# **Regulations Compliance Report**

Approved Document L1A, 2013 Edit Printed on 28 October 2020 at 14:53	ion, England assessed by Stror 3:36	na FSAP 2012 program, Version: 1.0.5.9	
Project Information:			
Assessed By: Zahid Ashraf (S	TRO001082)	Building Type: Flat	
Dwelling Details:			
NEW DWELLING DESIGN STAGE		Total Floor Area: 70.22m <sup>2</sup>	
Site Reference : Hermitage Lane		Plot Reference: Plot 47	
Address :			
Client Details:			
Name: Address :			
This report covers items included It is not a complete report of regu	within the SAP calculations. lations compliance.		
1a TER and DER			
Fuel for main heating system: Mains	gas (c)		
Fuel factor: 1.00 (mains gas (c))			
Target Carbon Dioxide Emission Ra	te (TER)	22.43 kg/m <sup>2</sup>	
Dwelling Carbon Dioxide Emission F	Rate (DER)	14.67 kg/m²	OK
1b TFEE and DFEE			
Target Fabric Energy Efficiency (TFI		72.0 kWh/m <sup>2</sup>	
Dweiling Fabric Energy Efficiency (L	IFEE)	53.3 KVVN/m <sup>2</sup>	OK
2 Echric II volues			UK
	A	llinhoot	
			OK
External wall	0.15 (max, 0.30)	0.13 (max, 0.70)	OK
Roof	0.12 (max, 0.23)	0.12 (max, 0.70) 0.10 (max, 0.35)	OK
Openings	1.40 (max, 2.00)	1 40 (max 3 30)	OK
2a Thermal bridging	1110 (110) 2100)		• · · ·
Thermal bridging calculated	d from linear thermal transmittar	oces for each junction	
3 Air permeability			
Air permeability at 50 pascals		3 00 (design value)	
Maximum		10.0	ОК
1 Heating efficiency			
Main Heating system:	Community heating schem	es - mains das	
Main Heating System.	Community heating schem	es - 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 tw	vo room thermostats	ОК
Hot water controls:	No cylinder thermostat No cylinder		

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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:	1.02	
Maximum	1.5	ОК
MVHR efficiency:	93%	
Minimum	70%	OK
9 Summertime temperature		
Overheating risk (Thames valley):	Slight	ОК
Based on:	-	
Overshading:	Average or unknown	
Windows facing: North East	7.5m <sup>2</sup>	
Windows facing: North West	6.12m <sup>2</sup>	
Ventilation rate:	6.00	
10 Key features		
Air permeablility	3.0 m³/m²h	
Roofs U-value	0.1 W/m²K	
Floors U-value	0.12 W/m²K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

			User D	etails:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 20	012		Stroma Softwa	a Num Ire Ver	ber: sion:		STRO Versio	001082 n: 1.0.5.9	
		Pr	operty /	Address:	Plot 47					
Address :										
1. Overall dwelling dime	ensions:									
Ground floor			Area	<b>a(m²)</b> 0.22	(1a) x	Av. He	<b>ight(m)</b> 2.5	(2a) =	Volume(m <sup>3</sup> 175.55	) (3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(	1e)+(1n	) 7	0.22	(4)					
Dwelling volume					(3a)+(3b)	+(3c)+(3c	l)+(3e)+	.(3n) =	175.55	(5)
2. Ventilation rate:										
	main heating	secondary heating	y	other		total			m <sup>3</sup> per hou	r
Number of chimneys	0 +	0	] + [	0	] = [	0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	] + [	0	i = Г	0	x	20 =	0	(6b)
Number of intermittent fa	ins				, r L	0	x /	10 =	0	 (7a)
Number of passive vents	i					0	<b>x</b> '	10 =	0	 (7b)
Number of flueless gas fi	res					0	x 4	40 =	0	 (7c)
								Air ob	l	
					_			Air Ch	langes per no	ur
Infiltration due to chimne	ys, flues and fans = $\frac{1}{2}$	(6a)+(6b)+(7a	a)+(7b)+(7	7c) =	ontinuo fr	0	(16)	÷ (5) =	0	(8)
Number of storevs in t	he dwelling (ns)	idea, proceed	<i>rio (17),</i> c		onunue no	5111 (9) 10 (	10)		0	<b>၂</b> (9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timbe	er frame or	0.35 for	masonr	y constr	uction			0	(11)
if both types of wall are p deducting areas of openii	resent, use the value con ngs); if equal user 0.35	responding to	the greate	er wall area	a (after					_
If suspended wooden t	floor, enter 0.2 (unse	ealed) or 0.	1 (seale	d), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter (	C							0	(13)
Percentage of window	s and doors draught	stripped							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)
Air permeability value,	q50, expressed in c		s per ho	ur per so	uare m	etre of e	nvelope	area	3	
Air permeability value applie	$\frac{11}{10} = \frac{11}{10}$	[(17) ÷ 20]+(0	e or a dec	se (10) = ( Iree air nei	meability	is heina u	sod		0.15	(18)
Number of sides sheltere	ed				meability	s being u	500		2	<b>(</b> 19)
Shelter factor				(20) = 1 - [	0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporat	ting shelter factor			(21) = (18)	x (20) =				0.13	(21)
Infiltration rate modified f	or monthly wind spe	ed								
Jan Feb	Mar Apr Ma	y Jun	Jul	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									
(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		
· · · · ·		I					•			

Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
~ ' '	0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calcul If me	ate effe echanic:	<i>ctive air</i> al ventila	change i ition:	rate for t	he appli	cable ca	se						0.5	(23a)
lf exh	aust air h	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)), other	wise (23b	) = (23a)			0.5	(23b)
If bala	anced with	h heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h)	) =	, , ,			79.05	(23c)
a) If	balance	ed mecha	anical ve	entilation	with he	at recove	erv (MVI	- - - - - - - - - - - - - - - - - - -	m = (2)	2b)m + (	23b) x [ <sup>-</sup>	1 – (23c)	- 1001	(200)
(24a)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25	]	(24a)
b) If	balance	ed mecha	anical ve	ntilation	without	heat rec	covery (N	и V) (24b	)m = (22	1 2b)m + (2	23b)		1	
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	iouse ex	tract ver	tilation of	or positiv	ve input v	ventilatio	on from c	outside	1		1	1	
i	if (22b)n	n < 0.5 ×	(23b), t	hen (24	c) = (23b	); otherv	wise (24	c) = (22b	) m + 0.	5 × (23b	)		_	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	/e input	ventilatio	on from l	oft	0 51				
(24d)m-		$\Gamma = \Gamma, \Pi$		$\frac{111}{0} = (221)$			4u)m =	0.5 + [(2.0)]			0	0	1	(24d)
Effo	1 ctivo air	change		tor (24a	$\sim$	$\sim$	$\sim$		(25)	0	0	0		(2.0)
(25)m=				0.25	0.24	0.23	0.23		0.23	0.24	0.25	0.25	]	(25)
(20)11-	0.27	0.20	0.20	0.20	0.24	0.20	0.20	0.22	0.20	0.24	0.20	0.20		(20)
3. He	at losse	s and he	eat loss p	paramete	er:									
ELEN	IENT	Gros area	ss (m²)	Openin m	gs I <sup>2</sup>	Net Ar A ,r	ea n²	U-valı W/m2	le K	A X U (W/I	<b>&lt;</b> )	k-value kJ/m²·l	e A K k.	X k J/K
Doors						2	x	1.4	=	2.8				(26)
Windo	ws Type	e 1				7.5	x1	/[1/( 1.4 )+	0.04] =	9.94				(27)
Windo	ws Type	e 2				6.12	x1	/[1/( 1.4 )+	0.04] =	8.11				(27)
Floor						5.699	) x	0.12		0.68388	 3 [			(28)
Walls -	Type1	54.9	96	13.6	2	41.34	ı x	0.15	=	6.2	i F		$\exists$	(29)
Walls -	Type2	18.9	92	2		16.92	<u>x</u>	0.14		2.39	i F		≓	(29)
Roof		70.2	22	0		70.22	<u>2</u> x	0.1		7.02	= i		$\exists$	(30)
Total a	area of e	elements	, m²			149.8	3		I		L			(31)
* for win	ndows and	l roof wind	ows, use e	ffective wi	ndow U-va	alue calcul	ated using	formula 1,	/[(1/U-valı	ıe)+0.04] a	ns given in	paragraph	1 3.2	
** inclua	le the area	as on both	sides of in	nternal wal	ls and par	titions		(26) (20)	. (22)					<b>—</b>
Fabric	neat los	SS, VV/K :	= S (A X	U)				(20)(30)	+ (32) =			(00-)	37.16	(33)
Heat C	apacity	Cm = S(	(A X K )			1/100.21			((28)	(30) + (32	2) + (32a).	(32e) =	1875.07	(34)
For door	iai mass	s parame	eter (Tivif	f = Cm +	- IFA) If	ion are not	t known n	onisoly the	indicative		TMD in T	abla 1f	100	(35)
can be u	used inste	ad of a de	tailed calc	ulation.	construct	ion ale noi	known pi	ecisely life	muicative	values of				
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	<						22.44	(36)
if details	s of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)								
Total fa	abric he	at loss							(33) +	(36) =			59.6	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y 				(38)m	= 0.33 × (	25)m x (5)	)	1	
(0.6)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(00)
(38)m=	15.49	15.3	15.12	14.19	14.01	13.09	13.09	12.9	13.45	14.01	14.38	14.75		(38)
Heat tr	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m	1	1	
(39)m=	75.09	74.9	74.72	73.8	73.61	72.69	72.69	72.5	73.06	73.61	73.98	74.35	70.75	
										erage =	oum(39)₁	12 / TZ=	/3./5	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.07	1.07	1.06	1.05	1.05	1.04	1.04	1.03	1.04	1.05	1.05	1.06		
Numbr	or of day		nth (Tab							Average =	Sum(40)1.	12 /12=	1.05	(40)
NULLIDE	lan	Feb	Mar		May	lun	1.1	Δυσ	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(,														
4. Wa	iter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13.9 A £ 13.9	ipancy,   9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13	2. .9)	25		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usaq hot water person pel	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	92 f	.29		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres pei	r day for ea	ach month	Vd,m = ta	ctor from	l able 1c x	(43)			07.00	404.50		
(44)m=	101.52	97.82	94.13	90.44	86.75	83.06	83.06	86.75	90.44	94.13	97.82	101.52	1107 44	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	m x nm x [	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	1107.44	
(45)m=	150.54	131.67	135.87	118.45	113.66	98.08	90.88	104.29	105.54	122.99	134.26	145.79		
lf instant	aneous w	ater heati	ng at point	t of use (no	o hot water	<sup>r</sup> storage),	enter 0 in	boxes (46	) to (61)	Total = Su	m(45) <sub>112</sub> =		1452.03	(45)
(46)m=	22.58	19.75	20.38	17.77	17.05	14.71	13.63	15.64	15.83	18.45	20.14	21.87		(46)
Water	storage	loss:	<b>I</b>	<b>I</b>	<u> </u>	<u> </u>	I	<u> </u>	I	I				
Storag	e volum	e (litres)	) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr	nunity h /ise if no	eating a	and no ta	ank in dw ar (this in	velling, e ocludes i	nter 110 nstantar	) litres in	(47) mbi boil	ers) ente	r '0' in <i>(</i>	(47)			
Water	storage	loss:	not wate			notantai								
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	<sup>-</sup> storage	e, kWh/ye	ear			(48) x (49)	) =		1	10		(50)
b) If m Hot wa	anufact	urer's de age loss	eclared (	cylinder l rom Tabl	oss fact e 2 (kW	or is not h/litre/da	known: av)				0	02		(51)
If com	nunity h	eating s	ee secti	on 4.3	- (	.,					0.	02		(0.)
Volum	e factor	from Ta	ble 2a								1.	03		(52)
Tempe	rature f	actor fro	m Table	2b							0	.6		(53)
Energy	lost fro	m water	r storage	e, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter	(50) OF (	(54) IN (5	oulated :	for oach	month			((56)m - (	55) v (41)	<b>m</b>	1.	03		(55)
valer	sionage											00.04		(50)
(56)m= If cylinde	32.01 er contains	28.92 s dedicate	d solar sto	30.98 prage, (57)	32.01 m = (56)m	30.98 x [(50) – (	32.01 H11)] ÷ (5	0), else (5	30.98 7)m = (56)	32.01 m where (	30.98 H11) is fro	32.01 m Append	ix H	(96)
(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)
Primar	v circuit	loss (ar	nual) fro	u om Table	• 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m		L			
(mod	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	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 ca	alculated	for eacl	n month	(61)m =	(60)	) ÷ 365 × (4	1)m							
(61)m=	0	0	0	0	0		0 0		0	0	0	0	0		(61)
Total h	eat req	uired for	water h	eating ca	alculated	l for	each mont	h (62	)m =	0.85 × (	(45)m -	+ (46)m +	(57)m	+ (59)m + (61)m	
(62)m=	205.82	181.59	191.15	171.95	168.94	15	1.57 146.16	6 159	9.57	159.03	178.27	7 187.75	201.07	· ]	(62)
Solar DI	HW input	calculated	using Ap	pendix G o	r Appendix	H (I	negative quant	ity) (er	iter '0	' if no sola	r contrib	ution to wate	er heating	g)	
(add a	dditiona	al lines if	FGHRS	and/or	WWHRS	ар	plies, see A	ppen	dix C	G)	_				
(63)m=	0	0	0	0	0		0 0		0	0	0	0	0		(63)
Output	from w	ater hea	ter												
(64)m=	205.82	181.59	191.15	171.95	168.94	15	1.57 146.16	5 159	9.57	159.03	178.27	7 187.75	201.07	·	
									Outp	out from wa	ater hea	ter (annual)	12	2102.87	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5´[	0.85 × (45)	m + (	61)m	n] + 0.8 >	د [(46)r	n + (57)m	+ (59)	m ]	
(65)m=	94.28	83.72	89.4	82.18	82.01	75	5.41 74.44	78	3.9	77.89	85.12	87.44	92.7	7	(65)
inclu	ide (57)	m in cal	culation	of (65)m	only if c	ylin	der is in the	dwe	lling	or hot w	ater is	from com	munity	 heating	
5. Int	ternal d	ains (see	e Table	5 and 5a	):	-			-				-	-	
Metab	olic gai	ns (Table	5) Wa	tte	/										
metab	Jan	Feb	Mar		Mav		Jun Jul		ua	Sep	Oct	Nov	Dec	-	
(66)m=	112.57	112.57	112.57	112.57	112.57	11	2.57 112.57	/ 11:	2.57	112.57	112.57	112.57	112.57	,	(66)
Lightin	n dains	L (calcula	L ted in A	I nnendix	I Lequat	ion	  9 or   9a)		See -	I Table 5	1				
(67)m=	17.82	15.83	12.87	9.75	7.28	6	15 6.65	8	64	11.59	14.72	17.18	18.32	7	(67)
Appliq							on 12 or l	120)							
	107.81					15		13a),	5 03	151 11		176.02	180.09	2	(68)
	197.01	199.00	194.09	100.00	103.70			· · · · ·				170.02	109.00	, 	(00)
						ion		a), as $1^{24}$	50 SE		0 24.26	24.26	24.26	7	(60)
(09)11=	34.20	. 34.20	(	34.20	34.20	34	4.20 34.20	34	.20	34.20	34.20	34.20	34.20		(03)
Pumps	s and fa	ins gains	(Table	5a)										-	( <b>70</b> )
(70)m=	0	0	0	0	0		0 0		0	0	0	0	0		(70)
Losses	s e.g. e	vaporatio	on (nega	tive valu	es) (Tab	le 5	5)			1				-	
(71)m=	-90.06	-90.06	-90.06	-90.06	-90.06	-9	0.06 -90.06	-90	0.06	-90.06	-90.06	-90.06	-90.06	i .	(71)
Water	heating	gains (1	able 5)				i					-		_	
(72)m=	126.72	124.59	120.16	114.14	110.23	10	4.73 100.05	5 10	6.05	108.18	114.4	121.44	124.59	)	(72)
Total i	nterna	l gains =					(66)m + (67)	)m + (6	8)m +	+ (69)m + (	(70)m +	(71)m + (72)	)m	_	
(73)m=	399.12	397.05	384.5	364.34	344.07	32	4.37 311.46	31	7.39	327.65	348.02	371.41	388.77	,	(73)
6. So	lar gain	s:													
Solar g	jains are	calculated	using sola	ar flux from	Table 6a	and	associated eq	uations	to co	onvert to th	e applic	able orientat	tion.		
Orienta	ation:	Access F	actor	Area			Flux		т	g_		FF Tabla Ga		Gains	
		Table 60				_	Table 6a	_		able ob				(VV)	_
Northea	ast <mark>0.9x</mark>	0.77	×	7.	5	x	11.28	x		0.63	x	0.7	=	25.86	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	7.	5	× [	22.97	x		0.63	x	0.7	=	52.64	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	7.	5	× [	41.38	x		0.63	x	0.7	=	94.84	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	7.	5	x [	67.96	x		0.63	x	0.7	=	155.76	(75)
Northea	ast <mark>0.9x</mark>	0.77	×	7.	5	x	91.35	x		0.63	x	0.7	=	209.37	(75)

