 19.85	20.19	20.42	20.		20.		20.51	20.24	19.73	19.21		(92)
Apply adjustmen		1	<del></del>	1		1			•			İ	(00)
` '	.52 19.85	20.19	20.42	20.	54 20.57	20.	.57	20.51	20.24	19.73	19.21		(93)
8. Space heating	•				( - ( <b>.</b> 4 <b>.</b> - <b>.</b>	<b>T</b> - 1.	I - OI		. T' /	70)	.1	la (a	
Set Ti to the mea				ned a	t step 11 of	rab	ie 9r	o, so tha	t 11,m=(	76)m an	d re-caid	culate	
	eb Mar		May	Ju	ın Jul	Α	ug	Sep	Oct	Nov	Dec		
Utilisation factor			1		1		- 3			1			
(94)m= 0.83 0	79 0.73	0.64	0.53	0.3	9 0.27	0.2	29	0.45	0.65	0.78	0.85		(94)
Useful gains, hm	Gm , W = (	94)m x (8	4)m		•								
(95)m= 480.22 50	6.93 501.49	458.26	379.64	268	.93 183.8	191	1.9	286.12	388.87	440.24	465.94		(95)
Monthly average	external te	mperatur	e from T	able	8								
(96)m= 4.3	.9 6.5	8.9	11.7	14.	6 16.6	16	5.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate fo					<del></del>	T-		<u> </u>		1	1	l	
` '	8.05 644.54		414.12	278		194		301.95	458	603.28	720.84		(97)
Space heating re	<del> </del>		1			<del></del>	<u> </u>		_ <u> </u>	r –	465 = :		
(98)m= 183.14 13	5.15 106.43	57.26	25.65	0	0		J	0	51.43	117.39	189.64		

	Total per year (kWh/year) = Sum(98) <sub>15,912</sub> =	866.1	(98)
Space heating requirement in kWh/m²/year		15.86	(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		0	(301)
Fraction of space heat from community system 1 – (301) =	, Г	1	(302)
The community scheme may obtain heat from several sources. The procedure allow	L s for CHP and up to four other heat sources; th	e latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See A Fraction of heat from Community boilers	Appendix C. Г	1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =		(304a)
Factor for control and charging method (Table 4c(3)) for community	L.	 1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating	L	kWh/year	
Annual space heating requirement		866.1	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	909.41	(307a
Efficiency of secondary/supplementary heating system in % (from T	able 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating	_		_
Annual water heating requirement		1935.32	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2032.09	(310a
Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] =	29.41	(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	189.41	(330a)
warm air heating system fans	Ī	0	(330b
pump for solar water heating	Ī	0	 (330g
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	189.41	(331)
Energy for lighting (calculated in Appendix L)	Ī	261.91	(332)
Electricity generated by PVs (Appendix M) (negative quantity)	Ī	-551.64	(333)
Electricity generated by wind turbine (Appendix M) (negative quanti	ity)	0	(334)
10b. Fuel costs – Community heating scheme			
<b>Fuel</b> kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating from CHP (307a) x	4.24 × 0.01 =	38.56	(340a
Water heating from CHP (310a) x	4.24 x 0.01 =	86.16	(342a)

		Fı	uel Price		
Pumps and fans	(331)		13.19 × 0.01 =	24.98	(349)
Energy for lighting	(332)		13.19 × 0.01 =	34.55	(350)
Additional standing charges (Table 12)				120	(351)
Energy saving/generation technologies					
Total energy cost	= (340a)(342e) + (345)(3	354) =		304.25	(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] =	=		1.28	(357)
SAP rating (section12)				82.1	(358)
12b. CO2 Emissions - Community heat	ting scheme	_			
		Energy kWh/year	Emission facto kg CO2/kWh	r Emissions kg CO2/year	
CO2 from other sources of space and v Efficiency of heat source 1 (%)		two fuels repeat (363)	to (366) for the second for	uel 94	(367a)
CO2 associated with heat source 1	[(307b)+(	[310b)] x 100 ÷ (367b) x	0.22	= 675.92	(367)
Electrical energy for heat distribution	]	(313) x	0.52	= 15.27	(372)
Total CO2 associated with community s	systems (	(363)(366) + (368)(3	372)	= 691.18	(373)
CO2 associated with space heating (se	condary) (	(309) x	0	= 0	(374)
CO2 associated with water from immers	sion heater or instantane	ous heater (312) x	0.22	= 0	(375)
