### **Regulations Compliance Report**

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.9 Printed on 28 October 2020 at 14:54:09

Project Information:

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

Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 73.82m<sup>2</sup> Plot Reference: Site Reference : Hermitage Lane Plot 34

Address:

Client Details:

Name: Address:

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)

Fuel factor: 1.00 (mains gas (c))

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

Dwelling Carbon Dioxide Emission Rate (DER) 11.57 kg/m<sup>2</sup> OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 51.4 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 40.9 kWh/m<sup>2</sup>

OK

2 Fabric U-values

**Element Average Highest** External wall 0.15 (max. 0.30) 0.15 (max. 0.70) OK Floor (no floor) Roof 0.10 (max. 0.20) OK 0.10 (max. 0.35)

1.40 (max. 3.30)

2a Thermal bridging

**Openings** 

Thermal bridging calculated from linear thermal transmittances for each junction

1.40 (max. 2.00)

3 Air permeability

Air permeability at 50 pascals 3.00 (design value)

OK Maximum 10.0

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

programmer and at least two room thermostats

Hot water controls: No cylinder thermostat

No cylinder

OK

OK

# **Regulations Compliance Report**

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK
8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	1.02	
Maximum	1.5	OK
MVHR efficiency:	93%	
Minimum	70%	OK
9 Summertime temperature		
Overheating risk (Thames valley):	Slight	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: South West	11.2m²	
Windows facing: North West	2.03m²	
Ventilation rate:	6.00	
10 Key features		
Air permeablility	3.0 m³/m²h	
Roofs U-value	0.1 W/m <sup>2</sup> K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

		Hear	Details:						
Access Name:	Zahid Ashraf	USEI		- Mirror	hau.		CTDO	001082	
Assessor Name: Software Name:	Stroma FSAP 2012		Stroma Softwa					n: 1.0.5.9	
			y Address:						
Address :									
1. Overall dwelling dime	ensions:		4 0						
Ground floor		Ar	ea(m²) 73.82	(1a) x		<b>ight(m)</b> 2.5	(2a) =	Volume(m³	(3a)
Total floor area TFA = (1	2)+(1b)+(1c)+(1d)+(1c)-	 - (1p) [		(4)				104.54	
	a)+(1b)+(1c)+(1d)+(1e)-	F(111)	73.82		)*(3°)*(3°	d)+(3e)+	(3n) -		7,5
Dwelling volume				(3a)+(3b)	)+(30)+(30	ı)+(3e)+	.(311) =	184.54	(5)
2. Ventilation rate:	main sec	condary	other		total			m³ per hou	r
Number of chimneys	heating he	ating +	0	1 = [	0	x 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0	]	0		20 =	0	(6b)
Number of intermittent fa			0	J <u> </u>			10 =	-	(7a)
Number of passive vents				Ļ	0		10 =	0	= ' '
·				Ļ	0		40 =	0	(7b)
Number of flueless gas f	ires				0	^	-	0	(7c)
Air changes per hour									
Infiltration due to chimne	ys, flues and fans = (6a)	+(6b)+(7a)+(7b)	+(7c) =	Γ	0		÷ (5) =	0	(8)
	peen carried out or is intended	, proceed to (17	), otherwise o	ontinue fr	om (9) to	(16)			<u>-</u> -
Number of storeys in the Additional infiltration	ne dwelling (ns)					[(9).	-1]x0.1 =	0	(9)
	.25 for steel or timber fra	ame or 0.35 f	or masonr	y constr	uction	[(0)	17.0.1 -	0	(11)
	resent, use the value correspo	onding to the gre	ater wall area	a (after			!		_
deducting areas of openial If suspended wooden to	ngs);	d) or 0.1 (sea	aled), else	enter 0			İ	0	(12)
If no draught lobby, en	,	, (	,,					0	(13)
Percentage of window	s and doors draught stri	pped						0	(14)
Window infiltration			0.25 - [0.2			. (45)		0	(15)
Infiltration rate	q50, expressed in cubic	motros por	(8) + (10) ·				aroa	0	= (16)
If based on air permeabil	•	•	•	•	elle oi e	rivelope	alea	0.15	(17)
·	es if a pressurisation test has b				is being u	sed		00	
Number of sides sheltere Shelter factor	ed		(20) = 1 - [	0 075 v (1	(Q)1 <b>—</b>			2	(19)
Infiltration rate incorporate	ting shelter factor		$(20) = 1 \cdot 1$ $(21) = (18)$		9)] =			0.85	(20)
Infiltration rate modified f	_		(= 1)	(=0)				0.13	(21)
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7	•							
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m = 1.27   1.25	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		
						•		1	