Northeast 0.9x	0.77	x	7.	5	x	9	7.38	x	0.63	x	0.7	=	223.21	(75)
Northeast 0.9x	0.77	x	7.	5	x	9	91.1	x	0.63	×	0.7	=	208.81	(75)
Northeast 0.9x	0.77	x	7.	5	x	7	2.63	x	0.63	×	0.7	=	166.47	(75)
Northeast 0.9x	0.77	x	7.	5	x	5	0.42	x	0.63	×	0.7	=	115.57	(75)
Northeast 0.9x	0.77	x	7.	5	x	2	8.07	x	0.63	x	0.7	=	64.33	(75)
Northeast 0.9x	0.77	x	7.	5	x	1	14.2	x	0.63	×	0.7	=	32.54	(75)
Northeast 0.9x	0.77	x	7.	5	x	g	9.21	x	0.63	×	0.7	=	21.12	(75)
Northwest 0.9x	0.77	x	6.1	2	x	1	1.28	x	0.63	×	0.7	=	21.1	(81)
Northwest 0.9x	0.77	x	6.1	2	x	2	2.97	x	0.63	×	0.7	=	42.96	(81)
Northwest 0.9x	0.77	x	6.1	2	x	4	1.38	x	0.63	x	0.7	=	77.39	(81)
Northwest 0.9x	0.77	x	6.1	2	x	6	7.96	x	0.63	x	0.7	=	127.1	(81)
Northwest 0.9x	0.77	x	6.1	2	x	9	1.35	x	0.63	x	0.7	=	170.85	(81)
Northwest 0.9x	0.77	x	6.1	2	x	9	7.38	x	0.63	×	0.7	=	182.14	(81)
Northwest 0.9x	0.77	x	6.1	2	x	9	91.1	x	0.63	x	0.7	=	170.39	(81)
Northwest 0.9x	0.77	x	6.1	2	x	7	2.63	x	0.63	x	0.7	=	135.84	(81)
Northwest 0.9x	0.77	x	6.1	2	x	5	0.42	x	0.63	x	0.7	=	94.3	(81)
Northwest 0.9x	0.77	x	6.1	2	x	2	8.07	x	0.63	x	0.7	=	52.5	(81)
Northwest 0.9x	0.77	x	6.1	2	x	1	14.2	x	0.63	x	0.7	=	26.55	(81)
Northwest 0.9x	0.77	x	6.1	2	x	ę	9.21	x	0.63	x	0.7	=	17.23	(81)
Solar gains in	watts ca	alculated	for eac	h month	n			(83)m	ı = Sum(74)m	(82)m				
(83)m= 46.96	95.6	172.24	282.86	380.22	. 40	05.36	379.2	302	.31 209.87	116.8	3 59.09	38.35	]	(83)
Total gains –	internal a	nd solar	(84)m =	- = (73)m	+ (8	83)m ,	, watts						<b>_</b>	
(84)m= 446.09	492.65	556.73	647.2	724.29	7	29.73	690.66	619	0.7 537.52	464.8	5 430.51	427.12	]	(84)
7 Mean inte	rnal temp	erature	(heating	seasor	n)									

1.1110		nai tomp	oracaro	(incaming	0000011	/								
Temp	erature	during h	eating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	iving are	ea, h1,m	(see Ta	ble 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.96	0.95	0.91	0.84	0.71	0.56	0.43	0.49	0.71	0.88	0.95	0.96		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)				-	
(87)m=	18.84	19.06	19.49	20.08	20.56	20.84	20.94	20.92	20.68	20.06	19.36	18.8		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, Tl	h2 (°C)				_	
(88)m=	20.03	20.03	20.03	20.04	20.04	20.05	20.05	20.06	20.05	20.04	20.04	20.03		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling, I	h2,m (se	e Table	9a)					_	
(89)m=	0.96	0.94	0.9	0.81	0.67	0.49	0.35	0.4	0.65	0.86	0.94	0.96		(89)
			-	4	- <b>f</b> - <b>h</b> 112				7 in Tabl	a () a)			•	

#### Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.13	17.46	18.08	18.9	19.55	19.91	20.02	20	19.73	18.9	17.9	17.08		(90)
					-		-		1	LA = Livin	g area ÷ (4	4) =	0.34	(91)
	• •						· · ·	<i></i>						-

# Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m=17.711818.5619.319.8920.2320.3320.3120.0519.318.417.67(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.71	18	18.56	19.3	19.89	20.23	20.33	20.31	20.05	19.3	18.4	17.67		(93)
8. Spa	ace hea	ting requ	uirement											
Set Ti the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	nperatur using Ta	e obtain Ible 9a	ed at ste	ep 11 of	Table 9t	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	:									I	
(94)m=	0.94	0.92	0.88	0.79	0.66	0.51	0.37	0.43	0.65	0.84	0.92	0.94		(94)
Usefu	I gains,	hmGm ,	, W = (94	4)m x (84	4)m									
(95)m=	417.88	452.37	488.62	513.48	481.07	368.91	258.8	265.43	351.22	389.9	394.01	402.58		(95)
Month	nly avera	age exte	rnal tem	perature	e from Ta	able 8	r	r						
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	_m , W =	=[(39)m :	x [(93)m·	– (96)m	]				(07)
(97)m=	1007.3	981.54	901.07	767.77	603.11	409.23	271.32	283.72	434.76	640.36	836.04	1001.36		(97)
Space		g require		r each m		/vn/moni	$\ln = 0.02$	24 X [(97)	)m – (95	)mj x (4 <sup>-</sup>	1)m	11E E		
(96)11=	430.33	300.0	300.80	163.09	90.79	0	0	U	0	100.34	310.27	445.5	0004.00	
Space	e heatin	a reauire	ement in	kWh/m²	/vear			Tota	i per year	(kvvn/year	) = Sum(9	8)15,912 =	33.11	(98)
			ata Car	n munitu	hooting	aabama							00.11	](,
90. En	ergy req	uiremer od for on	ns - Cor	nmunity	neating	scheme	ator boot	ing prov	ided by		unity onk	omo		
Fractio	n of spa	ace heat	from se	condary/	supplen	ng or wa nentary l	neating (	Table 1	1) '0' if n	one	unity scr	ieme.	0	(301)
Fractio	n of spa	ace heat	from co	mmunity	system	1 – (301	1) =						1	(302)
The com	nmunity so	heme may	y obtain he	eat from se	everal sour	ces. The p	orocedure	allows for	CHP and u	up to four o	other heat	sources; ti	he latter	•
includes	boilers, h	eat pumps	s, geotherr	mal and wa	aste heat f	rom powei	r stations.	See Apper	ndix C.					1
Fractio	n of hea	at from C	Commun	ity boiler	S								1	(303a)
Fractio	n of tota	al space	heat fro	m Comn	nunity bo	oilers				(3	02) x (303	a) =	1	(304a)
Factor	for cont	rol and o	charging	method	(Table 4	4c(3)) fo	r commu	unity hea	iting sys	tem			1	(305)
Distrib	ution los	s factor	(Table 1	2c) for c	commun	ity heatir	ng syste	m					1.05	(306)
Space	heating	9											kWh/year	_
Annua	space	heating	requirem	nent									2324.99	
Space	heat fro	m Comr	munity b	oilers					(98) x (30	04a) x (30	5) x (306) :	=	2441.24	(307a)
Efficier	ncy of se	econdary	y/supple	mentary	heating	system	in % (fro	om Table	e 4a or A	ppendix	E)		0	(308
Space	heating	requirer	ment fro	m secon	dary/sup	plemen	tary syst	tem	(98) x (30	01) x 100 -	+ (308) =		0	(309)
Water Appual	heating	<b>j</b>	equirem	ent									2102 87	1
If DHW	from co	ommunit	ty schem	ne:									2102.07	]
Water	heat fro	m Comn	nunity bo	oilers					(64) x (30	03a) x (30	5) x (306) =	=	2208.02	(310a)
Electric	city used	d for hea	t distribu	ution				0.01	× [(307a).	(307e) +	(310a)(	310e)] =	46.49	(313)
Coolin	g Syster	n Energ	y Efficie	ncy Ratio	C								0	(314)
Space	cooling	(if there	is a fixe	d cooling	g system	n, if not e	enter 0)		= (107) ÷	(314) =			0	(315)
Electric mecha	city for p nical ve	oumps aintilation	nd fans v - balanc	within dw ed, extra	velling (1 act or po	able 4f) sitive inj	: put from	outside					273.07	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330l	b) + (330g) =		273.07	(331)
Energy for lighting (calculated in Appendix L)				314.73	(332)
Electricity generated by PVs (Appendix M) (neg	ative quantity)			-708.08	(333)
Electricity generated by wind turbine (Appendix	M) (negative quantity)			0	(334)
12b. CO2 Emissions – Community heating sche	eme				
	Energy kWh/year	Emission fac kg CO2/kWh	tor Er kg	nissions J CO2/year	
CO2 from other sources of space and water hea Efficiency of heat source 1 (%)	ating (not CHP) If there is CHP using two fuels repeat (363) to	(366) for the secon	d fuel	94	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	1068.34	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	24.13	(372)
Total CO2 associated with community systems	(363)(366) + (368)(372	2)	=	1092.47	(373)
CO2 associated with space heating (secondary	) (309) x	0	=	0	(374)

(332))) x

Total CO2 associated with space and water heating	(373) + (374) + (375) =

CO2 associated with electricity for pumps and fans within dwelling (331)) x

CO2 associated with electricity for lighting

Energy saving/generation technologies (333) to (334) as applicable Item 1

sum of (376)...(382) = Total CO2, kg/year **Dwelling CO2 Emission Rate** (383) ÷ (4) = El rating (section 14)

163.35	(379)
-367.49	(380)
1030.05	(383)
14.67	(384)
88.02	(385)

1092.47

141.72

=

=

x 0.01 =

0.52

0.52

0.52

(376)

(378)

# SAP 2012 Overheating Assessment

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

Property Details: Plot 47

Dwelling type: Located in: Region: Cross ventilation pose Number of storeys: Front of dwelling face Overshading: Overhangs: Thermal mass parame Night ventilation: Blinds, curtains, shutt Ventilation rate during Overheating Details: Summer ventilation her Transmission heat loss Summer heat loss coe	sible: s: eter: g hot wea eat loss as coeffic	ather (a coeffici cient:	ich): ient:	Flat England Thames va Yes 1 South Wes Average o None Indicative False 6 (Window 347.59 59.6 407.2	alley st r unknown Value Low ws fully open)			(P1) (P2)
Overnangs:								
<b>Orientation:</b> North East (NE) North West (NW)	<b>Ratio:</b> 0 0		<b>Z_overhangs:</b> 1 1					
Solar shading:								
<b>Orientation:</b> North East (NE) North West (NW)	<b>Z blind</b> 1 1	ls:	<b>Solar access:</b> 0.9 0.9	<b>Ove</b> 1 1	rhangs:	<b>Z summer:</b> 0.9 0.9		(P8) (P8)
Solar gains:								
<b>Orientation</b> North East (NE) North West (NW)	0.9 x 0.9 x	<b>Area</b> 7.5 6.12	<b>Flux</b> 98.85 98.85	<b>g_</b> 0.63 0.63	<b>FF</b> 0.7 0.7	Shading 0.9 0.9 Total	<b>Gains</b> 264.81 216.09 480.9	(P3/P4)
Internal gains:								
Internal gains Total summer gains Summer gain/loss ratio Mean summer external Thermal mass temperat Threshold temperature	tempera	ture (T	hames valley)	Ju 44 96 2 16 1 19	une 19.8 58.96 38 5 3 2.68	July 433.33 914.24 2.25 17.9 1.3 21.45	August 441.24 834.68 2.05 17.8 1.3 21.15	(P5) (P6) (P7)
Assessment of likelih	ood of h	igh inte	ernal temperatur	re: <u>SI</u>	ight	Siight	Slight	

Assessor Name:       Zahid Ashraf       Stroma Number:       STR0001082         Software Name:       Stroma FSAP 2012       Software Version:       Version: 1.0.5.9         Property Address: Plot 47       Version: 1.0.5.9       Version: 1.0.5.9         Address :       Image: Plot 47       Version: 1.0.5.9         1. Overall dwelling dimensions:       Av. Height(m)       Volume(m³)	
Property Address: Plot 47 Address : 1. Overall dwelling dimensions: Area(m <sup>2</sup> ) Av. Height(m) Volume(m <sup>3</sup> )	
Address : 1. Overall dwelling dimensions: Area(m <sup>2</sup> ) Av. Height(m) Volume(m <sup>3</sup> )	
1. Overall dwelling dimensions: Area(m <sup>2</sup> ) Av Height(m) Volume(m <sup>3</sup> )	
Area(m²) Av Height(m) Volume(m³)	
Ground floor     70.22     (1a) x     2.5     (2a) =     175.55     (3a)	a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 70.22 (4)	
Dwelling volume $(3a)+(3c)+(3d)+(3e)+(3n) = 175.55$ (5)	I
2. Ventilation rate:	
main secondary other total m <sup>3</sup> per hour heating beating	
Number of chimneys $0 + 0 + 0 = 0$ $x 40 = 0$ (6a)	a)
Number of open flues $0 + 0 + 0 = 0 \times 20 = 0$ (6b)	<b>ว</b> )
Number of intermittent fans $3 \times 10 = 30$ (7a)	a)
Number of passive vents $0 \times 10 = 0$ (7b)	ა)
Number of flueless gas fires $0 \times 40 = 0$ (7c	2)
Air changes per bour	
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 30$ $\div$ (5) = 0.17 (8) If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)	
Number of storeys in the dwelling (ns) $0$ (9)	,
Additional infiltration $[(9)-1]x0.1 = 0$ (10)	))
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	I)
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	2)
If no draught lobby, enter 0.05, else enter 0	3)
Percentage of windows and doors draught stripped	4)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$ 0       (15)	5)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16)	3)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area 3 (17	7)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ 0.32 (18	3)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used	2)
Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.85$ (20)	") ))
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.27$ (21)	1)
Infiltration rate modified for monthly wind speed	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Monthly average wind speed from Table 7	
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	
Wind Factor $(22a)m = (22)m \div 4$	
(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18	