Total CO2 associated with space and w	vater heating (	(373) + (374) + (375) =		691.18	(376)
CO2 associated with electricity for pum	ps and fans within dwelli	ng (331)) x	0.52	98.31	(378)
CO2 associated with electricity for lighti	ng (	(332))) x	0.52	= 135.93	(379)
Energy saving/generation technologies Item 1	(333) to (334) as applica	able	0.52 x 0.01 =	-286.3	(380)
Total CO2, kg/year	sum of (376)(382) =			639.12	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			11.71	(384)
El rating (section 14)				91.4	(385)
13b. Primary Energy – Community heat	ting scheme	<b>-</b>	Duimen	D. F	
		Energy kWh/year	Primary factor	P.Energy kWh/year	
Energy from other sources of space and Efficiency of heat source 1 (%)	d water heating (not CHF If there is CHP using	P) g two fuels repeat (363)	to (366) for the second for	uel 94	(367a)
Energy associated with heat source 1	[(307b)+(	(310b)] x 100 ÷ (367b) x	1.22	= 3817.68	(367)
Electrical energy for heat distribution	]	(313) x		= 90.3	(372)
Total Energy associated with communit	y systems (	(363)(366) + (368)(3	372)	= 3907.99	(373)
if it is negative set (373) to zero (unle	ss specified otherwise, s	ee C7 in Appendix	(C)	3907.99	(373)
Energy associated with space heating (	secondary) (	(309) x	0	= 0	(374)

Energy associated with water from immersion heater or insta	ntaneous heater(312) x	1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =			3907.99	(376)
Energy associated with space cooling	(315) x	3.07	=	0	(377)
Energy associated with electricity for pumps and fans within o	dwelling (331)) x	3.07	=	581.5	(378)
Energy associated with electricity for lighting	(332))) x	3.07	=	804.06	(379)
Energy saving/generation technologies Item 1		3.07 × 0.01	= _	-1693.55	(380)
Total Primary Energy, kWh/year sum of (376	5)(382) =			3600	(383)

		1.16	ser De	otaile:						
Access an Names	Johid Ashrof	<u> </u>			- M	<b>b</b> a		CTDO	004000	
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	<b>)</b>		Stroma Softwa					001082 on: 1.0.5.9	
Contware Hame.	Ottoma 1 O/A 2012			Address:				V 01010	7.0.0.0	
Address :										
1. Overall dwelling dime	ensions:									
Ground floor		Г	Area		(1a) v		ight(m)	(2a) =	Volume(m³	(3a)
	a) . (4 b) . (4 a) . (4 d) . (4 a)	. (4.5)			(1a) x		2.5	(2a) =	136.49	(Sa)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)	+(1n) [	5	4.6	(4)	) (O.) (O.)	I) (O )	(0.)		_
Dwelling volume					(3a)+(3b)	)+(3c)+(3c	d)+(3e)+	.(3n) =	136.49	(5)
2. Ventilation rate:	main se	condary		other		total			m³ per hou	r
Number of allignments	heating he	eating	+ [		1 _ F			40 =	-	_
Number of chimneys			<u> </u>	0	] = [	0			0	(6a)
Number of open flues	0 +	0	+	0	] = [	0		20 =	0	(6b)
Number of intermittent fa					L	2		10 =	20	(7a)
Number of passive vents	3					0	X '	10 =	0	(7b)
Number of flueless gas fi	ires					0	X 4	40 =	0	(7c)
								Air ch	nanges per ho	our
Infiltration due to chimne	vs_flues and fans = (6a	)+(6b)+(7a)+	·(7b)+(7	7c) =	Г	20		÷ (5) =	0.15	(8)
	peen carried out or is intended				ontinue fr			. (0) –	0.13	
Number of storeys in the	he dwelling (ns)								0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timber frugger or steel or timber frugger from the steel or timber from the st				•	uction			0	(11)
deducting areas of openi		oriding to the	greate	er wan area	a (anter					
If suspended wooden	floor, enter 0.2 (unseale	ed) or 0.1 (	seale	d), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0								0	(13)
· ·	s and doors draught str	ipped							0	(14)
Window infiltration				0.25 - [0.2	, ,	_			0	(15)
Infiltration rate				(8) + (10) -	• • • •	, , ,	, ,		0	(16)
•	q50, expressed in cubi	•			•	etre of e	envelope	area	5	(17)
If based on air permeabil	es if a pressurisation test has					is boing u	sod		0.4	(18)
Number of sides sheltere		been done of	i a uegi	ree air per	пеаышу	is being u	seu		3	(19)
Shelter factor			(	(20) = 1 - [	0.075 x (1	9)] =			0.78	(20)
Infiltration rate incorporate	ting shelter factor		(	(21) = (18)	x (20) =				0.31	(21)