Adjusted infiltra	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15	1	
Calculate effec			-	_	· ·	-	0.12	0.10	0.14	0.14	0.10	J	
If mechanica	al ventila	ition:										0.5	(2:
If exhaust air he	eat pump (	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	quation (N	N5)) , other	wise (23b	) = (23a)			0.5	(23
If balanced with	heat reco	overy: effic	ency in %	allowing f	or in-use fa	actor (fron	n Table 4h)	) =				79.05	(23
a) If balance				with he		<u> </u>	HR) (24a	<u> </u>	2b)m + (2	23b) × [	1 – (23c)	÷ 100]	
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		(24
b) If balance	d mecha	anical ve	ntilation	without	heat rec	overy (N	/IV) (24b	)m = (22	2b)m + (2	23b)	1	1	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h				•	•				F (00)	,			
if (22b)n		(23b), t	`	c) = (230)	o); otherv	•	ŕ	0) m + 0.	· ` `	<u> </u>	Ι ,	1	(24
24c)m= 0	0		0			0	0		0	0	0		(22
d) If natural if (22b)n				•	ve input v erwise (2				0.51				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24
Effective air	change	rate - er	ıter (24a	or (24b	o) or (240	c) or (24	d) in box	(25)	<u> </u>		!	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
											ı	ı	
3. Heat losse	_	·			NIat An		Harali		A V I I		la comban	- ^	V I
LEMENT	Gros area	-	Openin m		Net Ard A ,n		U-valı W/m2		A X U (W/ł	<b>〈</b> )	k-value kJ/m²-l		X X k J/K
oors		, ,			2	x	1.4	_ = [	2.8	, 			(20
Vindows Type	: 1				11.20	5 x1	/[1/( 1.4 )+	0.04] =	14.86				(27
Vindows Type	2				2.025	x1.	/[1/( 1.4 )+	0.04] =	2.68				(27
Valls Type1	48.4	3	13.23	3	35.2	×	0.15	= [	5.28	=			(29
Valls Type2	25.5	52	2	=	23.52	x	0.14	<b>=</b>	3.33	<b>=</b>		7	(29
Roof	73.8		0	=	73.82	=	0.1	<b>=</b>	7.38	<b>=</b>		7  -	(30
otal area of e					147.70	=	<u> </u>		7.00				(3 <sup>,</sup>
for windows and			ffective wi	ndow U-va			formula 1	/[(1/U-valu	ıe)+0.04] a	s given in	paragraph	1 3.2	(0
* include the area								2(	, ,	3	7		
abric heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				36.33	(3:
leat capacity	Cm = S(	(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	1486.37	(34
hermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Low		100	(38
or design assess				construct	ion are not	known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
<i>an be used inste.</i> Thermal bridge				ıcina Δr	nandiv k	•						12.0	
details of therma	,	•		• .	•	`						13.6	(30
otal fabric he		a. 0 7.00 1.1.1	omii (00) =	- 0.00 X (0	'/			(33) +	(36) =			49.93	(3
entilation hea	it 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= 16.28	16.08	15.89	14.92	14.73	13.76	13.76	13.56	14.14	14.73	15.11	15.5	1	(3
											•	•	
leat transfer o	oefficier	nt, W/K						(39)m	= (37) + (3	38)m			
leat transfer of 66.21	oefficier 66.02	nt, W/K 65.82	64.85	64.66	63.69	63.69	63.49	(39)m 64.08	= (37) + (3 64.66	65.05	65.43	1	