Adjust	ed infiltr	ation rat	e (allowi	ng for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m				_		
<b>.</b>	0.35	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32			
Calcul	ate effe	ctive air	change i tion:	rate for t	he appli	cable ca	se								
lf exh	aust air h		usina Anne	endix N (2	<sup>1</sup> 3h) – (23a	a) x Emv (e	equation (I	N5)) other	wise (23h	) – (23a)			0		$\left[ \begin{array}{c} 23a \\ 32b \end{array} \right]$
lf hal:	anced with	heat reco	overv: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h	) =	) = (20u)			0		
a) If		d moob			with ho	of rocov			) = (2)	2h)m i (	226) v [/	1 (22a)	0		(23C)
a) II (24a)m-									0 $11 = (2)$	$\frac{20}{10}$		$\frac{1}{0}$	÷ 100]		(24a)
 h) If					without	hoot roc			$\frac{1}{2}$		) 22h)	Ū			(=,
0) II (24b)m-								viv) (240 0	0 $11 = (22)$	$\frac{20}{1}$		0	l		(24b)
(240)III=		0								0	0	0			(240)
с) п	if (22b)n	ouse ex ∩ < 0.5 ×	(23b), t	hen (24	c) = (23b)	b); other	ventilatio wise (24	c) = (22b	o) m + 0.	.5 × (23b	)				
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0			(24c)
d) If	natural if (22b)n	ventilation = 1, the	on or wh en (24d)	ole hous m = (221	se positiv b)m othe	ve input erwise (2	ventilatio 4d)m =	on from l 0.5 + [(2	oft 2b)m² x	0.5]					
(24d)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55			(24d)
Effe	ctive air	change	rate - er	nter (24a	ı) or (24t	) or (24	c) or (24	d) in boy	(25)						
(25)m=	0.56	0.56	0.56	0.55	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55			(25)
2 1 10	otlogge					1	1	•		1					
		s and ne	eat loss p		er:	Not Ar	200		10			k volue	<b>`</b>		k
		area	(m²)	n	195 1 <sup>2</sup>	A,r	n²	W/m2	K	(W/I	<b>&lt;</b> )	kJ/m²·l	<del>,</del> <	kJ/K	K K
Doors						2	X	1.4	=	2.8					(26)
Windo	ws Type	e 1				7.5	x1	/[1/( 1.4 )+	0.04] =	9.94					(27)
Windo	ws Type	92				6.12	x1	/[1/( 1.4 )+	0.04] =	8.11					(27)
Floor						5.699	) X	0.12	=	0.68388	3				(28)
Walls 7	Type1	54.9	96	13.6	2	41.34	1 X	0.15	=	6.2					(29)
Walls -	Type2	18.9	92	2		16.92	<u>2 x</u>	0.14	=	2.39					(29)
Roof		70.2	22	0		70.22	<u>2</u> X	0.1	=	7.02			7 7		(30)
Total a	area of e	lements	, m²			149.8	3								(31)
* for win ** inclua	dows and le the area	roof winde as on both	ows, use e sides of ir	effective wi nternal wal	indow U-va Is and par	alue calcul titions	ated using	g formula 1,	/[(1/U-valı	ıe)+0.04] a	ns given in	paragraph	n 3.2		
Fabric	heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				37.1	6	(33)
Heat c	apacity	Cm = S(	(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	1875.	.07	(34)
Therm	al mass	parame	ter (TMF	- Cm -	÷ TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	)	(35)
For desi can be ι	ign assess used inste	sments wh ad of a de	ere the de tailed calci	tails of the ulation.	construct	ion are noi	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f			-
Therm	al bridge	es : S (L	x Y) cal	culated	using Ap	pendix l	<						22.4	4	(36)
if details	s of therma	al bridging	are not kn	own (36) =	= 0.05 x (3	1)									_
Total f	abric he	at loss							(33) +	(36) =			59.6	3	(37)
Ventila	ation hea	at loss ca	alculated	monthl	y	1		1	(38)m	= 0.33 × (	25)m x (5)		I		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(38)m=	32.47	32.33	32.2	31.57	31.46	30.91	30.91	30.81	31.12	31.46	31.69	31.94			(38)
Heat tr	ransfer o	coefficier	nt, W/K	-					(39)m	= (37) + (3	38)m				
(39)m=	92.07	91.94	91.8	91.18	91.06	90.51	90.51	90.41	90.72	91.06	91.3	91.54			-
										Average =	Sum(39)1	12 /12=	91.1	8	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.31	1.31	1.31	1.3	1.3	1.29	1.29	1.29	1.29	1.3	1.3	1.3		
Numbe	er of dav	vs in mo	nth (Tab	le 1a)				-		Average =	Sum(40)1.	12 /12=	1.3	(40)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	ter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	ipancy,   9, N = 1 9, N = 1	N + 1.76 ×	: [1 - exp	(-0.0003	849 x (TF	FA -13.9	9)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13.	2. .9)	25		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the a vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	92 f	.29		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres pei	r day for e	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	· · · · ·					
(44)m=	101.52	97.82	94.13	90.44	86.75	83.06	83.06	86.75	90.44	94.13	97.82	101.52		
Enorm	contant of	hot water	upped op	loulotod m	onthly _ 1	100 v Vd r		Tm / 2600	- kW/b/mor	Total = Su	m(44) <sub>112</sub> =	- - 1d)	1107.44	(44)
					5/////y = 4.							<i>c, 10)</i>		
(45)m=	150.54	131.67	135.87	118.45	113.66	98.08	90.88	104.29	105.54	122.99 Total – Su	m(45)	145.79	1452.03	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water	storage	loss:							1		·			
Storag	e volum	e (litres)	) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr	nunity h vise if no	eating a	and no ta	ank in dw ar (this ir	/elling, e	nter 110 nstantar	) litres in	1 (47) Smbi boil	ars) ante	ər '()' in <i>(</i>	(17)			
Water	storage	loss:	not wate	51 (1113 11	iciuues i	nstantai			ers) erite					
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature fa	actor fro	m Table	2b								0		(49)
Energy	/ lost fro	m water	storage	e, kWh/ye	ear			(48) x (49)	) =			0		(50)
b) If m	anufact	urer's de	eclared (	cylinder   com Tabl	loss fact	or is not b/litro/da	known:					0		(51)
If com	munity h	leating s	see secti	on 4.3		n/ntre/ue	, y )					J		(31)
Volum	e factor	from Ta	ble 2a									0		(52)
Tempe	erature fa	actor fro	m Table	2b								0		(53)
Energy	/ lost fro	m water	storage	e, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter	(50) or (	(54) in (5	55)		_							0		(55)
Water	storage	loss cal	culated	for each	month		-	((56)m = (	55) × (41)ı	m	1		1	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	Page 1.1	(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m I	x [(50) – ( I	[H11)] ÷ (5 ]	50), else (5	7)m = (56) 1	m wnere ( r	H11) IS Tro	m Appena		
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m Novilia - Ira	r th a r	ata <sup>1</sup>			
(MOC								ng and a				0	l	(59)
(59)11=	U	U					0					U	l	(00)

(61)m=       0 </th <th><ul> <li>(61)</li> <li>(62)</li> <li>(63)</li> <li>(63)</li> <li>(64)</li> <li>(65)</li> </ul></th>	<ul> <li>(61)</li> <li>(62)</li> <li>(63)</li> <li>(63)</li> <li>(64)</li> <li>(65)</li> </ul>										
Total heat required for water heating calculated for each month $(62)m = 0.85 \times (45)m + (46)m + (57)m + (59)m + (61)m$ (62)m = 127.96 111.92 115.49 100.69 96.61 83.37 77.25 88.65 89.71 104.54 114.12 123.93 Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)m = 0  0  0  0  0  0  0  0  0  0	(62) (63) ](64) (65)										
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	(62) (63) ](64) (65)										
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 Output from water heater (64)m= 127.96 111.92 115.49 100.69 96.61 83.37 77.25 88.65 89.71 104.54 114.12 123.93 Output from water heater (annual)112 1234.23	(63) ](64) (65)										
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)         (63)m=       0       0       0       0       0       0       0       0         Output from water heater         (64)m=       127.96       111.92       115.49       100.69       96.61       83.37       77.25       88.65       89.71       104.54       114.12       123.93         Output from water heater (annual)	(63) ](64) (65)										
(63)m=       0       0       0       0       0       0       0       0       0       0       0         Output from water heater       (64)m=       127.96       111.92       115.49       100.69       96.61       83.37       77.25       88.65       89.71       104.54       114.12       123.93         Output from water heater (annual)         Output from water heater (annual)	(63) ](64) (65)										
Output from water heater         (64)m=       127.96       111.92       115.49       100.69       96.61       83.37       77.25       88.65       89.71       104.54       114.12       123.93         Output from water heater (annual)	](64) (65)										
(64)m=         127.96         111.92         115.49         100.69         96.61         83.37         77.25         88.65         89.71         104.54         114.12         123.93           Output from water heater (annual)	)(64) (65)										
Output from water heater (annual) <sub>112</sub> 1234.23	(64)										
Heat gains from water beating $k/k/b/month 0.25$ (0.85 x (46)m + (61)m] + 0.8 x (46)m + (57)m + (50)m ]											
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]	(65)										
(65)m= 31.99 27.98 28.87 25.17 24.15 20.84 19.31 22.16 22.43 26.14 28.53 30.98											
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating											
5. Internal gains (see Table 5 and 5a):											
Metabolic gains (Table 5) Watts											
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec											
(66)m= 112.57 112.57 112.57 112.57 112.57 112.57 112.57 112.57 112.57 112.57 112.57 112.57 112.57	(66)										
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5											
(67)m= 17.82 15.83 12.87 9.75 7.28 6.15 6.65 8.64 11.59 14.72 17.18 18.32	(67)										
Appliances gains (calculated in Appendix L equation 1.13 or 1.13a), also see Table 5											
(68)m= 197.81 199.86 194.69 183.68 169.78 156.71 147.99 145.93 151.11 162.12 176.02 189.08	(68)										
Cooking gains (calculated in Appendix L. equation L 15 or L 15a), also see Table 5											
$\begin{array}{c} (69)m = \\ 34.26$	(69)										
Pumps and fans gains (Table 5a)	· · ·										
(70)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(70)										
Losses e.g. evaporation (negative values) (Table 5)											
(71)m - $[-90, 06]$ $[-90,$	(71)										
Water besting gains (Table 5)	()										
(72) 42 41 64 28 81 24 06 22 46 28 05 25 06 20 70 21 15 25 12 20 62 41 64	(72)										
$T_{1} = \begin{bmatrix} 4.5 \\ 4.5 \end{bmatrix} + \begin{bmatrix} 4.5 \\ 4.5 \end{bmatrix} + \begin{bmatrix} 5.5 \\ 5.5 \end{bmatrix} = \begin{bmatrix} 5.5 \\ 5.5 \end{bmatrix} = \begin{bmatrix} 5.5 \\ 2.5 \end{bmatrix} = \begin{bmatrix} 5.$	(12)										
(00) (1 + (07)) (1 + (00)) (1 + (07)) (1	(72)										
(r3)m= 315.4 314.1 303.14 285.16 266.3 248.58 237.36 241.13 250.62 268.14 289.6 305.81	(73)										
o. Solar gains. Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.											
Orientation: Access Factor Area Flux a FF Gains											
Table 6d $m^2$ Table 6aTable 6bTable 6c(W)											
Northeast $0.9x$ 0.77 x 7.5 x 11.28 x 0.63 x 0.7 = 25.86	](75)										
Northeast $0.9x$ 0.77 x 7.5 x 22.97 x 0.63 x 0.77 = 52.64	](75)										
Northeast $0.9x$ 0.77 x 7.5 x 41.38 x 0.63 x 0.77 = 94.84	](75)										
Northeast $0.9x$ 0.77 x 7.5 x 67.96 x 0.63 x 0.77 = 155.76	](75)										
Northeast $0.9x$ 0.77 x 7.5 x 91.35 x 0.63 x 0.7 = 209.37	<u>_``</u>										

Northeas	t 0.9x	0.77		x	7.5	5	x	g	97.38	x	0.	.63	x	0.7		=	223.	21	(75)
Northeas	t 0.9x	0.77		x	7.5	5	x	9	91.1	x	0.	.63	×	0.7		=	208.	81	(75)
Northeas	t 0.9x	0.77		x	7.5	5	x	7	72.63	x	0.	.63	×	0.7		=	166.	47	(75)
Northeas	t 0.9x	0.77		x	7.5	5	x	5	50.42	x	0.	.63	×	0.7		=	115.	57	(75)
Northeas	t 0.9x	0.77		x	7.5	5	x	2	28.07	x	0.	.63	×	0.7		=	64.3	33	(75)
Northeas	t 0.9x	0.77		x	7.5	5	x		14.2	x	0.	.63	×	0.7		=	32.5	54	(75)
Northeas	t 0.9x	0.77		x	7.5	5	x	9	9.21	×	0.	.63	×	0.7		=	21.1	12	(75)
Northwes	st <u>0.9</u> x	0.77		x	6.1	2	x	1	1.28	×	0.	.63	×	0.7		=	21.	1	(81)
Northwes	st <u>0.9</u> x	0.77		x	6.1	2	x	2	22.97	x	0.	.63	×	0.7		=	42.9	96	(81)
Northwes	st 0.9x	0.77		x	6.1	2	x	4	1.38	×	0.	.63	×	0.7		=	77.3	39	(81)
Northwes	st 0.9x	0.77		x	6.1	2	x	6	67.96	×	0.	.63	×	0.7		=	127	.1	(81)
Northwes	st 0.9x	0.77		x	6.1	2	x	9	91.35	x	0.	.63	×	0.7		=	170.	85	(81)
Northwes	st 0.9x	0.77		x	6.1	2	x	9	97.38	×	0.	.63	×	0.7		=	182.	14	(81)
Northwes	st 0.9x	0.77		x	6.1	2	x		91.1	x	0.	.63	×	0.7		=	170.	39	(81)
Northwes	st 0.9x	0.77		x	6.1	2	x	7	72.63	x	0.	.63	×	0.7		=	135.	84	(81)
Northwes	st 0.9x	0.77		x	6.1	2	x	5	50.42	×	0.	.63	×	0.7		=	94.	3	(81)
Northwes	st 0.9x	0.77		x	6.1	2	x	2	28.07	x	0.	.63	×	0.7		=	52.	5	(81)
Northwes	st 0.9x	0.77		x	6.1	2	x		14.2	x	0.	.63	×	0.7		=	26.5	55	(81)
Northwes	st <u>0.9</u> x	0.77		x	6.1	2	x		9.21	x	0.	.63	×	0.7		=	17.2	23	(81)
Solar da	ins in	watts. ca	alculate	ed	for eacl	h mont	h			(83)m	n = Sum(	(74)m	.(82)m						
(83)m=	46.96	95.6	172.24	ŀ	282.86	380.22	4	405.36	379.2	302	.31 20	09.87	116.8	3 59.09	38	.35			(83)
Total ga	ins – i	nternal a	and sola	ar	(84)m =	= (73)m	+ (	(83)m	, watts					!					
(84)m=	362.37	409.7	475.38	3	568.02	646.52	6	653.94	616.57	543	.44 46	60.49	385.5	7 348.69	344	4.17			(84)
7. Mea	n inter	nal temp	peratur	e (	heating	seaso	n)												
Tempe	rature	during h	neating	pe	eriods ir	n the liv	ving	area	from Tab	ole 9	, Th1 ('	°C)					21		(85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.98	0.97	0.94	0.89	0.8	0.66	0.54	0.61	0.81	0.93	0.97	0.98		(86)
Mean	internal	temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Table	e 9c)					
(87)m=	18.15	18.39	18.87	19.56	20.2	20.65	20.85	20.79	20.38	19.58	18.75	18.1		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, Tl	n2 (°C)					
(88)m=	19.83	19.83	19.84	19.84	19.84	19.85	19.85	19.85	19.85	19.84	19.84	19.84		(88)
Utilisa	Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)													
(89)m=	0.97	0.96	0.94	0.87	0.76	0.59	0.43	0.5	0.75	0.91	0.96	0.98		(89)
Mean	internal	temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	ps 3 to 7	7 in Tabl	e 9c)				
(90)m=	17.24	17.47	17.95	18.63	19.23	19.63	19.78	19.75	19.42	18.66	17.84	17.19		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.34	(91)
													•	

# Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$ (92)m=17.5517.7818.2718.9419.5619.9820.1520.1119.7518.9718.1517.5

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(92)

(93)m=	17.55	17.78	18.27	18.94	19.56	19.98	20.15	20.11	19.75	18.97	18.15	17.5		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set Ti the ut	to the rilisation	mean int factor fo	ernal tei or gains	mperatui using Ta	re obtain Ible 9a	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(	76)m an	d re-calc	culate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	tion fac	tor for g	ains, hm	1 <u></u> 1:										
(94)m=	0.96	0.95	0.92	0.85	0.74	0.6	0.46	0.53	0.75	0.9	0.95	0.97		(94)
Usefu	l gains,	hmGm	W = (94	4)m x (84	4)m			•			•	•		
(95)m=	348.52	388.49	436.4	483.95	480.59	391.75	285.89	286.42	343.37	345.25	330.85	332.42		(95)
Month	nly avera	age exte	rnal terr	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	oss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m	]				
(97)m=	1219.62	1184.55	1080.26	915.7	715.69	486.88	320.97	335.25	512.58	762.2	1008.68	1217.59		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Nh/mon	h = 0.02	24 x [(97	)m – (95	)m] x (4	1)m			
(98)m=	648.1	534.95	479.03	310.87	174.91	0	0	0	0	310.21	488.04	658.57		
				•				Tota	l per year	(kWh/year	.) = Sum(9	8)15,912 =	3604.68	(98)
Space	e heatin	g require	ement in	kWh/m²	/year								51.33	(99)
8c Sr		olina rea	uiremer	ht										]
Calcu	lated fo	r lune	luly and	August	See Tal	ole 10b								
Calcu	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec		
Heat I	oss rate	e Lm (ca	Iculated	using 2	5°C inter	nal tem	perature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	850.82	669.8	687.13	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.71	0.77	0.72	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = (	(100)m x	(101)m			1			1		I	
(102)m=	0	0	0	0	0	602.18	515.69	497.98	0	0	0	0		(102)
Gains	(solar g	gains ca	culated	for appli	cable we	eather re	egion, se	e Table	10)					
(103)m=	0	0	0	0	0	847.81	802.46	718.33	0	0	0	0		(103)
Space	e coolin	g require	ement fo	r month,	whole c	lwelling,	continue	ous ( kW	(h) = 0.0	24 x [(10	)3)m – (	102)m]:	x (41)m	
set (1	04)m to	zero if (	104)m <	: 3 × (98	)m						1	1	l .	
(104)m=	0	0	0	0	0	176.85	213.36	163.94	0	0	0	0		_
									Total	= Sum(	104)	=	554.15	(104)
Cooled	I fractior	ר י ( <del>-</del>							fC=	cooled	area ÷ (4	4) =	1	(105)
Interm	ttency f	actor (1a	able 10b			0.05	0.05	0.05					I	
(106)m=	0	0	0	0	0	0.25	0.25	0.25		0	0	0		
Snoos	ممانمم	roquiror	nont for	month	(104)m	(105)	(106)	~	Total	= Sum(	104)	=	0	(106)
Space	cooling			$\frac{1}{1}$	(104)m	× (105)	× (100)1	10 08	0	0	0	0		
(107)11=	U	0	0		0	44.21	55.54	40.90			107)		400 54	
0				\\// / <del>-</del> '					i otal	= Sum(	1 <b>.Q</b> .(7)	=	138.54	
Space	cooling	requirer	nent in k	«Wh/m²/y	/ear				(107)	÷ (4) =			1.97	(108)
8f. Fab	ric Enei	rgy Effici	ency (ca	alculated	only un	der spec	cial cond	litions, s	ee sectio	on 11)				
Fabrio	Energy	y Efficier	псу						(99) -	+ (108) =	=		53.31	(109)