Infiltration rate modified f	or monthly wind speed									_
Jan Feb	Mar Apr May	Jun ,	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7	-					-		•	
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Easter (22a)m = (2	2)m : 4									
Wind Factor $(22a)m = (2(22a)m = 1.27)$ 1.25	2)m ÷ 4 1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
1.20		J.55   C		0.02	•		L2		I	

Adjusted infiltration rate (allowi	ing for shelter ar	nd wind s	peed) =	(21a) x	(22a)m					
0.39 0.38 0.38	0.34 0.33	0.29	0.29	0.28	0.31	0.33	0.35	0.36	]	
Calculate effective air change	rate for the appl	icable ca	se			ı			<u>,                                      </u>	<b>-</b>
If mechanical ventilation:  If exhaust air heat pump using Appo	andiv N (22h) - (22	o) v Emy (c	auation (N	VEVV otho	muiaa (22h	) - (220)			0	(23a)
If balanced with heat recovery: effic						) = (23a)			0	(23b)
•						26\m . /	22b) [	1 (22a)	0	(23c)
a) If balanced mechanical ve		at recove		7R) (248	$\frac{1}{10} = \frac{2}{10}$	2b)m + (	23b) × [	0	) ÷ 100] ]	(24a)
b) If balanced mechanical ve			<u> </u>						J	(214)
$(24b)m = 0 \qquad 0 \qquad 0$		0	0	0	0	0	0	0	1	(24b)
c) If whole house extract ver	<u> </u>		<u> </u>						]	,
if $(22b)m < 0.5 \times (23b)$ , t	•	•				5 × (23b	o)			
(24c)m= 0 0 0	0 0	0	0	0	0	0	0	0	]	(24c)
d) If natural ventilation or wh	ole house positi	ve input	ventilatio	on from I	oft		!	!	<b>.</b>	
if (22b)m = 1, then (24d)	<del>r ì r</del>	· `	4d)m =	0.5 + [(2	2b)m² x	0.5]		•	7	
(24d)m= 0.58 0.57 0.57	0.56 0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	]	(24d)
Effective air change rate - er	<del>-                                    </del>	<del>í ` ` </del>	ŕ	<del>r</del>	<del>``</del>				٦	
(25)m= 0.58 0.57 0.57	0.56 0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57	]	(25)
3. Heat losses and heat loss	parameter:									
<b>ELEMENT</b> Gross area (m²)	Openings m²	Net Ar A ,r		U-valı W/m2		A X U (W/I		k-value kJ/m²-		X k /K
Doors	Ш	2	x	1	.K = [	2	N)	KJ/III-•I	r Ku	(26)
Windows			=	<u> </u>	;		$\dashv$			(27)
Floor		8.651	_			11.47				(28)
Malla Tarada		54.59	=	0.13	=	7.09748	<u>"                                    </u>			= '
Walla Tara 2	8.65	8.93	=	0.18	=	1.61	믁 ¦			(29)
	2	27.26	=	0.18	= [	4.91				(29)
Total area of elements, m <sup>2</sup> * for windows and roof windows, use 6	effective window I I-v	101.4		r formula 1	/[/1/    <sub>-</sub> val	(مرامر) ۱۸۱	e aiven in	naragrani	h 3 2	(31)
** include the areas on both sides of in			ateu using	i ioiiniala i	/[( 1/ <b>O</b> -vaic	1 <del>0</del> /+0.0+j 6	is given in	paragrapi	7 3.2	
Fabric heat loss, W/K = S (A x	U)			(26)(30)	) + (32) =				27.08	(33)
Heat capacity $Cm = S(A \times k)$					((28)	.(30) + (32	2) + (32a).	(32e) =	4601.43	(34)
Thermal mass parameter (TMI	P = Cm ÷ TFA) i	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assessments where the de		tion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
can be used instead of a detailed calc Thermal bridges: S (L x Y) cal		nandiy k	<i>(</i>						40.00	(36)
if details of thermal bridging are not kn		•	`						10.98	(30)
Total fabric heat loss	(,	,			(33) +	(36) =			38.06	(37)
Ventilation heat loss calculated	d monthly				(38)m	= 0.33 × (	(25)m x (5)	)		
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(38)m= 25.98 25.84 25.71	25.09 24.98	24.44	24.44	24.34	24.65	24.98	25.21	25.46		(38)
Heat transfer coefficient, W/K					(39)m	= (37) + (37)	38)m			
(39)m= 64.04 63.9 63.77	63.15 63.04	62.5	62.5	62.4	62.71	63.04	63.27	63.52	<u></u>	
						Average =	Sum(39) <sub>1</sub>	12 /12=	63.15	(39)

Heat loss para	meter (l	-II P) \//	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.17	1.17	1.17	1.16	1.15	1.14	1.14	1.14	1.15	1.15	1.16	1.16		
(40)1112	1.17	1.17	1.10	1.10	1.14	1.17	1.14			Sum(40) <sub>1</sub> .		1.16	(40)
Number of days	s in mo	nth (Tab	le 1a)					,	Average =	Ourr(+0)1.	12 / 12-	1.10	(10)
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)
		!						ļ.	<u>!</u>	!			