# SAP Input

Property Details: Pl	ot 47										
Address: Located in: Region: UPRN: Date of assessm Date of certificat Assessment type Transaction type Tenure type: Related party dis Thermal Mass Pa Water use <= 12 PCDF Version:	ent: te: e: sclosure: arameter: 25 litres/per	Englar Thame 08 July 28 Oct New d New d Unkno No rel Indica son/day: 466	England Thames valley 08 July 2020 28 October 2020 New dwelling design stage New dwelling Unknown No related party Indicative Value Low ay: False 466								
Property description	n:										
Dwelling type: Detachment: Year Completed: Floor Location:		Flat 2020 Floor	Flat 2020 Floor area:								
Floor 0		70.22	l m²		2.5 m						
Living area: Front of dwelling fa	aces:	23.949 South	9 m <sup>2</sup> (fraction 0.3 West	41)							
Opening types:											
Name: SW	Source: Manufacturer	T S	ype: olid	Glazing:	od	Argon:	Fran	าย:			
NW	Manufacturer	V	/indows	double-glaze	ed ed	Yes					
Name: SW NE NW	<b>Gap:</b> mm 16mm o 16mm o	r more r more	Frame Facto 0 0.7 0.7	<b>or: g-value:</b> 0 0.63 0.63	<b>U-value:</b> 1.4 1.4 1.4	<b>Area:</b> 2 7.5 6.12	<b>No. c</b> 1 1 1	of Openings:			
Name: SW NE NW	Type-Name	e: L C E E	ocation: orridor Wall xternal Wall xternal Wall	Orient: South West North East North West		Width: 0 0 0	Heig 0 0 0	ht:			
Overshading:		Averaç	ge or unknown								
Opaque Elements:											
Type: External Elements	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain	wall:	Карра:			
External Wall Corridor Wall Flat Roof Exposed Floor Internal Elements Party Elements	54.957 18.924 70.221 5.699	13.62 2 0	41.34 16.92 70.22	0.15 0.15 0.1 0.12	0 0.4 0	False False		N/A N/A N/A N/A			
Thermal bridges:											
Thermal bridges:		User-c Leng 7.637	lefined (individual th Psi-valu 0.293	PSI-values) Y-Valu IE E2 Other	ie = 0.1498	other steel linte	ls)				

# SAP Input

	24.528	0.048	E4	Jamb
	5.351	0.057	E7	Party floor between dwellings (in blocks of flats)
[Approved]	5.3	0.09	E16	Corner (normal)
	5.3	0.108	E25	Staggered party wall between dwellings
	5.3	0.055	E18	Party wall between dwellings
	20.738	0.104	E24	Eaves (insulation at ceiling level - inverted)
	20.738	0.56	E15	Flat roof with parapet
[Approved]	2.832	0.04	E3	Sill
	7.141	0.062	E14	Flat roof
	1.79	0.131	E20	Exposed floor (normal)
	8.158	0.114	E21	Exposed floor (inverted)
	2.65	-0.072	E17	Corner (inverted internal area greater than external area)
	8.68	0	P3	Intermediate floor between dwellings (in blocks of flats)
	8.68	0.24	P4	Roof (insulation at ceiling level)

Ventilation:	
Pressure test: Ventilation:	Yes (As designed) Balanced with heat recovery Number of wet rooms: Kitchen + 2 Ductwork: Insulation, rigid Approved Installation Scheme: True
Number of chimneys: Number of open flues: Number of fans: Number of passive stacks: Number of sides sheltered: Pressure test: Main heating system:	0 0 0 2 3
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: In Smoke Control Area: Conservatory: Low energy lights: Terrain type: EPC language: Wind turbine:	Standard Tariff Unknown No conservatory 100% Low rise urban / suburban English No

# **SAP Input**

Photovoltaics:

Photovoltaic 1 Installed Peak power: 0.86 Tilt of collector: 30° Overshading: None or very little Collector Orientation: South West No

Assess Zero Carbon Home:

		U	Jser Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 20	12	Stroma Softwa	a Numbe Ire Versi	er: ion:		STRO Versio	001082 n: 1.0.5.9	
		Prop	perty Address:	Plot 47					
Address :									
1. Overall dwelling dimer	nsions:			_					
Ground floor			Area(m²)	(1a) x	2.8	jht(m)	(2a) =	175.55	(3a)
Total floor area TFA = (1a	)+(1b)+(1c)+(1d)+(1	e)+(1n)	70.22	(4)					
Dwelling volume				(3a)+(3b)+(3	3c)+(3d)+	+(3e)+	(3n) =	175.55	(5)
2. Ventilation rate:									
	main s heating	secondary heating	other	t	total			m <sup>3</sup> per hour	•
Number of chimneys	0 +	0	+ 0	] = [	0	x 4	= 0	0	(6a)
Number of open flues	0 +	0	+ 0	] = [	0	x 2	20 =	0	(6b)
Number of intermittent far	IS				3	x 1	0 =	30	(7a)
Number of passive vents					0	x 1	0 =	0	(7b)
Number of flueless gas fir	es				0	x 4	40 =	0	(7c)
							Air ch	anges per ho	ur
Infiltration due to chimney	s flues and fans = $($	6a)+(6b)+(7a)+	+(7b)+(7c) =		20		- (5) -	0.17	
If a pressurisation test has be	en carried out or is inten	ded, proceed to	o (17), otherwise d	ontinue from	n (9) to (1	6)		0.17	
Number of storeys in the	e dwelling (ns)						[	0	(9)
Additional infiltration						[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0.2 if both types of wall are pre- deducting areas of opening	25 for steel or timber esent, use the value corre gs); if equal user 0.35	r frame or 0.	.35 for masonr e greater wall area	y construc a (after	tion			0	(11)
If suspended wooden fle	oor, enter 0.2 (unsea	aled) or 0.1	(sealed), else	enter 0				0	(12)
If no draught lobby, ente	er 0.05, else enter 0						[	0	(13)
Percentage of windows	and doors draught s	stripped						0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 100]	] =			0	(15)
Infiltration rate			(8) + (10) -	+ (11) + (12)	+ (13) +	(15) =		0	(16)
Air permeability value, o	50, expressed in cu	bic metres p	per hour per so	quare metr	re of en	velope	area	5	(17)
If based on air permeabilit	(18) = [(18)]	$(17) \div 20]+(8), 0$	otherwise $(18) = ($	10) moobility is h	hoing use	d		0.42	(18)
Number of sides sheltered			or a degree an per		Jenny use	u	[	2	(19)
Shelter factor	-		(20) = 1 - [	0.075 x (19)]	=			0.85	(20)
Infiltration rate incorporation	ng shelter factor		(21) = (18)	x (20) =				0.36	(21)
Infiltration rate modified for	r monthly wind spee	ed					L		
Jan Feb I	Mar Apr May	Jun	Jul Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	ed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8 3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	)m ÷ 4								
(22a)m= 1.27 1.25 1	.23 1.1 1.08	0.95	0.95 0.92	1	1.08	1.12	1.18		

Adjust	ed infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m				_	
	0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42		
Calcul If m	ate etteo echanica	ctive air al ventila	<i>change i</i> tion:	rate for t	he appli	cable ca	ISE						0	(23a)
lf exh	naust air he	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	) = (23a)			0	(23b)
If bala	anced with	n heat reco	overy: effici	ency in %	allowing f	or in-use f	actor (fron	n Table 4h	) =	, , ,			0	(23c)
a) If	balance	d mech	anical ve	ntilation	with he	at recove	erv (MV	HR) (24a	a)m = (2)	2b)m + (	23b) x [ <sup>-</sup>	1 – (23c)	÷ 1001	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
b) If	balance	d mecha	anical ve	ntilation	without	heat rec	covery (I	u MV) (24b	)m = (22	1 2b)m + (2	23b)		1	
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	ouse ex	tract ven	tilation o	or positiv	ve input v	ventilatio	on from c	utside				1	
	if (22b)n	n < 0.5 ×	: (23b), t	hen (240	c) = (23b	); other	wise (24	-c) = (22t	o) m + 0.	.5 × (23b	)	-		
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural if (22b)n	ventilation = 1, the	on or whe	ole hous m = (22t	e positiv b)m othe	ve input erwise (2	ventilatie 24d)m =	on from I 0.5 + [(2	oft 2b)m² x	0.5]				
(24d)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	]	(24d)
Effe	ctive air	change	rate - en	iter (24a	) or (24t	) or (24	c) or (24	ld) in boy	(25)				1	
(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	]	(25)
3 Ho	atlosso	s and he	at loss r	aramot	or:								,	
ELEN	<b>IENT</b>	Gros	SS (	Openin	gs	Net Ar	rea	U-valu	Je	AXU		k-value	9	AXk
Dooro		area	(m²)	m	2	A ,r	m²	vv/m2	κ	(۷۷/	<) 	KJ/M2•1	ĸ	KJ/K
Duuis		. 1				2			=	2				(26)
	ws Type					7.5		/[1/( 1.4 )+	0.04] =	9.94				(27)
vvinao	ws Type	e Z				6.12	X <sup>1</sup>	/[1/( 1.4 )+	0.04] =	8.11	╡,			(27)
Floor						5.699	) ×	0.13	=	0.740869	99		$\dashv$ $\vdash$	(28)
Walls	Type1	54.9	6	13.62	2	41.34	1 X	0.18	=	7.44			$\exists$	(29)
Walls	Type2	18.9	2	2		16.92	<u>2</u> X	0.18	=	3.05			$\_$ $\_$	(29)
Roof		70.2	2	0		70.22	2 X	0.13	=	9.13				(30)
Total a	area of e	lements	, m²			149.8	3							(31)
* for win	ndows and he the area	roof winde	ows, use e sides of in	ffective wi ternal wal	ndow U-va Is and par	alue calcul titions	lated using	g formula 1	/[(1/U-valı	ıe)+0.04] a	ns given in	paragraph	1 3.2	
Fabric	heat los	s. W/K :	= S (A x	U)	o una pun			(26)(30)	+ (32) =				40.4	1 (33)
Heat c	apacity	Cm = S(	Axk)	- /					((28).	(30) + (32	2) + (32a).	(32e) =	1875.0	07 (34)
Therm	al mass	parame	ter (TMF	? = Cm ÷	- TFA) ir	n kJ/m²K	,		Indica	tive Value	Medium		250	(35)
For desi can be i	ign assess used instei	sments wh	ere the de tailed calcu	tails of the	construct	ion are noi	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix I	K						24.3	9 (36)
if details	s of therma	al bridging	, are not kn	own (36) =	= 0.05 x (3	1)								
Total f	abric he	at loss							(33) +	(36) =			64.8	(37)
Ventila	ation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (	25)m x (5)	)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	34.99	34.76	34.53	33.45	33.25	32.31	32.31	32.14	32.67	33.25	33.66	34.08		(38)
Heat ti	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m	•		
(39)m=	99.79	99.56	99.33	98.25	98.05	97.11	97.11	96.94	97.47	98.05	98.46	98.88		
										Average =	Sum(39)1	12 /12=	98.2	5 (39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)				
(40)m=	1.42	1.42	1.41	1.4	1.4	1.38	1.38	1.38	1.39	1.4	1.4	1.41			
Numbe	er of dav	s in mo	nth (Tab	le 1a)			•	•	,	Average =	Sum(40)1.	12 /12=	1.4	(40)	
	Jan	Feb	Mar	Apr	Mav	Jun	Jul	Aua	Sep	Oct	Nov	Dec			
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)	
4. Wa	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:		
Assum if TF if TF	ied occu A > 13.9 A £ 13.9	upancy,   9, N = 1 9, N = 1	N + 1.76 x	(1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13.	2. .9)	25		(42)	
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usag hot water person pe	ge in litre usage by r day (all w	es per da 5% if the a vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	87 f	.67		(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Hot wate	er usage i	n litres per	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)	·						
(44)m=	for water usage in litres per day for each month Vd,m = factor from Table 1c x (43)         44)m=       96.44       92.93       89.43       85.92       82.41       78.91       78.91       82.41       85.92       89.43       92.93       96.44         Total = Sum(44)         Total = Sum(44)       112 =       1052.07       (44)         Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)         (44)         Total = Sum(41)         143.02       125.08       129.08       112.53       107.98       93.18       86.34       99.08       100.26       116.84       127.54       138.5														
_	14)m=       96.44       92.93       89.43       85.92       82.41       78.91       78.91       82.41       85.92       89.43       92.93       96.44         Total = Sum(44) $_{112}$ =       1052.07       (44)         Energy content of hot water used - calculated monthly = 4.190 x Vd, m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)         45)m=       143.02       125.08       129.08       112.53       107.98       93.18       86.34       99.08       100.26       116.84       127.54       138.5														
Energy of	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$														
(45)m=	$Total = Sum(44)_{112} = 1052.07 $ (44) nergy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) I5)m= 143.02 125.08 129.08 112.53 107.98 93.18 86.34 99.08 100.26 116.84 127.54 138.5 Total = Sum(45)_{112} = 1379.43 (45) instantaneous water beating at point of use (no bet water storage) onter 0 in bases (46) to (61)														
lf instant	$\begin{aligned} & \text{Total} = \text{Sum}(44)_{112} = & 1052.07 \end{aligned} (44) \\ & \text{Total} = \text{Sum}(44)_{112} = & 1052.07 \end{aligned} (44) \\ & \text{Total} = \text{Sum}(45)_{112} = & 1052.07 \end{aligned} (44) \\ & \text{Total} = \text{Sum}(45)_{112} = & 1052.07 \end{aligned} (45) \\ & \text{Total} = \text{Sum}(45)_{112} = & 1379.43 \end{aligned} (45) \end{aligned}$														
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0		(46)	
Water	storage	loss:						I							
Storag	e volum	e (litres)	) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)	
If comr Otherw	munity h vise if no	eating a stored	and no ta hot wate	ank in dw er (this ir	velling, e Icludes i	nter 110 nstantar	) litres in neous co	ı (47) ombi boil	ers) ente	er '0' in (	47)				
vvater	storage	10SS: urer's de	eclared I	oss fact	or is kno	wn (kWł	n/dav).					0	l	(48)	
Tempe	anulaci	actor fro	m Table	2h			i/day).					0		(40)	
Energy	/ lost fro	m water	storage	kWh/v	ar			(48) x (49)	) =			0 		(50)	
b) If m	anufact	urer's de	eclared	cylinder	loss fact	or is not	known:	(,(,	,			0		(00)	
Hot wa	ter stor	age loss	factor fi	rom Tab	e 2 (kW	h/litre/da	ay)					0		(51)	
If comr	nunity h o footor	from To	ee secti	on 4.3									l	(50)	
Tempe	e lactor	actor fro	m Table	2b								0		(52)	
Energy	/ lost fro	m water	storage	. kWh/ve	ear			(47) x (51)	) x (52) x (	53) =		0 n		(54)	
Enter	(50) or (	(54) in (5	55)	,, y						,		0		(55)	
Water	storage	loss cal	culated	for each	month			((56)m = (	55) × (41)	m					
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)	
If cylinde	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (	[H11)] ÷ (5	50), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H		
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)	
Primar	y circuit	loss (ar	nnual) fro	om Table	e 3							0		(58)	
Primar	y circuit	loss cal	culated	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m						
(moo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)		1		
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)	

Combi	loss ca	lculated	for eac	ch i	month (	(61)m =	(60	)) ÷ 36	65 × (41)	m									
(61)m=	0	0	0		0	0		0	0	0		0	0		0	0	)		(61)
Total h	eat req	uired for	water	he	ating ca	alculated	l fo	r eacl	n month	(62)r	n =	0.85 × (	45)m	+ (4	16)m +	(57)	m +	(59)m + (61)m	
(62)m=	121.56	106.32	109.71	1	95.65	91.78	-	79.2	73.39	84.2	22	85.22	99.32	2	108.41	117	7.73		(62)
Solar DH	HW input	calculated	using Ap	ope	ndix G or	Appendix	Η (	(negativ	ve quantity	) (ente	er '0'	' if no sola	r contrib	outio	n to wate	er hea	iting)	-	
(add a	dditiona	al lines if	FGHR	Sa	and/or V	WWHRS	ap	plies	, see Ap	pend	ix G	G)						_	
(63)m=	0	0	0		0	0		0	0	0		0	0		0	0	)		(63)
Output	from w	ater hea	ter																
(64)m=	121.56	106.32	109.71	1	95.65	91.78	7	79.2	73.39	84.2	22	85.22	99.32	2	108.41	117	.73		
										(	Outp	out from wa	ater hea	ater (	(annual)₁	12		1172.52	(64)
Heat g	ains fro	m water	heatin	g, l	kWh/m	onth 0.2	5 ´	[0.85	× (45)m	+ (6	1)m	n] + 0.8 x	c [(46)i	m +	(57)m	+ (5	9)m	]	
(65)m=	30.39	26.58	27.43	Т	23.91	22.94		19.8	18.35	21.0	)5	21.31	24.83	3	27.1	29.	43		(65)
inclu	de (57)	m in calo	culatior	ו ס	f (65)m	only if c	ylir	nder is	s in the c	dwelli	ng	or hot w	ater is	fro	m com	mun	ity h	eating	
5. Int	ernal a	ains (see	e Table	5	and 5a	):	-				-						-	-	
Metabo	olic gair	ns (Table	5) W	atte	2														
metab	Jan	Feb	Mar	·	Apr	Mav		Jun	Jul	Αι	ıa	Sep	Oct	t	Nov	D	ec		
(66)m=	112.57	112.57	112.57	7	112.57	112.57	1.	12.57	112.57	112.	57	112.57	112.5	7	112.57	112	.57		(66)
Liahtin	u a aains	ı (calcula	ted in <i>i</i>		pendix	equat	ion	190	rl9a)a	lso se		Table 5						1	
(67)m=	17.82	15.83	12.87		9.75	7.28	6	6.15	6.65	8.6	4	11.59	14.72	2	17.18	18.	32	1	(67)
Annlia		l lins (calc	L ulated	 in	Annend				13 or 1 1	33) 3			hla 5				_	I	
Appilai	107 81		104 60	2	183.68	160 78		56 71	147 99	5a), a	a3	151 11		2	176.02	180	08	]	(68)
Cookin				/^	nondiv			145	or 147.00	- 140.				2	170.02	105	.00	l	(00)
				AP T		L, equai			01 L 15a)	, aise			Э 24.26		34.26	24	26	1	(69)
(09)11=	34.20		(7		\$	34.20	3	4.20	34.20	34.2	10	34.20	34.20	,	34.20	34.	20	J	(00)
Pumps	and ta	ns gains	(Table	9 5a	a)									_				1	( <b>70</b> )
(70)m=	0	0	0		0	0		0	0	0		0	0		0		)		(70)
Losses	s e.g. ev	/aporatic	on (neg I	ati	ve valu	es) (Tab	le	5)										1	(= .)
(71)m=	-90.06	-90.06	-90.06	5	-90.06	-90.06	-6	90.06	-90.06	-90.	06	-90.06	-90.00	6	-90.06	-90	.06		(71)
Water	heating	gains (T	able 5	)														1	
(72)m=	40.85	39.55	36.87		33.21	30.84	2	27.5	24.66	28.	3	29.59	33.37	7	37.64	39.	56		(72)
Total i	nterna	gains =						(66)	m + (67)m	+ (68	)m +	+ (69)m + (	(70)m +	(71)	m + (72)	)m			
(73)m=	313.25	312.02	301.2		283.41	264.68	24	47.14	236.07	239.	64	249.06	266.9	9	287.62	303	.73		(73)
6. Sol	lar gain	s:																	
Solar g	ains are	calculated	using so	lar	flux from	Table 6a	and	associ	ated equa	tions t	o co	nvert to th	e applic	able	e orientat	tion.			
Orienta	ation:	Access F	actor		Area			Flu	X No 6o		т	g_		Tal	FF			Gains	
		Table 60			[[] <del>-</del>				Jie ba		I			Tai				(VV)	_
Northea	ast <mark>0.9</mark> x	0.77		x	7.	5	x	1	1.28	x		0.63	x		0.7		=	25.86	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	7.	5	x	2	2.97	x		0.63	×		0.7		=	52.64	(75)
Northea	ast <mark>0.9</mark> x	0.77		x	7.	5	x	4	1.38	x		0.63	×		0.7		=	94.84	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	7.	5	x	6	7.96	x		0.63	x		0.7		=	155.76	(75)
Northea	ast <mark>0.9x</mark>	0.77		x	7.	5	x	9	1.35	x		0.63	x		0.7		=	209.37	(75)

Northea	ist <mark>0.9x</mark>	0.77		x	7.	5	x	g	97.38	x	0.63	x	0.7		=	223.21	(75)
Northea	ist 0.9x	0.77		x	7.	5	x		91.1	x	0.63	x	0.7		=	208.81	(75)
Northea	st 0.9x	0.77		x	7.	5	x	7	72.63	x	0.63	x	0.7		=	166.47	(75)
Northea	ist 0.9x	0.77		x	7.	5	x	5	50.42	x	0.63	×	0.7		=	115.57	(75)
Northea	ist 0.9x	0.77		x	7.	5	x	2	28.07	x	0.63	×	0.7		=	64.33	(75)
Northea	ist 0.9x	0.77		x	7.	5	x		14.2	x	0.63	×	0.7		=	32.54	(75)
Northea	ist 0.9x	0.77		x	7.	5	x		9.21	x	0.63	×	0.7		=	21.12	(75)
Northwe	est 0.9x	0.77		x	6.1	2	x	1	1.28	x	0.63	×	0.7		=	21.1	(81)
Northwe	est 0.9x	0.77		x	6.1	2	x	2	22.97	x	0.63	×	0.7		=	42.96	(81)
Northwe	est 0.9x	0.77		x	6.1	2	x	4	41.38	x	0.63	×	0.7		=	77.39	(81)
Northwe	est 0.9x	0.77		x	6.1	2	x	6	67.96	x	0.63	×	0.7		=	127.1	(81)
Northwe	est 0.9x	0.77		x	6.1	2	x	9	91.35	x	0.63	×	0.7		=	170.85	(81)
Northwe	est 0.9x	0.77		x	6.1	2	x		97.38	x	0.63	×	0.7		=	182.14	(81)
Northwe	est 0.9x	0.77		x	6.1	2	x		91.1	x	0.63	×	0.7		=	170.39	(81)
Northwe	est 0.9x	0.77		x	6.1	2	x	7	72.63	x	0.63	×	0.7	=	=	135.84	(81)
Northwe	est 0.9x	0.77		x	6.1	2	x	5	50.42	x	0.63	×	0.7	=	=	94.3	(81)
Northwe	est 0.9x	0.77		x	6.1	2	x		28.07	x	0.63	×	0.7		=	52.5	(81)
Northwe	est 0.9x	0.77		x	6.1	2	x		14.2	x	0.63	×	0.7		=	26.55	(81)
Northwe	est <u>0.9x</u>	0.77		x	6.1	2	x		9.21	x	0.63	۲ ×	0.7		=	17.23	(81)
	L	0.1.1									0.00						(- )
Solar o	ains in	watts. ca	alculate	ed	for eacl	h mont	h			(83)m	= Sum(74)m	(82)n	1				
(83)m=	46.96	95.6	172.24	t I	282.86	380.22	2 4	405.36	379.2	302	.31 209.87	116.8	3 59.09	38.	35		(83)
Total g	ains – i	nternal a	and sol	ar	(84)m =	= (73)m	) + (	(83)m	, watts			1		1			
(84)m=	360.22	407.62	473.44	t	566.27	644.9		652.49	615.27	541	.95 458.94	383.8	346.71	342	.09		(84)

1														
7. Me	an inter	nal temp	erature	(heating	season	)								
Temp	erature	during h	eating p	eriods ir	n the livir	ng area f	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	tion fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)	-			-			-
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.98	0.92	0.79	0.64	0.73	0.93	0.99	1	1		(86)
Mean	interna	l temper	ature in	living ar	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)					
(87)m=	19.33	19.47	19.76	20.19	20.59	20.87	20.96	20.93	20.69	20.18	19.69	19.31		(87)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, Tl	n2 (°C)					
=m(88)	19.75	19.75	19.75	19.76	19.77	19.78	19.78	19.78	19.77	19.77	19.76	19.76		(88)
Utilisa	tion fac	tor for ga	ains for	rest of d	welling, I	h2,m (se	e Table	9a)						
(89)m=	1	1	0.99	0.97	0.88	0.69	0.49	0.58	0.88	0.99	1	1		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	18.24	18.38	18.67	19.1	19.48	19.71	19.77	19.76	19.58	19.1	18.61	18.23		(90)
•				•					f	LA = Livin	g area ÷ (4	4) =	0.34	(91)

#### Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

	(92)m=	18.61	18.76	19.04	19.47	19.86	20.11	20.17	20.16	19.96	19.47	18.98	18.6	
--	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	--

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.61	18.76	19.04	19.47	19.86	20.11	20.17	20.16	19.96	19.47	18.98	18.6		(93)
8. Spa	ace hea	ting requ	uirement	t										
Set Ti the ut	to the i ilisation	mean int factor fo	ernal te or gains	mperatu using Ta	re obtain Ible 9a	ned at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	tion fac	tor for g	ains, hm	<u>ו י</u> ו:					·					
(94)m=	1	1	0.99	0.97	0.89	0.72	0.54	0.63	0.89	0.98	1	1		(94)
Usefu	l gains.	hmGm	. W = (9	1 4)m x (84	1 4)m	1		I			1			
(95)m=	359.45	406.03	468.71	546.62	572.65	472.72	333.86	340.31	408.18	377.45	345.4	341.51		(95)
Month	ly aver	age exte	rnal terr	nperature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	oss rate	e for mea	an interr	nal tempe	erature.	Lm , W =	L =[(39)m :	r [(93)m	– (96)m	1	1			
(97)m=	1428.41	1379.38	1245.97	1038.6	800.32	534.73	347.02	364.39	570.97	869.57	1169.57	1423.81		(97)
Space	e heatin	ı a reauire	i ement fo	r each n	i nonth. k\	ı Wh/mont	h = 0.02	1 24 x [(97	)m – (95	)ml x (4 <sup>-</sup>	1)m			
(98)m=	795.3	654.09	578.28	354.23	169.39	0	0	0	0	366.14	593.4	805.23		
						-	-	Tota	l per year	(kWh/year	r) = Sum(9	8)15,912 =	4316.07	(98)
Space	m=       795.3       654.09       578.28       354.23       169.39       0       0       0       0       366.14       593.4       805.23         Total per year (kWh/year) = Sum(98) <sub>15912</sub> =         pace heating requirement in kWh/m²/year         C. Space cooling requirement         alculated for June, July and August. See Table 10b         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec													
00 Sr														
			lanemer	11 A	0 T-I									
Calcu	lated to	r June, J	July and	August.	See Tai		lul.	Aug	Son	Oct	Nov	Dee		
Hoot														
	055 181		(100)											
				0	0	912.04	710.02	730.72	0	0	0	0		(100)
Utilisa	pace heating requirement in kWh/m <sup>2</sup> /year <b>Space cooling requirement</b> alculated for June, July and August. See Table 10b Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec eat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10) 0)m = 0 0 0 0 0 0 912.84 718.62 736.72 0 0 0 0 0 tilisation factor for loss hm 1)m = 0 0 0 0 0 0 0.78 0.85 0.8 0 0 0 0 seful loss, hmLm (Watts) = (100)m x (101)m 2)m = 0 0 0 0 0 0 712.96 613.96 590.79 0 0 0 0													
(101)m=	0				0	0.78	0.85	0.8	0	0	0	0		(101)
Usefu	l loss, r	imLm (V	Vatts) =	(100)m x T	(101)m				-		-	_		(400)
(102)m=	0	0	0	0	0	712.96	613.96	590.79	0	0	0	0		(102)
Gains	(solar (	gains ca	lculated	for appli	cable we	eather re	egion, se	e Table	10)		i	· · · · · ·		
(103)m=	0	0	0	0	0	846.36	801.17	716.84	0	0	0	0		(103)
Space	e cooling	g require	ement fo 104\m <	or month, < 3 x (98	whole c	dwelling,	continue	ous ( kN	(h) = 0.0	24 x [(10	03)m – (	102)m]>	(41)m	
(104)m=	0	0	0		0	96.05	139.28	93.78	0	0	0	0		
, ,									Total	= Sum(	104)	=	329.11	(104)
Cooled	fractio	n							f C =	cooled	area ÷ (4	4) =	1	(105)
Intermi	ttency f	actor (Ta	able 10b	))							,	, I		
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
I									Total	' = Sum(	(104)	=	0	(106)
Space	cooling	requirer	ment for	month =	(104)m	× (105)	× (106)r	n		·		l		
(107)m=	0	0	0	0	0	24.01	34.82	23.44	0	0	0	0		
I									Total	= Sum(	107)	=	82.28	(107)
Space	cooling	requirer	ment in l	kWh/m²/y	/ear				(107)	÷ (4) =			1.17	(108)
8f. F <u>ab</u>	ric <u>Ene</u> l	rgy Effici	ien <u>cy (c</u> a	alculated	l only un	der spec	cial <u>con</u> d	litio <u>ns, s</u>	ee <u>sectic</u>	on 11)				_
Fabric	Energ	y Efficier	псу						(99) -	+ (108) =	=		62.64	(109)
Targe	t Fabri	c Energ	y Efficie	ency (TF	EE)							Ì	72.03	(109)

			User D	etails:						
Assessor Name:	Zahid Ashraf			Strom	a Num	ber:		STRO	001082	
Software Name:	Stroma FSAP 2	2012		Softwa	re Ver	sion:		Versio	n: 1.0.5.9	
		Pr	operty A	Address:	Plot 47					
Address :										
1. Overall dwelling dime	nsions:		_							
Ground floor			Area	<b>a(m²)</b> 0.22	(1a) x	Av. He	<b>ight(m)</b> 2.5	(2a) =	Volume(m <sup>3</sup> 175.55	<b>)</b> (3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	(1e)+(1n	) 7	0.22	(4)					_
Dwelling volume					(3a)+(3b)	+(3c)+(3c	l)+(3e)+	.(3n) =	175.55	(5)
2. Ventilation rate:				_						
	main heating	secondary heating	y	other		total			m <sup>3</sup> per hou	r
Number of chimneys	0 +	0	+	0	] = [	0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	] + [	0	] = [	0	x	20 =	0	(6b)
Number of intermittent fa	ns					0	x ′	10 =	0	(7a)
Number of passive vents						0	x ^	10 =	0	(7b)
Number of flueless gas fi	res					0	x 4	40 =	0	(7c)
					L			Air ch	anges per bo	
	<i>a</i> 1 <i>a</i>	$(0, \cdot) \cdot (0, \cdot) \cdot (7, \cdot)$	-).(71.).(7	7 - )					anges per no	
Inflitration due to chimney	ys, flues and fans =	= (62)+(60)+(73	a)+(7D)+(7D)+(7D)	(C) = otherwise c	ontinue fri	$\frac{0}{2m(9) to t}$	(16)	÷ (5) =	0	(8)
Number of storeys in th	ne dwelling (ns)	, proceed	110 (11), 0		onundo no	5/// (0) 10 (	10)		0	(9)
Additional infiltration							[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0.	.25 for steel or timb	er frame or	0.35 for	masonr	y constr	uction			0	(11)
if both types of wall are pr	resent, use the value co	rresponding to	the greate	er wall area	a (after					
If suspended wooden f	loor, enter 0.2 (uns	ealed) or 0.	1 (seale	d), else	enter 0				0	<b>(</b> 12)
If no draught lobby, en	ter 0.05, else enter	0	,	,,					0	(13)
Percentage of windows	s and doors draugh	t stripped							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)
Air permeability value,	q50, expressed in	cubic metres	s per ho	ur per so	quare m	etre of e	nvelope	area	3	(17)
If based on air permeabil	ity value, then (18)	= [(17) ÷ 20]+(8	), otherwis	se (18) = (	16)				0.15	(18)
Air permeability value applie	s if a pressurisation test	t has been don	e or a deg	ıree air pei	meability i	is being u	sed		_	
Shelter factor	d			(20) = 1 - [	0.075 x (1	9)] =			2	$-\binom{(19)}{(20)}$
Infiltration rate incorporat	ing shelter factor			(21) = (18)	x (20) =				0.00	$\Box_{(21)}^{(=0)}$
Infiltration rate modified for	or monthly wind sp	eed							0.10	
Jan Feb	Mar Apr M	ay Jun	Jul	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 = (22a)m $	2)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1 1.0	8 0.95	0.95	0.92	1	1.08	1.12	1.18		
	I								I	