4 \\/											1-) 0 //- /		
4. Water heati	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)	)2)] + 0.0	0013 x (¯	TFA -13		83		(42)
Annual average	l average	hot water	usage by	$5\%$ if the $\alpha$	lwelling is	designed t			se target o		.56		(43)
not more that 125	ilites per	person per		rater use, r	ioi and co	ia)					1		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	litres per	r day for ea	ach month	Vd,m = fa	ctor from 7	Table 1c x	(43)	_					
(44)m= 85.31	82.21	79.11	76	72.9	69.8	69.8	72.9	76	79.11	82.21	85.31		
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D	)Tm / 3600			m(44) <sub>112</sub> = ables 1b, 1		930.67	(44)
(45)m= 126.51	110.65	114.18	99.55	95.52	82.42	76.38	87.64	88.69	103.36	112.83	122.52		
LL				ı	ı		ı	-	Total = Su	m(45) <sub>112</sub> =	=	1220.26	(45)
If instantaneous wa	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	) to (61)					
(46)m= 18.98	16.6	17.13	14.93	14.33	12.36	11.46	13.15	13.3	15.5	16.92	18.38		(46)
Water storage	loss:			l			I						
Storage volume	e (litres)	) includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community he	eating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot water	er (this in	ıcludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage													
a) If manufactu				or is kno	wn (kWł	n/day):				1.	39		(48)
Temperature fa	actor fro	m Table	2b							0.	54		(49)
Energy lost from		_	-				(48) x (49)	) =		0.	75		(50)
b) If manufactu			-										<b>(= 1)</b>
Hot water stora	-			e z (KVV	n/iitre/aa	ıy)					0		(51)
Volume factor f	_		511 4.5								0		(52)
Temperature fa			2b								0		(53)
Energy lost from				ar			(47) v (51)	) x (52) x (	53) -				` '
Enter (50) or (		_	, KVVII/yt	zai			(+1) X (51)	) X (32) X (	JJ) =		0 75		(54) (55)
Water storage	, ,	,	or each	month			((56)m = (	55) × (41)ı	m	0.	10		(00)
					T	i	., , ,		ı	T	l		(50)
(56)m= 23.33 If cylinder contains	21.07 dedicate	23.33 d solar sto	22.58 rage, (57)	23.33 m = (56)m	22.58 x [(50) – (	23.33 H11)] ÷ (5	23.33 0), else (5	22.58 7)m = (56)	23.33 m where (	22.58 H11) is fro	23.33 m Append	ix H	(56)
(57)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Primary circuit	loss (ar	nnual) fro	m Table	3							0		(58)
Primary circuit (modified by	loss cal	culated f	for each	month (	•	. ,	, ,		r thermo	ostat)			
(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)
20.20	21.01	20.20	22.01	20.20	22.01	20.20	20.20			22.01	20.20		(00)

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$														
(61)m= 0	0	0	0	0	0	0	)   0	)	0	0	0	0	]	(61)
	uired for	water he	eating ca	alculated	l for ea	ch month	(62)	 m =	0.85 × (	(45)m +	(46)m +	(57)m +	ים - (59)m + (61)m	
(62)m= 173.11	152.74	160.78	144.64	142.11	127.52		134		133.78	149.96	157.92	169.12	1	(62)
Solar DHW input	calculated	using App	endix G oı	· Appendix	H (nega	tive quantity	y) (ent	er '0	if no sola	r contribu	tion to wate	er heating)	)	
(add additiona	al lines if	FGHRS	and/or \	WWHRS	applie	s, see Ap	pend	lix C	€)					
(63)m= 0	0	0	0	0	0	0	0	)	0	0	0	0		(63)
Output from w	ater hea	ter												
(64)m= 173.11	152.74	160.78	144.64	142.11	127.52	122.97	134	.24	133.78	149.96	157.92	169.12		_