Adjust	ed infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
<u> </u>	0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calcula If me	ate etteo echanica	ctive air al ventila	change	rate for t	he appli	cable ca	ISE						0.5	(232)
lf exh	aust air he	eat pump	using App	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othei	wise (23b	) = (23a)			0.5	(23b)
lf bala	anced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h	) =	, , ,			79.05	(23c)
a) If	balance	d mecha	anical ve	entilation	with he	at recove	erv (MVI	HR) (24a	u)m = (22	2b)m + ()	23b) x [ <sup>-</sup>	1 – (23c)	÷ 100]	(200)
(24a)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25	]	(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat rec	covery (N	MV) (24b	)m = (22	2b)m + (2	23b)	I	1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
c) If	whole h	ouse ex	tract ver	tilation o	or positiv	ve input v	ventilatio	on from c	outside			<u>.</u>		
i	if (22b)n	n < 0.5 ×	(23b), t	hen (240	c) = (23b	); otherv	wise (24	c) = (22b	o) m + 0.	5 × (23b	)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous $m = (22)$	e positiv	/e input v arwise (2	ventilatio	on from I	oft 2h)m² x	0 51				
(24d)m=	0	0		0						0.0	0	0	1	(24d)
Effe	ctive air	change	rate - er	ter (24a	) or (24t	(24)	c) or (24	d) in hoy	(25)				J	
(25)m=	0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25	]	(25)
							1						J	
3. He	at losse	s and he	eat loss	oaramete	er:	Net An		11					- /	
ELEN	/IEN I	area	ss (m²)	Openin m	gs I <sup>2</sup>	Net Ar A ,r	rea m²	U-vall W/m2	le K	A X U (W/ł	<b>&lt;</b> )	k-value kJ/m²·l	e A K k	ахк J/K
Doors						2	x	1.4	=	2.8				(26)
Windo	ws Type	e 1				7.5	x1	/[1/( 1.4 )+	0.04] =	9.94				(27)
Windo	ws Type	2				6.12	x1	/[1/( 1.4 )+	0.04] =	8.11				(27)
Floor						5.699	x f	0.12	=	0.68388	3			(28)
Walls <sup>-</sup>	Type1	54.9	96	13.6	2	41.34	1 X	0.15	=	6.2	ז ר		$\neg$	(29)
Walls <sup>-</sup>	Type2	18.9	92	2		16.92	2 X	0.14	=	2.39	ז ר		$\neg$	(29)
Roof		70.2	22	0		70.22	2 X	0.1	= [	7.02	i F		$\exists$	(30)
Total a	area of e	lements	, m²			149.8	3							(31)
* for win	dows and	roof wind	ows, use e	effective wi	ndow U-va	alue calcul	lated using	g formula 1,	/[(1/U-valu	ie)+0.04] a	ns given in	paragraph	h 3.2	
Fabric	heat los	s W/K :	= S (A x)		is and pari	llions		(26)(30)	+ (32) =				27.16	(33)
Heat c	apacity	Cm = S(	′A x k )	0)				· / · / /	((28)	.(30) + (32	2) + (32a).	(32e) =	1875.07	(34)
Therm	al mass	parame	ter (TM	<sup>-</sup> = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	: Low		1075.07	(35)
For desi	ign assess	sments wh	ere the de	tails of the	construct	ion are not	t known pr	recisely the	indicative	values of	TMP in Ta	able 1f	100	(00)
can be ι	used inste	ad of a de	tailed calc	ulation.										
Therm	al bridge	es : S (L	x Y) cal	culated u	using Ap	pendix ł	K						22.44	(36)
if details	of therma	al bridging at loss	are not kr	iown (36) =	= 0.05 x (3	1)			(33) +	(36) -			50.0	(27)
Ventilo	abion her	at loss	alculater	monthly					(32)+	$-0.33 \sim 0$	25)m v (5)		59.6	(37)
v entild	Jan	Foh	Mar	Δητ	May	Jun	6.0	Δυσ	Sen		Nov	Dec	]	
(38)m=	15.49	15.3	15.12	14.19	14.01	13.09	13.09	12.9	13.45	14.01	14.38	14.75	1	(38)
Heat tr	ransfer o		$\frac{1}{1} \frac{1}{1} \frac{1}$						(30)m	= (37) + ('	1 38)m		1	
(39)m=	75.09	74.9	74.72	73.8	73.61	72.69	72.69	72.5	73.06	73.61	73.98	74.35	1	
. ,				-				-		Average =	Sum(39)₁		73.75	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	1.07	1.07	1.06	1.05	1.05	1.04	1.04	1.03	1.04	1.05	1.05	1.06		
Numbr	or of day		nth (Tab							Average =	Sum(40)1.	12 /12=	1.05	(40)
NULLIDE	lan	Feb	Mar		May	lun	1.1	Δυσ	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
(,														
4. Wa	iter heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ed occu A > 13.9 A £ 13.9	ipancy,   9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13	2. .9)	25		(42)
Annua Reduce not more	l averag the annua e that 125	e hot wa al average litres per j	ater usaq hot water person pel	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	92 f	.29		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres pei	r day for ea	ach month	Vd,m = ta	ctor from	l able 1c x	(43)			07.00	404.50		
(44)m=	101.52	97.82	94.13	90.44	86.75	83.06	83.06	86.75	90.44	94.13	97.82	101.52	1107 44	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	m x nm x [	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)	1107.44	
(45)m=	$Total = Sum(44)_{112} = 110$ Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) $(45)m = 150.54  131.67  135.87  118.45  113.66  98.08  90.88  104.29  105.54  122.99  134.26  145.79$ $Total = Sum(45) = 145$													
lf instant	aneous w	ater heati	ng at point	t of use (no	o hot water	<sup>r</sup> storage),	enter 0 in	boxes (46	) to (61)	Total = Su	m(45) <sub>112</sub> =		1452.03	(45)
(46)m=	22.58	19.75	20.38	17.77	17.05	14.71	13.63	15.64	15.83	18.45	20.14	21.87		(46)
Water	storage	loss:	<b>I</b>	<b>I</b>	<u> </u>	<u> </u>	I	<u> </u>	I	I				
Storag	e volum	e (litres)	) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr	nunity h /ise if no	eating a	and no ta	ank in dw ar (this in	velling, e ocludes i	nter 110 nstantar	) litres in	(47) mbi boil	ers) ente	r '0' in <i>(</i>	(47)			
Water	storage	loss:	not wate			notantai								
a) If m	anufact	urer's de	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	rature f	actor fro	m Table	2b								0		(49)
Energy	lost fro	m water	<sup>-</sup> storage	e, kWh/ye	ear			(48) x (49)	) =		1	10		(50)
b) If m Hot wa	anufact	urer's de age loss	eclared (	cylinder l rom Tabl	oss fact e 2 (kW	or is not h/litre/da	known: av)				0	02		(51)
If com	nunity h	eating s	ee secti	on 4.3	- (	.,					0.	02		(0.)
Volum	e factor	from Ta	ble 2a								1.	03		(52)
Tempe	rature f	actor fro	m Table	2b							0	.6		(53)
Energy	lost fro	m water	r storage	e, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter	(50) OF (	(54) IN (5	oulated :	for oach	month			((56)m - (	55) v (41)	<b>m</b>	1.	03		(55)
valer	sionage											00.04		(50)
(56)m= If cylinde	32.01 er contains	28.92 s dedicate	d solar sto	30.98 prage, (57)	32.01 m = (56)m	30.98 x [(50) – (	32.01 H11)] ÷ (5	0), else (5	30.98 7)m = (56)	32.01 m where (	30.98 H11) is fro	32.01 m Append	ix H	(96)
(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)
Primar	v circuit	loss (ar	nual) fro	u om Table	• 3							0		(58)
Primar	y circuit	loss cal	culated	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m		L			
(moo	dified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	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 ca	alculated	for eac	h month	(61)m =	(60)	÷ 365 × (41	)m						
(61)m=	0	0	0	0	0	(	0 0	0	0	0	0	0	]	(61)
Total h	eat rec	uired for	water h	neating c	alculated	for	each month	(62)m =	= 0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	205.82	181.59	191.15	171.95	168.94	151	1.57 146.16	159.57	159.03	178.27	187.75	201.07	]	(62)
Solar DI	HW input	calculated	using Ap	pendix G o	r Appendix	H (n	egative quantity	y) (enter '(	)' if no sola	r contribu	tion to wate	er heating)	-	
(add a	dditiona	al lines if	FGHRS	and/or	WWHRS	app	olies, see Ap	pendix	G)				_	
(63)m=	0	0	0	0	0	(	0 0	0	0	0	0	0		(63)
Output	from w	vater hea	ter											
(64)m=	205.82	181.59	191.15	171.95	168.94	151	1.57 146.16	159.57	159.03	178.27	187.75	201.07		
			-					Out	put from w	ater heate	er (annual)₁	12	2102.87	(64)
Heat g	ains fro	om water	heating	j, kWh/m	onth 0.2	5 ´ [(	0.85 × (45)m	ı + (61)r	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	1]	
(65)m=	94.28	83.72	89.4	82.18	82.01	75	.41 74.44	78.9	77.89	85.12	87.44	92.7		(65)
inclu	ide (57)	)m in calo	culation	of (65)m	only if c	ylind	der is in the	dwelling	or hot w	vater is f	rom com	munity ł	neating	
5. Int	ernal g	ains (see	Table	5 and 5a	):									
Metab	olic dai	ns (Table	5) Wa	tts										
motab	Jan	Feb	Mar	Apr	May	J	un Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m=	135.09	135.09	135.09	135.09	135.09	135	5.09 135.09	135.09	135.09	135.09	135.09	135.09	1	(66)
Lightin	g gains	(calcula	ted in A	ppendix	L, equat	ion l	9 or L9a), a	lso see	Table 5				1	
(67)m=	44.55	39.57	32.18	24.36	18.21	15	.38 16.61	21.6	28.99	36.8	42.96	45.79	]	(67)
Applia	nces da	ains (calc	ulated i	n Appen	u dix L. ea	uatio	on L13 or L1	i 3a), alsi	i o see Ta	ble 5	<u> </u>	ļ	1	
(68)m=	295.24	298.31	290.59	274.15	253.4	23	3.9 220.88	217.81	225.53	241.97	262.72	282.22	]	(68)
Cookir	L gains	s (calcula	i ated in A	 Appendix	L equat	ion	   15 or   15a	) also s	ee Table	1 9.5			1	
(69)m=	50.76	50.76	50.76	50.76	50.76	50	.76 50.76	50.76	50.76	50.76	50.76	50.76	1	(69)
Pumps	and fa	I Ins dains	(Table	1 5a)									1	
(70)m=					0		0 0	0	0	0	0	0	1	(70)
		Vanoratio	n (nega	l ative valu	l les) (Tab	L	)		-		-	_	1	
(71)m=	-90.06	-90.06	-90.06	-90.06	-90.06	-90	0.06 -90.06	-90.06	-90.06	-90.06	-90.06	-90.06	1	(71)
Water	heating		[										1	
(72)m-	126 72	124 59	120 16	114 14	110.23	104	173 100.05	106.05	108.18	114.4	121 44	124 59	1	(72)
Total i	ntorna		120.10	114.14	110.20	10-	(66)m + (67)m	100.00	+ (69)m +	(70)m + (7)m +	$71)m \pm (72)$	124.00	1	(/
(73)m-	562 3	558 25	538 72	508.44	477.64	11		1 (00)m	458.48	188 07	522.0	5/18/30	1	(73)
(73)III=	ar gain	000.20	550.72	308.44	477.04	44	9.0 433.33	441.24	430.40	400.97	522.9	540.59	ļ	(10)
Solar o	ains are	calculated	usina soli	ar flux from	Table 6a	and a	ssociated equa	ations to c	onvert to th	ne applica	ble orientat	ion.		
Orienta	ation:	Access F	actor	Area	1		Flux		a		FF		Gains	
•		Table 6d		m²			Table 6a	٦	Table 6b	Т	able 6c		(VV)	
Northea	ast <u>0.9x</u>	0.77	,	7	5	хΓ	11.28	1 x 🗆	0.63	ר × ר	0.7		25.86	<b>1</b> (75)
Northea	ast <u>0.9x</u>	0.77	,		5	хГ	22.97		0.63	╡ <sub>╸</sub> ╞	0.7		52.64	](75)
Northea	ast 0.9x	0.77	—		5	ц Х Г	41 38		0.63	`` L 	0.7	<b>─</b> ┤ _	94.84	_`_' ](75)
Northea	ast <u>o gy</u>	0.77	=		5	, L X L	67.96		0.63		0.7		155.76	$\frac{1}{75}$
Northea	ast 0.9x	0.77			5	́ Г х Г	91.35		0.63		0.7		209 37	](75)
Tionanou	0.3	0.77		· /.	c	^ L	91.35	^	0.63	^	0.7	-	209.37	(73)

Northea	ast <mark>0.9x</mark>	0.77	x		7.5		× g	7.38	x	0.63	x	0.7	=	223.21	(75)
Northea	ast <mark>0.9x</mark>	0.77	x		7.5	Ī	x s	91.1	x	0.63	x	0.7	=	208.81	(75)
Northea	ast <mark>0.9x</mark>	0.77	x		7.5	Ī	<b>x</b> 7	2.63	×	0.63	x	0.7	=	166.47	(75)
Northea	ast <mark>0.9x</mark>	0.77	x		7.5	٦.	× 5	0.42	x	0.63	x	0.7	=	115.57	(75)
Northea	ast <mark>0.9x</mark>	0.77	x		7.5	Ī	× 2	8.07	×	0.63	x	0.7	=	64.33	(75)
Northea	ast <mark>0.9x</mark>	0.77	x		7.5		x	14.2	×	0.63	x	0.7	=	32.54	(75)
Northea	ast <mark>0.9</mark> x	0.77	x		7.5		x s	9.21	x	0.63	x	0.7	=	21.12	(75)
Northw	est <mark>0.9x</mark>	0.77	x		6.12		× 1	1.28	x	0.63	x	0.7	=	21.1	(81)
Northw	est 0.9x	0.77	x		6.12		x 2	2.97	x	0.63	x	0.7	=	42.96	(81)
Northw	est <mark>0.9x</mark>	0.77	x		6.12		<b>x</b> 4	1.38	x	0.63	x	0.7	=	77.39	(81)
Northw	est <mark>0.9x</mark>	0.77	x		6.12		× 6	57.96	×	0.63	x	0.7	=	127.1	(81)
Northw	est 0.9x	0.77	x		6.12		x g	1.35	x	0.63	x	0.7	=	170.85	(81)
Northw	est <mark>0.9x</mark>	0.77	x		6.12		x g	7.38	×	0.63	x	0.7	=	182.14	(81)
Northw	est <mark>0.9x</mark>	0.77	x		6.12	Ī	x s	91.1	x	0.63	x	0.7	=	170.39	(81)
Northw	est <mark>0.9x</mark>	0.77	x		6.12	Ī	<b>x</b> 7	2.63	x	0.63	x	0.7	=	135.84	(81)
Northw	est <mark>0.9x</mark>	0.77	x		6.12		× 5	60.42	x	0.63	x	0.7	=	94.3	(81)
Northw	est <mark>0.9x</mark>	0.77	x		6.12		x 2	8.07	×	0.63	x	0.7	=	52.5	(81)
Northw	est 0.9x	0.77	x		6.12		x	14.2	x	0.63	x	0.7	=	26.55	(81)
Northw	est 0.9x	0.77	x		6.12		x s	9.21	x	0.63	x	0.7	=	17.23	(81)
Solar	nains in	watts c	alculated	l for	each mo	nth			(83)m	n = Sum(74)m	(82)m				
(83)m=	46.96	95.6	172.24	282	2.86 380.	22	405.36	379.2	302	.31 209.87	116.8	3 59.09	38.35	]	(83)
Total g	jains – i	nternal a	and sola	· (84	)m = (73)	m +	+ (83)m	, watts			I			1	
(84)m=	609.27	653.85	710.95	791	1.31 857.	86	855.16	812.54	743	.55 668.36	605.7	9 581.99	586.75	]	(84)
7. Me	an intei	rnal temp	perature	(hea	ating seas	son)	)								
Temp	erature	during h	neating p	erio	ds in the	livir	ng area	from Tab	ole 9	, Th1 (°C)				21	(85)

#### Utilisation factor for gains for living area, h1,m (see Table 9a)

													-		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
(86)m=	0.92	0.9	0.86	0.78	0.65	0.49	0.38	0.42	0.63	0.81	0.9	0.93		(86)	
Mean	internal	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	in Tabl	e 9c)				-		
(87)m=	19.19	19.39	19.77	20.27	20.66	20.89	20.96	20.95	20.77	20.28	19.67	19.15		(87)	
Temp	emperature during heating periods in rest of dwelling from Table 9, Th2 (°C)														
(88)m=	20.03	20.03	20.03	20.04	20.04	20.05	20.05	20.06	20.05	20.04	20.04	20.03		(88)	
Utilisa	Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)														
(89)m=	0.91	0.89	0.85	0.75	0.6	0.43	0.3	0.34	0.56	0.78	0.88	0.92		(89)	
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	e 9c)					
(90)m=	17.63	17.92	18.46	19.15	19.67	19.95	20.03	20.02	19.83	19.19	18.33	17.58		(90)	
•									f	LA = Livin	g area ÷ (4	4) =	0.34	(91)	

#### Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

(92) m = 16.16 16.42 16.9 19.53 20.01 20.27 20.35 20.35 20.15 19.56 16.79 16.12

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.16	18.42	18.9	19.53	20.01	20.27	20.35	20.33	20.15	19.56	18.79	18.12		(93)
8. Sp	ace hea	ting requ	uirement	t i				•						
Set T the ut	i to the r ilisation	nean int factor fo	ernal ter or gains	mperatur using Ta	e obtain Ible 9a	ed at ste	ep 11 of	Table 9	o, so tha	ıt Ti,m=(	76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:										
(94)m=	0.89	0.87	0.82	0.73	0.6	0.45	0.32	0.37	0.57	0.76	0.86	0.9		(94)
Usefu	ıl gains,	hmGm ,	W = (94	4)m x (84	4)m									
(95)m=	541.62	566.9	583.67	578.51	515.97	382.41	263.59	272.84	382.01	463.42	499.47	526.11		(95)
Month	nly avera	age exte	rnal tem	perature	e from Ta	able 8							l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m·	– (96)m		004.5	4004 70		(07)
(97)m=	1040.99	1012.73	926.79	/84.65	011.5	412.17	272.31	285.27	442	$\frac{659.7}{1001}$	864.5	1034.73		(97)
Space (98)m-	371 53	200 50	255 29	148 42	71 07		$\ln = 0.02$		)m – (95 	0)11] X (4	262.82	378 41		
(50)11-	071.00	200.00	200.20	140.42	11.01	Ū	0	Tota		(k)//b/voa	r = Sum(9)	8)	1033 17	1(98)
Space	e heatin	g require	ement in	kWh/m²	/year			TOta	i pei yeai	(KWII/yeai	) = 0011(9	0)15,912 -	27.53	(99)
9b En	erav rea	uiremer	nts – Cor	mmunitv	heating	scheme								J
This pa	art is use	ed for sp	ace hea	itina. spa	ace cooli	ing or wa	ater hea	tina prov	ided by	a comm	unitv sch	neme.		
Fractio	on of spa	ace heat	from se	condary/	/supplen	nentary I	neating	(Table 1	1) '0' if n	one			0	(301)
Fractio	raction of space heat from community system $1 - (301) =$													
The con	nmunity so	cheme may	y obtain he	eat from se	everal sour	rces. The p	procedure	allows for	CHP and	up to four	other heat	sources; tl	he latter	
includes Fractic	boilers, h	eat pumps at from C	s, geotherr	nal and wa ity boiler	aste heat f	rom powei	r stations.	See Appel	ndix C.				1	(3032)
Fractio	on of tota	a) =	1	(304a)										
Factor	for cont	rol and d	haraina	method	(Table (	4c(3)) fo	r commi	unity hea	itina svs	tem			1	] (305)
Distrib	ution los	s factor	(Table 1	12c) for c	commun	ity heatir	ng syste	m	ung sys	tern			1.05	(306)
Snace	heating	r	,	,		,	0,						kWb/vear	]
Annua	l space	<b>a</b> heating	requirem	nent									1933.17	]
Space	heat fro	m Comr	nunity b	oilers					(98) x (30	04a) x (30	5) x (306) =	=	2029.83	(307a)
Efficier	ncy of se	econdary	/supple	mentary	heating	system	in % (fro	om Table	e 4a or A	ppendix	E)		0	(308
Space	heating	requirer	ment fro	m secon	dary/sup	oplemen	tary sys	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water Appua	heating	<b>j</b>	equirem	ent									2102 87	1
If DHW	/ from co	ommunit	ty schem	ne:									2102.07	]
Water	heat fro	m Comn	nunity bo	oilers					(64) x (30	03a) x (30	5) x (306) =	=	2208.02	(310a)
Electri	city used	d for hea _	t distribu	ution				0.01	× [(307a)	(307e) +	· (310a)(	[310e)] =	42.38	(313)
Coolin	g Syster	n Energ	y Efficie	ncy Ratio	C								0	(314)
Space	cooling	(if there	is a fixe	d cooling	g systen	n, if not e	enter 0)		= (107) ÷	- (314) =			0	(315)
Electri	city for p	oumps aintilation	nd fans v - balanc	within dw ed, extra	velling (1 act or po	Fable 4f) sitive in	: put from	outside					273.07	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/	year	=(330a) + (330b) + (3	30g) =	273.07	(331)
Energy for lighting (calculated in Ap	pendix L)			314.73	(332)
Electricity generated by PVs (Apper	ndix M) (negative quantity)			-708.08	(333)
Electricity generated by wind turbine	e (Appendix M) (negative quantity	y)		0	(334)
10b. Fuel costs – Community heat	ing scheme				
	<b>Fuel</b> kWh/year	<b>Fuel Pri</b> (Table 12	<b>ce</b> 2)	<b>Fuel Cost</b> £/year	
Space heating from CHP	(307a) x	4.24	x 0.01 =	86.06	(340a)
Water heating from CHP	(310a) x	4.24	x 0.01 =	93.62	(342a)
		Fuel Prie	ce		_
Pumps and fans	(331)	13.19	x 0.01 =	36.02	(349)
Energy for lighting	(332)	13.19	x 0.01 =	41.51	(350)
Additional standing charges (Table	12)			120	(351)
Energy saving/generation technolog <b>Total energy cost</b> 11b SAP rating - Community heat	<b>jies</b> = (340a)(342e) + (345)(354) = ing scheme	-		377.22	(355)
				<b></b>	-
Energy cost deflator (Table 12)	$[(355) \times (356)] \div [(4) + 45.0] =$			0.42	(356)
SAP rating (section12)	[(000) x (000)] ÷ [(4) + 40.0] =			1.38	(357)
12b CO2 Emissions – Community I	neating scheme			00.02	
		Energy Em kWh/year kg (	ission factor CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space an Efficiency of heat source 1 (%)	nd water heating (not CHP) If there is CHP using two	fuels repeat (363) to (366) f	or the second fue	94	(367a)
CO2 associated with heat source 1	[(307b)+(310b	)] x 100 ÷ (367b) x	0.22	973.8	(367)
Electrical energy for heat distribution	n [(313)	x	0.52	21.99	(372)
Total CO2 associated with commun	ity systems (363).	(366) + (368)(372)	=	995.8	(373)
CO2 associated with space heating	(secondary) (309)	x	0 =	= 0	(374)
CO2 associated with water from imr	mersion heater or instantaneous	heater (312) x	0.22	= 0	(375)
Total CO2 associated with space ar	nd water heating (373)	+ (374) + (375) =		995.8	(376)
CO2 associated with electricity for p	oumps and fans within dwelling	(331)) x	0.52	141.72	(378)
CO2 associated with electricity for li	ghting (332))	) x	0.52	163.35	(379)
Energy saving/generation technolog	gies (333) to (334) as applicable	0.52	x 0.01 =	-367.49	(380)
Total CO2, kg/year	sum of (376)(382) =			933.37	(383)

Dwelling CO2 Emission Rate (383) ÷ (4) =				13.29	(384)
El rating (section 14)				89.15	(385)
13b. Primary Energy – Community heating scheme					
	Energy kWh/year	Primary factor	P. kV	Energy Nh/year	
Energy from other sources of space and water heating ( Efficiency of heat source 1 (%)	not CHP) CHP using two fuels repeat (363) to	(366) for the second	fuel	94	(367a)
Energy associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	1.22	=	5500.19	(367)
Electrical energy for heat distribution	[(313) x		=	130.1	(372)
Total Energy associated with community systems	(363)(366) + (368)(372	2)	=	5630.29	(373)
if it is negative set (373) to zero (unless specified othe	erwise, see C7 in Appendix C	;)		5630.29	(373)
Energy associated with space heating (secondary)	(309) x	0	=	0	(374)
Energy associated with water from immersion heater or	instantaneous heater(312) x	1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =			5630.29	(376)
Energy associated with space cooling	(315) x	3.07	=	0	(377)
Energy associated with electricity for pumps and fans wi	thin dwelling (331)) x	3.07	=	838.33	(378)
Energy associated with electricity for lighting	(332))) x	3.07	=	966.23	(379)
Energy saving/generation technologies Item 1		3.07 × 0.01	=	-2173.81	(380)
Total Primary Energy, kWh/year sum	of (376)(382) =			5261.04	(383)

			User D	etails:						
Assessor Name:	Zahid Ashraf			Strom	a Num	ber:		STRO	001082	
Software Name:	Stroma FSAP 2	012		Softwa	are Ver	sion:		Versic	on: 1.0.5.9	
		Р	roperty a	Address:	Plot 47					
Address :										
1. Overall dwelling dime	nsions:									
Ground floor			Area	<b>a(m²)</b> 0.22	(1a) x	Av. Hei	<b>ight(m)</b> 2.5	(2a) =	Volume(m <sup>3</sup> )	) (3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+	(1e)+(1r	ר) ד	0.22	(4)					
Dwelling volume					(3a)+(3b)	)+(3c)+(3d	l)+(3e)+	.(3n) =	175.55	(5)
2. Ventilation rate:									<u> </u>	
Number of chimneys	main heating 0 +	secondar heating	ſ <b>y</b> +	0 0	] = [	total 0	X 4	40 =	m <sup>3</sup> per hou	r (6a)
Number of open flues	0 +	0	+	0	=	0	x	20 =	0	(6b)
Number of intermittent fai	ns					3	х ′	10 =	30	(7a)
Number of passive vents						0	x ′	10 =	0	(7b)
Number of flueless gas fi	res				Г	0	x 4	40 =	0	(7c)
					L			Air ch	anges per ho	ur
Infiltration due to chimne	vs. flues and fans -	(6a)+(6b)+(7	7a)+(7h)+(	7c) -	Г			. (5)		
If a pressurisation test has be	een carried out or is inte	ended, procee	d to (17), d	otherwise c	continue fro	30 om (9) to (	(16)	÷ (5) =	0.17	(0)
Number of storeys in th	ne dwelling (ns)		( ):				,		0	(9)
Additional infiltration							[ <b>(</b> 9)·	-1]x0.1 =	0	(10)
Structural infiltration: 0.	25 for steel or timb	er frame or	0.35 foi	r masonr	y constr	uction			0	(11)
if both types of wall are pr deducting areas of openin	resent, use the value con ngs); if equal user 0.35	rresponding to	o the great	er wall are	a (after					_
If suspended wooden f	loor, enter 0.2 (uns	ealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, ent	ter 0.05, else enter	U t atrianad							0	(13)
Window infiltration	s and doors draugh	t stripped		0.25 - [0.2	x (14) ÷ 1	001 =			0	(14)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13) -	+ (15) =		0	(15)
Air permeability value,	q50, expressed in (	cubic metre	es per ho	our per so	quare m	etre of e	nvelope	area	5	(17)
If based on air permeabili	ity value, then (18) =	[(17) ÷ 20]+(	8), otherwi	se (18) = (	16)				0.42	(18)
Air permeability value applies	s if a pressurisation test	has been dor	ne or a deg	gree air pei	rmeability	is being us	sed			
Number of sides sheltere	d								2	(19)
Shelter factor				(20) = 1 -	0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorporati	ing shelter factor			(21) = (18)	) x (20) =				0.36	(21)
Infiltration rate modified for	or monthly wind spe	ed	1					_	1	
Jan Feb	Mar   Apr   Ma	ay   Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	eed 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 = (22	2)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1 1.08	3 0.95	0.95	0.92	1	1.08	1.12	1.18	]	

Adjust	ed infiltr	ation rat	e (allow	ing for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m		-		_	
~ / /	0.46	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42		
Calcul If m	ate ette	<i>ctive air</i> al ventila	change	rate for t	ne appli	cable ca	ISE						0	(23a)
lf exh	naust air h	eat pump	using App	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	) = (23a)			0	(23b)
If bala	anced with	h heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h	) =	, , ,			0	(23c)
a) If	balance	ed mecha	anical ve	entilation	with he	at recove	erv (MV	HR) (24a	a)m = (2)	2b)m + ()	23b) x [ <sup>,</sup>	1 – (23c)	÷ 100]	(100)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
b) If	balance	ed mecha	anical ve	entilation	without	heat rec	covery (I	u MV) (24b	m = (22)	1 2b)m + (2	23b)		1	
, (24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If	whole h	iouse ex	tract ver	ntilation of	or positiv	ve input v	ventilatio	on from c	outside	1			1	
	if (22b)r	n < 0.5 ×	(23b), t	then (24	c) = (23b	); otherv	wise (24	c) = (22b	o) m + 0.	.5 × (23b	)		_	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If	natural	ventilatio	on or wh	ole hous	e positiv	/e input	ventilati	on from I	oft					
(0.1.1)	if (22b)r	n = 1, th	en (24d)	m = (221)	o)m othe	erwise (2	24d)m =	0.5 + [(2)]	2b)m² x	0.5]	0.50	0.50	1	(244)
(24a)m=	. 0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	J	(240)
Effe	ctive air	change	rate - er	nter (24a	) or (24t	o) or (240	c) or (24	ld) in boy	(25)	0.57	0.59	0.50	1	(25)
(25)m=	0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	J	(25)
3. He	at losse	s and he	eat loss	paramete	ər:									
ELEN	IENT	Gros area	ss (m²)	Openin m	gs I <sup>2</sup>	Net Ar A ,r	rea m²	U-valı W/m2	ue :K	A X U (W/I	K)	k-value kJ/m²⊷	e / K ł	A X k kJ/K
Doors						2	x	1	=	2				(26)
Windo	ws Type	e 1				7.5	x1	/[1/( 1.4 )+	0.04] =	9.94				(27)
Windo	ws Type	e 2				6.12	x1	/[1/( 1.4 )+	0.04] =	8.11				(27)
Floor						5.699	) x	0.13	=	0.740869	99			(28)
Walls <sup>-</sup>	Type1	54.9	96	13.6	2	41.34	1 X	0.18	=	7.44			$\neg$	(29)
Walls <sup>-</sup>	Type2	18.9	92	2		16.92	<u>2</u> X	0.18	=	3.05			7 —	(29)
Roof		70.2	22	0		70.22	2 X	0.13		9.13	ז ד		$\exists$	(30)
Total a	area of e	elements	, m²			149.8	3	L						(31)
* for win ** includ	ndows and le the area	l roof winde as on both	ows, use e sides of ii	effective wi nternal wal	ndow U-va Is and part	alue calcul titions	lated using	g formula 1	/[(1/U-valı	ıe)+0.04] a	as given in	paragraph	1 3.2	
Fabric	heat los	ss, W/K :	= S (A x	U)				(26)(30)	) + (32) =				40.41	(33)
Heat c	apacity	Cm = S(	(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	1875.07	(34)
Therm	al mass	parame	ter (TMI	⊃ = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For desi can be u	ign asses: used inste	sments wh ad of a de	ere the de tailed calc	etails of the ulation.	construct	ion are not	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Therm	al bridg	es : S (L	x Y) cal	culated u	using Ap	pendix ł	K						24.39	(36)
if details	s of therma	al bridging	are not kr	nown (36) =	= 0.05 x (3	1)								_
Total f	abric he	at loss							(33) +	(36) =			64.8	(37)
Ventila	ation hea	at loss ca	alculated	d monthly	/	· ·	<b>.</b>	1.	(38)m	= 0.33 × (	25)m x (5)	)	1	
(00)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(20)
(38)m=	34.99	34.76	34.53	33.45	33.25	32.31	32.31	32.14	32.67	33.25	33.66	34.08	J	(38)
Heat ti	ransfer o		nt, W/K		aa	a=			(39)m	= (37) + (3	38)m		1	
(39)m=	99.79	99.56	99.33	98.25	98.05	97.11	97.11	96.94	97.47	98.05	98.46	98.88	00.05	(30)
										rverage =	Juni(28)1	12 / 1 🚄	90.20	(39)