								Outp	out from wa	ater heate	er (annual)	112	1768.87	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	ı + (6	1)m	1] + 0.8 >	( [(46)m	+ (57)m	+ (59)m	<u>]</u> ]	
(65)m= 79.34	70.46	75.24	69.17	69.04	63.48	62.67	66.	42	65.56	71.64	73.59	78.01		(65)
include (57)	m in calc	culation o	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal g	ains (see	Table 5	and 5a	):										
Metabolic gair	ns (Table	5), Wat	ts										_	
Jan	Feb	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec	]	
(66)m= 91.28	91.28	91.28	91.28	91.28	91.28	91.28	91.	28	91.28	91.28	91.28	91.28	]	(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9	or L9a), a	lso s	ee -	Table 5				_	
(67)m= 14.83	13.17	10.71	8.11	6.06	5.12	5.53	7.1	19	9.65	12.25	14.3	15.24	]	(67)
Appliances ga	ains (calc	ulated in	Append	dix L, eq	uation I	_13 or L1	3a), a	also	see Ta	ble 5				
(68)m= 159.14	160.8	156.63	147.77	136.59	126.08	119.06	117	.41	121.57	130.43	141.61	152.12	]	(68)
Cooking gains	s (calcula	ited in A	ppendix	L, equat	ion L15	or L15a	), als	o se	ee Table	5			_	
(69)m= 32.13	32.13	32.13	32.13	32.13	32.13	32.13	32.	13	32.13	32.13	32.13	32.13	]	(69)
Pumps and fa	ıns gains	(Table 5	āa)										_	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3	3	]	(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)								_	
(71)m= -73.02	-73.02	-73.02	-73.02	-73.02	-73.02	-73.02	-73.	.02	-73.02	-73.02	-73.02	-73.02	]	(71)
Water heating	gains (T	able 5)											_	
(72)m= 106.64	104.85	101.13	96.07	92.79	88.17	84.24	89.	27	91.06	96.3	102.21	104.86	]	(72)
Total interna	l gains =	:			(60	6)m + (67)n	า + (68	3)m +	+ (69)m + (	(70)m + (7	71)m + (72)	)m	_	
(73)m= 334	332.2	321.86	305.34	288.83	272.75	262.21	267	.25	275.66	292.36	311.5	325.61		(73)
6. Solar gain														
Solar gains are		•					ations	to co		e applica		tion.		
Orientation:	Access F Table 6d		Area m²			ux able 6a		т	g_ able 6b	Т	FF able 6c		Gains (W)	
							1					_	. ,	٦
Southeast 0.9x	0.77	X	8.6		X	36.79	X		0.63	×	0.7	_ =	97.28	[(77)
Southeast 0.9x	0.77	X	8.6		X	62.67	X		0.63	X	0.7	=	165.7	(77)
Southeast 0.9x	•	X	8.6		x	85.75	] X ]		0.63		0.7	=	226.72	(77)
Southeast 0.9x	0.77	X	8.6		-	106.25	X 1		0.63	×	0.7	_ =	280.91	[(77)
Southeast 0.9x	0.77	X	8.6	35	X	119.01	X		0.63	X	0.7	=	314.65	(77)

Southeast <sub>0.9x</sub>	0.77	X	8.6	S5	x	118.15	X		0.63	x	0.7	=	312.37	(77)
Southeast 0.9x	0.77	X	8.6	S5	x	113.91	x		0.63	x	0.7	=	301.16	(77)
Southeast 0.9x	0.77	X	8.6	65	x	104.39	X		0.63	x	0.7	=	275.99	(77)
Southeast 0.9x	0.77	X	8.6	65	x	92.85	x		0.63	x	0.7	=	245.49	(77)
Southeast 0.9x	0.77	Х	8.6	35	х	69.27	X		0.63	x	0.7	=	183.13	(77)
Southeast <sub>0.9x</sub>	0.77	X	8.6	35	х	44.07	х		0.63	х	0.7	=	116.52	(77)
Southeast 0.9x	0.77	X	8.6	35	x	31.49	x		0.63	x	0.7	=	83.25	(77)
•														
Solar gains in	watts, ca	alculated	for eac	h month			(83)m	ı = Sı	um(74)m .	(82)m	_			
(83)m= 97.28	165.7	226.72	280.91	314.65	312.3	7 301.16	275.	.99	245.49	183.13	116.52	83.25		(83)
Total gains – i	internal a	nd solar	(84)m =	= (73)m	+ (83)r	n , watts							•	
(84)m= 431.28	497.9	548.58	586.25	603.47	585.1	2 563.37	543.	.24	521.15	475.49	428.01	408.86		(84)
7. Mean inte	rnal temp	erature	(heating	season	)									
Temperature	during h	eating p	eriods ir	n the livi	ng are	a from Ta	ble 9,	, Th	1 (°C)				21	(85)
Utilisation fac	ctor for g	ains for I	iving are	ea, h1,m	(see	Table 9a)								
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(86)m= 0.99	0.99	0.97	0.92	0.82	0.65	0.48	0.5	52	0.75	0.94	0.99	0.99		(86)
Mean interna	al temper	ature in	living are	ea T1 (fo	ollow s	tens 3 to	7 in T	able	e 9c)			•	•	
(87)m= 19.9	20.08	20.33	20.62	20.84	20.96	- <del>i</del>	20.9		20.93	20.64	20.21	19.87		(87)
Temperature	during b	ooting n	oriode ir	roct of	dwollir	a from T	abla C		2 (°C)					
(88)m= 19.94	19.94	19.95	19.95	19.96	19.96	<del>-</del>	19.9		19.96	19.96	19.95	19.95		(88)
` '	ļ.			<u> </u>		<u> </u>		<u> </u>	10.00	10.00	10.00	10.00		()
Utilisation fac					<del>- `</del>		T		0.00	0.04	T		Ī	(00)
(89)m= 0.99	0.98	0.96	0.9	0.77	0.56	0.37	0.4	1	0.66	0.91	0.98	0.99		(89)
Mean interna	al temper	ature in	the rest	of dwelli		<u>`                                    </u>	eps 3	to 7	in Tabl	e 9c)		ı	Ī	
(90)m= 18.5	18.76	19.11	19.52	19.81	19.94	19.96	19.9	96	19.91	19.56	18.96	18.46		(90)
									f	LA = Livir	ng area ÷ (	4) =	0.48	(91)
Mean_interna	al temper	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1	– fL	A) × T2					
(92)m= 19.17	19.39	19.69	20.04	20.3	20.43	20.45	20.4	45	20.39	20.07	19.56	19.13		(92)
Apply adjusti	ment to the	ne mean	interna	temper	ature f	rom Table	4e, v	whe	re appro	priate	i		•	
(93)m= 19.17	19.39	19.69	20.04	20.3	20.43	20.45	20.4	45	20.39	20.07	19.56	19.13		(93)
8. Space hea														
Set Ti to the the utilisation					ned at	step 11 of	Tabl	e 9b	o, so tha	t Ti,m=(	76)m an	d re-calc	culate	
Jan	Feb	Mar	Apr	May	Jun	Jul	ΙΔι	ug	Sep	Oct	Nov	Dec		
Utilisation fac			•	iviay	l our	1 001	1 /10	ug į	ОСР	001	1100	Dec		
(94)m= 0.99	0.98	0.95	0.9	0.79	0.6	0.42	0.4	16	0.7	0.91	0.98	0.99		(94)
Useful gains	, hmGm ,	W = (94)	1)m x (84	ւ 4)m	<u> </u>	-1					Į.	1		
(95)m= 426.54	486.98	523.77	527.31	474.42	350.9	7 238.96	250.	.01	365.55	434.01	418.51	405.31		(95)
Monthly aver	age exte	rnal tem	perature	from T	able 8						<u> </u>		•	
(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	e for mea	an intern	al tempe	erature,	Lm , V	/ =[(39)m	x [(93	3)m-	- (96)m	]			•	
(97)m= 952.16	925.74	841.17	703.73	542.34	364.3	240.86	252.	.88	394.64	597.22	788.33	948.2		(97)
Space heating	Ť						<del></del>	Ť		<del>- `</del>	<del> </del>		Ī	
(98)m= 391.06	294.84	236.14	127.02	50.53	0	0	0		0	121.43	266.27	403.91		

Space heating requirement in kWh/m²/year  9a. Energy requirements – Individual heating systems including micro-CHP)  Space heating: Fraction of space heat from secondary/supplementary system  Fraction of space heat from main system(s)  Fraction of total heating from main system 1  Efficiency of main space heating system 1  Efficiency of secondary/supplementary heating system, %  Total per year (kWh/year) = Sum(98) <sub>15912</sub> = 1891.21  34.64  34.64  93.64  10  11  11  12  12  13  14  15  16  16  17  17  18  18  18  18  18  18  18  18	(98) (99) (201) (202) (204)