Heat lo	oss para	meter (H	HLP), W	/m²K					(40)m	= (39)m ÷	(4)			
(40)m=	1.42	1.42	1.41	1.4	1.4	1.38	1.38	1.38	1.39	1.4	1.4	1.41		
Numb	er of day	re in mo	nth (Tab	le 12)					,	Average =	Sum(40)1.	.12 /12=	1.4	(40)
Numb	lan	Feb	Mar		May	lun	1.1	Δυσ	Sen	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
( ,	01	20								01		01		(/
4. Wa	ater heat	ting ene	rgy requ	irement:								kWh/ye	ear:	
Assum if TF if TF	ned occu A > 13.9 A £ 13.9	upancy, 9, N = 1 9, N = 1	N + 1.76 x	: [1 - exp	0(-0.0003	849 x (TF	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13.	<u>2.</u> 9)	25		(42)
Annua Reduce not mor	l averag the annua e that 125	e hot wa al average litres per	ater usag hot water person pel	ge in litre usage by r day (all w	es per da 5% if the d vater use, l	ay Vd,av Iwelling is hot and co	erage = designed ld)	(25 x N) to achieve	+ 36 a water us	se target o	87 f	.67		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	96.44	92.93	89.43	85.92	82.41	78.91	78.91	82.41	85.92	89.43	92.93	96.44		
Energy	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	m x nm x L	OTm / 3600	) kWh/mor	Total = Su oth (see Ta	m(44) <sub>112</sub> = ables 1b, 10	: c, 1d)	1052.07	(44)
(45)m=	143.02	125.08	129.08	112.53	107.98	93.18	86.34	99.08	100.26	116.84	127.54	138.5		
16 10 10 10 10						(			-	Total = Su	m(45) <sub>112</sub> =		1379.43	(45)
lf instan	taneous w	ater heati	ng at point I	t of use (no I	o hot water	r storage), I	enter 0 in I	boxes (46	) to (61)				I	(10)
(46)m= Water	21.45 storage	18.76 IOSS:	19.36	16.88	16.2	13.98	12.95	14.86	15.04	17.53	19.13	20.78		(46)
Storag	je volum	e (litres)	) includir	ng any se	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If com	munity h	eating a	and no ta	ank in dw	velling, e	nter 110	) litres in	(47)						
Otherv	vise if no	stored	hot wate	er (this ir	ncludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (	47)			
Water	storage	loss: urer's d	aclarad I	oss fact	or is kno	wn (k\//	v(dav).					20		(49)
Temp	erature f	actor fro	m Table	2h			i/day).					59		(40)
Energy	v lost fro	m water	storage	. ∠0 	ear			(48) x (49	) =		0.	75		(50)
b) If n	nanufact	urer's de	eclared of	cylinder	loss fact	or is not	known:		/		0.	15		(00)
Hot wa	ater stor	age loss	factor fr	rom Tabl	le 2 (kW	h/litre/da	ay)				(	)		(51)
If com	munity h o factor	from Ta	ee secti blo 20	on 4.3								-		(50)
Tempe	erature f	actor fro	m Table	2b								ן ר		(52)
Energy	v lost fro	m water	storage	. kWh/ve	ear			(47) x (51	) x (52) x (	53) =		<u>,                                    </u>		(54)
Enter	(50) or (	(54) in (5	55)	,, <b>,</b>						,	0.	75		(55)
Water	storage	loss cal	culated	for each	month			((56)m = (	55) × (41)ı	m	L			
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(56)
If cylind	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Prima	y circuit	loss (ar	nnual) fro	om Table	e 3						(	)		(58)
Prima	y circuit	loss cal	culated	for each	month (	59)m = (	(58) ÷ 36	65 × (41)	m					
(mo	dified by	tactor f	rom Tab	le H5 if t	there is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)	00.00	l	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi	loss ca	lculated	for eac	ch	month (	(61)m =	(60	)) ÷ 36	65 × (41)	)m									
(61)m=	0	0	0		0	0		0	0	0		0	0		0	C	)		(61)
Total h	neat req	uired for	water	he	ating ca	alculated	d fo	r eacl	h month	(62)r	n =	0.85 × (	(45)m	+ (-	46)m +	(57)	m +	(59)m + (61)m	
(62)m=	189.61	167.17	175.67	7	157.62	154.57	1:	38.27	132.94	145.	67	145.35	163.4	4	172.64	185	5.1		(62)
Solar DI	-IW input	calculated	using Ap	ope	ndix G or	· Appendix	(H)	(negati	ve quantity	/) (ente	er '0'	' if no sola	r contrib	outic	on to wate	er hea	iting)		
(add a	dditiona	al lines if	FGHR	Sa	and/or \	WWHRS	s ap	oplies	, see Ap	pend	ix G	G)						_	
(63)m=	0	0	0		0	0		0	0	0		0	0		0	C	)		(63)
Output	t from w	ater hea	ter																
(64)m=	189.61	167.17	175.67	7	157.62	154.57	1:	38.27	132.94	145.	67	145.35	163.4	4	172.64	18	5.1		
										. (	Dutp	out from wa	ater hea	ater	(annual) <sub>1</sub>	12		1928.05	(64)
Heat g	ains fro	m water	heatin	g, I	kWh/m	onth 0.2	5 ′	[0.85	× (45)m	+ (6	1)m	n] + 0.8 x	د [(46)۱	m +	+ (57)m	+ (5	9)m	]	
(65)m=	84.83	75.26	80.19	Τ	73.49	73.18	6	67.05	65.98	70.2	22	69.41	76.13	3	78.48	83.	33		(65)
inclu	de (57)	m in cal	ulatior	י ר ר	f (65)m	only if c	:ylir	nder i	s in the c	dwelli	ng	or hot w	ater is	frc	om com	mun	ity h	eating	
5. In	ternal q	ains (see	e Table	5	and 5a	):	-				-						-		
Metab	olic gai	ns (Table	5) W	atte	s														
motab	Jan	Feb	Mar	·	Apr	May		Jun	Jul	Au	ıa	Sep	Oct	t	Nov	D	ec		
(66)m=	112.57	112.57	112.57	7	112.57	112.57	1	12.57	112.57	112.	57	112.57	112.5	7	112.57	112	.57		(66)
Liahtin	a aains	(calcula	ted in /	- L Api	pendix	L. equat	ion	L9 o	r L9a). a	lso se	e T	Table 5	1			1		1	
(67)m=	17.82	15.83	12.87	Ť	9.75	7.28	(	6.15	6.65	8.6	4	11.59	14.72	2	17.18	18.	32		(67)
(67)m=       17.82       15.83       12.87       9.75       7.28       6.15       6.65       8.64       11.59       14.72       17.18       18.32       (67)         Appliances gains (calculated in Appendix L equation L13 or L13a) also see Table 5       14.72       17.18       18.32       (67)																			
(68)m=	197.81	199.86	194.69	 	183.68	169.78		56.71	147.99	145.	93	151.11	162.1	2	176.02	189	.08	]	(68)
Cookir				_ل ۸n	nondiv			1 15	or   152)				5	-				I	. ,
(69)m-	34.26	34 26	34.26	T	34.26	2, Equa		4 26	34.26	34 2	130	34.26	34.26	;	34.26	34	26	]	(69)
Dump			(Toble		o4.20	04.20		7.20	04.20	04.2	.0	04.20	04.20	<u>́</u>	04.20	04.	20		(00)
(70)m-					a)	2	1	2	2	2		2	2		2		>	1	(70)
(70)11=								5 	5	5		5	5		5		,	l	(10)
Losses			n (neg					5)	00.00	00	20	00.00			00.00	00	00	1	(71)
(71)m=	-90.06	-90.06	-90.06	, T	-90.06	-90.06	-:	90.06	-90.06	-90.	90	-90.06	-90.00	0	-90.06	-90	.06		(71)
vvater	heating	gains (I	able 5	)	400.07			0.40	00.00				400.0		400	<u> </u>	-	1	(70)
(72)m=	114.02	111.99	107.79	<i>,</i>	102.07	98.36	6	3.13	88.69	94.3	88	96.4	102.3	2	109	11	2		(72)
Total	nterna	gains =	: 					(66)	m + (67)m	1 + (68 	)m +	- (69)m + (	(70)m +	(71	)m + (72)	m		1	(70)
(73)m=	389.42	387.46	375.12	2	355.27	335.19	3	15.77	303.09	308.	73	318.88	338.9	3	361.98	379	.17		(73)
6. So	lar gain	S:		lor	flux from	Table Co	0 m d		inted agus	tiona t		nu ort to th	o opplia	abl	o oriental	ion			
			Tactor	nai		I ADIE DA	anu				0.00		ie applic	abi		.1011.		Caine	
Onenta		Table 6d	actor		m²			Tat	x ole 6a		Т	g_ able 6b		Та	ble 6c			(W)	
Northe	ast o ov	0.77		~	-	- T	~		4.00	I _ Г		0.00	٦.,		0.7	_			7(75)
Northe	ast o ou	0.77		×			×		1.20			0.03		╘	0.7		=	25.86	$\int_{(75)}^{(75)}$
Northa	act c c	0.77		×	7.		×		2.97	×    「		0.63			0.7	$\dashv$	=	52.64	$\int_{(75)}^{(75)}$
Northe	aot c.c	0.77		x	7.	5	x	4	1.38	×   		0.63			0.7		=	94.84	] <sup>(75)</sup>
Northe	ast <u>0.9</u> x	0.77		x	7.	5	x	6	57.96			0.63	×		0.7		=	155.76	_(75)
Northe	ast 0.9x	0.77		x	7.	5	x	9	1.35	X		0.63	×		0.7		=	209.37	(75)

Northea	ast <mark>0.9x</mark>	0.77	x		7.5		x	ę	97.38	x		0.63	x	0.7		=	223.21	(75)
Northea	ast 0.9x	0.77	x		7.5	·	x		91.1	×		0.63	x	0.7		=	208.81	(75)
Northea	ast <mark>0.9x</mark>	0.77	x		7.5		x	7	72.63	x		0.63	×	0.7		=	166.47	(75)
Northea	ast 0.9x	0.77	x		7.5		x	5	50.42	x		0.63	×	0.7		=	115.57	(75)
Northea	ast <mark>0.9x</mark>	0.77	x		7.5	·	x	2	28.07	x		0.63	×	0.7		=	64.33	(75)
Northea	ast <u>0.9</u> x	0.77	x		7.5		x		14.2	×		0.63	×	0.7		=	32.54	(75)
Northea	ast <mark>0.9x</mark>	0.77	x		7.5		x		9.21	x		0.63	×	0.7		=	21.12	(75)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x	1	1.28	x		0.63	×	0.7		=	21.1	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x	2	22.97	×		0.63	×	0.7		=	42.96	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x	4	41.38	x		0.63	×	0.7		=	77.39	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x	6	67.96	x		0.63	x	0.7		=	127.1	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x	9	91.35	x		0.63	x	0.7		=	170.85	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x	9	97.38	x		0.63	×	0.7		=	182.14	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x		91.1	x		0.63	×	0.7		=	170.39	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x	7	72.63	x		0.63	x	0.7		=	135.84	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x	5	50.42	x		0.63	×	0.7		=	94.3	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x	2	28.07	x		0.63	x	0.7		=	52.5	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x		14.2	x		0.63	x	0.7		=	26.55	(81)
Northwe	est <mark>0.9x</mark>	0.77	x		6.12	2	x		9.21	×		0.63	×	0.7		=	17.23	(81)
Solar o	ains in	watts. ca	alculated	d for	each	mont	า			(83)m	ι = Sι	um(74)m .	.(82)m					
(83)m=	46.96	95.6	172.24	282	2.86	380.22	4	05.36	379.2	302	.31	209.87	116.8	3 59.09	38	3.35		(83)
Total g	ains – ii	nternal a	nd sola	r (84	)m =	(73)m	+ (	83)m	, watts			1			_!			

(84)m=	436.39	483.06	547.36	638.13	715.42	721.13	682.3	611.03	528.75	455.76	421.07	417.53		(84)
7. Me	an interi	nal temp	erature	(heating	season	)								
Temp	erature	during h	eating p	eriods ir	n the livir	ng area f	rom Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	tion fac	tor for g	ains for l	iving are	ea, h1,m	(see Ta	ble 9a)							_
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	0.99	0.97	0.9	0.75	0.59	0.67	0.9	0.98	1	1		(86)
Mean	an internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)													
(87)m=	19.43	19.57	19.85	20.27	20.65	20.89	20.97	20.95	20.75	20.27	19.79	19.41		(87)
Temp	emperature during heating periods in rest of dwelling from Table 9, Th2 (°C)													
=m(88)	19.75	19.75	19.75	19.76	19.77	19.78	19.78	19.78	19.77	19.77	19.76	19.76		(88)
Utilisa	tion fac	tor for g	ains for I	rest of d	welling, l	h2,m (se	e Table	9a)						
(89)m=	1	0.99	0.99	0.95	0.85	0.65	0.44	0.52	0.83	0.97	0.99	1		(89)
Mean	internal	l temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	17.68	17.89	18.3	18.9	19.42	19.71	19.77	19.76	19.56	18.91	18.21	17.66		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.34	(91)

#### Mean internal temperature (for the whole dwelling) = $fLA \times T1 + (1 - fLA) \times T2$

			· ·			0,							
(92)m=	18.28	18.46	18.83	19.37	19.84	20.11	20.18	20.17	19.96	19.37	18.75	18.26	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.28	18.46	18.83	19.37	19.84	20.11	20.18	20.17	19.96	19.37	18.75	18.26		(93)						
8. Spa	ace hea	ting requ	uirement	t																
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calcutte the utilisation factor for gains using Table 9a										ulate										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec								
Utilisa	ation fac	tor for g	ains, hm	1:																
(94)m=	1	0.99	0.98	0.95	0.85	0.68	0.5	0.57	0.84	0.97	0.99	1		(94)						
Usefu	I gains,	hmGm	, W = (9	4)m x (84	4)m		r		r	r	r									
(95)m=	434.25	479.17	537.53	604.5	610.65	487.89	338.06	348.37	445.59	441.46	417.47	415.84		(95)						
Month	nly aver	age exte	ernal terr	perature	e from Ta	able 8							l							
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)						
Heat	loss rate	e for mea	an interr	al tempe	erature,	Lm , W =	=[(39)m : Lour or	x [(93)m·	– (96)m	]		4000.07	l	(07)						
(97)m=	1394.91	1349.98	1224.77	1028.6	798.42	535.27	347.37	365.03	5/1.5	860.37	1146.82	1389.87		(97)						
Space		g require		or each n		/vn/mon	$\ln = 0.02$	24 x [(97)	)m – (95 I	)mj x (4 211.67	1)m	704 69								
(90)11=	/14./2	565.19	511.51	305.55	139.7	0	0	U Tata			525.15	724.00	2017 75							
Total per year (kWh/year) = Sum(98) <sub>15,912</sub> =											54.07									
Space heating requirement in kWh/m²/year											54.37	(99)								
9a. Energy requirements – Individual heating systems including micro-CHP)																				
Space heating: Fraction of space heat from secondary/supplementary system									0	<b>]</b> (201)										
Fraction of space heat from main system(s) $(202) = 1 - (201) =$										1	(202)									
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$										1	(204)									
Efficiency of main space heating system 1										93.5	(206)									
Efficiency of secondary/supplementary beating system %										0	(208)									
lan Eab Mar Apr May Jun Jul Aug Son Oct Nov Doo										k\\/h/vea	]() ir									
Space	e heatin	a require	ement (c	alculate	d above)	)		,9	000			200								
•	714.72	585.19	511.31	305.35	139.7	0	0	0	0	311.67	525.13	724.68								
(211)m	n = {[(98	)m x (20	4)] } x 1	00 ÷ (20	)6)									(211)						
( )	764.41	625.87	546.86	326.58	149.41	0	0	0	0	333.33	561.64	775.06		. ,						
			1					Tota	l (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	=	4083.15	(211)						
Space heating fuel (secondary) kWh/month											J									
$= \{[(98)m \times (201)]\} \times 100 \div (208)$																				
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0								
								Tota	l (kWh/yea	ar) =Sum(2	2 <b>15)</b> <sub>15,1012</sub>	=	0	(215)						
Water heating											-									
Output	from w	ater hea	ter (calc	ulated a	bove)															
	189.61	167.17	175.67	157.62	154.57	138.27	132.94	145.67	145.35	163.44	172.64	185.1		,						
Efficier	ncy of w	ater hea	iter										79.8	(216)						
(217)m=	88.03	87.88	87.5	86.55	84.55	79.8	79.8	79.8	79.8	86.51	87.59	88.1		(217)						
Fuel for water heating, kWh/month $(219)m = (64)m \times 100 \div (217)m$																				
(∠19)m= (219)m=	215.41	190.22	200.77	182.12	182.83	173.27	166.59	182.55	182.15	188.93	197.09	210.11								
< - /···		L		L · ·=				Tota	l = Sum(2	19a) <sub>112</sub> =			2272.01	(219)						
Annual totals kWh/vear											kWh/vear	], _,								
Space heating fuel used, main system 1									4083.15	]										
	-									opace nearing ruer used, main system r										

Water heating fuel used	2272.01	]								
Electricity for pumps, fans and electric keep-hot			-		-					
central heating pump:		(230c)								
boiler with a fan-assisted flue	45		(230e)							
Total electricity for the above, kWh/year	sum of (230a)	[	75	(231)						
Electricity for lighting			[	314.73	(232)					
12a. CO2 emissions – Individual heating systems including micro-CHP										
	<b>Energy</b> kWh/year	Emission fac kg CO2/kWh	tor	<b>Emissions</b> kg CO2/yea	ır					
Space heating (main system 1)	(211) x	0.216	=	881.96	(261)					
Space heating (secondary)	(215) x	0.519	=	0	(263)					
Water heating	(219) x	0.216	=	490.75	(264)					
Space and water heating	(261) + (262) + (263) + (264) =		[	1372.71	(265)					
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= [	38.93	(267)					
Electricity for lighting	(232) x	0.519	=	163.35	(268)					
Total CO2, kg/year	sum	of (265)(271) =	[	1574.99	(272)					

TER =

(273)

22.43