9a. Energy requirements – Individual heating systems including micro-CHP)  Space heating: Fraction of space heat from secondary/supplementary system  Fraction of space heat from main system(s)  Fraction of total heating from main system 1  Efficiency of main space heating system 1  Space heating system 1  (202) = 1 - (201) = 1  (204) = (202) × [1 - (203)] = 1  93.5	(201)
Space heating:Fraction of space heat from secondary/supplementary system0Fraction of space heat from main system(s) $(202) = 1 - (201) =$ 1Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$ 1Efficiency of main space heating system 193.5	(202)
Fraction of space heat from secondary/supplementary system  Fraction of space heat from main system(s) $(202) = 1 - (201) = 1$ Fraction of total heating from main system 1  Efficiency of main space heating system 1 $(204) = (202) \times [1 - (203)] = 1$ $(204) = (202) \times [1 - (203)] = 1$ $(204) = (202) \times [1 - (203)] = 1$	(202)
Fraction of space heat from main system(s) $ (202) = 1 - (201) = $ $ 1 $ Fraction of total heating from main system 1 $ (204) = (202) \times [1 - (203)] = $ $ 1 $ Efficiency of main space heating system 1 $ 93.5 $	(202)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] = 1$ Efficiency of main space heating system 1 $93.5$	] `
Efficiency of main space heating system 1 93.5	
	(206)
, , , , , , , , , , , , , , , , , , , ,	(208)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/yea	]
Space heating requirement (calculated above)	•
391.06 294.84 236.14 127.02 50.53 0 0 0 121.43 266.27 403.91	
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$	(211)
418.25 315.34 252.55 135.85 54.05 0 0 0 129.87 284.78 431.99	
Total (kWh/year) =Sum(211) <sub>15,1012</sub> = 2022.69	(211)
Space heating fuel (secondary), kWh/month	
$= \{ [(98)m \times (201)] \} \times 100 \div (208) $ $(215)m =                                   $	
Total (kWh/year) =Sum(215) <sub>151012</sub> = 0	(215)
Water heating	]`
Output from water heater (calculated above)	
173.11     152.74     160.78     144.64     142.11     127.52     122.97     134.24     133.78     149.96     157.92     169.12	1
Efficiency of water heater 79.8	(216)
(217)m= 86.92   86.54   85.84   84.47   82.35   79.8   79.8   79.8   79.8   84.26   86.2   87.06	(217)
Fuel for water heating, kWh/month $(219)m = (64)m \times 100 \div (217)m$	
(219)m= 199.15 176.49 187.3 171.23 172.56 159.79 154.1 168.22 167.65 177.97 183.21 194.26	_
Total = Sum(219a) <sub>112</sub> = 2111.94	(219)
Annual totals kWh/year kWh/year Space heating fuel used, main system 1 2022.69	1
	] 1
Water heating fuel used 2111.94	
Electricity for pumps, fans and electric keep-hot	
central heating pump:	(2300
boiler with a fan-assisted flue	(230e
Total electricity for the above, kWh/year sum of (230a)(230g) = 75	(231)
Electricity for lighting 261.91	(232)
12a. CO2 emissions – Individual heating systems including micro-CHP	
Energy Emission factor Emissions kWh/year kg CO2/kWh kg CO2/year	r
Space heating (main system 1) (211) $\times$ 0.216 = 436.9	(261)

Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	456.18 (264)
Space and water heating	(261) + (262) + (263) + (264) =		893.08 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	135.93 (268)
Total CO2, kg/year	sum	of (265)(271) =	1067.94 (272)

TER = 19.56 (273)