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.9	0.89	0.89	0.88	0.88	0.86	0.86	0.86	0.87	0.88	0.88	0.89		
		!						,	Average =	Sum(40) <sub>1</sub> .	12 /12=	0.88	(40)
Number of day	·							_	<u> </u>				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ar:	
Assumed occurring TFA > 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (¯	TFA -13		34		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the a	welling is	designed t			se target o		.38		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage				,									
(44)m= 103.82	100.04	96.26	92.49	88.71	84.94	84.94	88.71	92.49	96.26	100.04	103.82		
	ļ							-	Total = Su	m(44) <sub>112</sub> =	= [	1132.53	(44)
Energy content of	f hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x C	Tm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 153.95	134.65	138.95	121.14	116.23	100.3	92.94	106.65	107.93	125.78	137.3	149.1		_
If instantaneous v	water heati	na at noint	of use (no	hot water	etoraga)	enter∩in	hoves (16		Total = Su	m(45) <sub>112</sub> =	= [	1484.92	(45)
	1		,		,		` '						(40)
(46)m= 23.09 Water storage	20.2 ! loss:	20.84	18.17	17.44	15.05	13.94	16	16.19	18.87	20.59	22.36		(46)
Storage volum		) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community I	neating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if n	o stored	hot wate	er (this in	cludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	47)			
Water storage													
a) If manufac				or is kno	wn (kWh	n/day):					0		(48)
Temperature f											0		(49)
Energy lost fro		•					(48) x (49)	) =		1	10		(50)
<ul><li>b) If manufact</li><li>Hot water stor</li></ul>			-							0	02		(51)
If community I	•			- (	.,	-77				<u>_</u>	.02		(= -)
Volume factor	from Ta	ble 2a								1.	.03		(52)
Temperature f	factor fro	m Table	2b							0	.6		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter (50) or	(54) in (	55)								1.	.03		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)ı	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	хН	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	 3							0		(58)
Primary circuit	`	,			59)m = (	(58) ÷ 36	65 × (41)	m					
(modified by	y factor f	rom Tab	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss c	alculated	for each	month (	(61)m =	(60) ÷ 3	65 × (41)	)m						
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(61)
Total heat re	auired for	water he	eating ca	alculated	for eac	h month	(62)m :	= 0.85 × (	 (45)m +	(46)m +	(57)m +	ı (59)m + (61)m	
(62)m= 209.23	<del>`</del>	194.22	174.63	171.51	153.79	148.22	161.93		181.06	190.79	204.37	]	(62)
Solar DHW inpu	t calculated	using App	endix G oı	· Appendix	H (negat	ive quantity	/) (enter '	D' if no sola	r contribu	tion to wate	er heating)	ı	
(add addition	al lines if	FGHRS	and/or \	vwhrs	applies	, see Ap	pendix	G)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from v	water hea	ter				•			•		•		
(64)m= 209.23	184.58	194.22	174.63	171.51	153.79	148.22	161.93	161.42	181.06	190.79	204.37		
	•					•	Out	put from w	ater heate	er (annual) <sub>1</sub>	12	2135.76	(64)
Heat gains fr	om water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)r	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	ı ]	
(65)m= 95.41	84.71	90.42	83.07	82.87	76.15	75.13	79.68	78.68	86.04	88.45	93.8		(65)
include (57	)m in cal	culation of	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is f	rom com	munity h	neating	
5. Internal of	gains (see	Table 5	and 5a	):									
Metabolic ga	ins (Table	5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 116.75	116.75	116.75	116.75	116.75	116.75	116.75	116.75	116.75	116.75	116.75	116.75		(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equat	on L9 o	r L9a), a	lso see	Table 5				•	
(67)m= 18.77	16.67	13.56	10.27	7.67	6.48	7	9.1	12.21	15.51	18.1	19.3		(67)
Appliances g	ains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5		•	•	
(68)m= 206.03	3 208.17	202.79	191.32	176.84	163.23	154.14	152	157.39	168.86	183.34	196.94		(68)
Cooking gain	s (calcula	ted in Ap	pendix	L, equat	ion L15	or L15a	), also s	ee Table	5		!	•	
(69)m= 34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	1	(69)
Pumps and fa	ans gains	(Table 5	ia)					1				ı	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(70)
Losses e.g. e	evaporatio	n (negat	ive valu	es) (Tab	le 5)								
(71)m= -93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	1	(71)
Water heating	g gains (T	able 5)				!						•	
(72)m= 128.2 <sup>2</sup>	<del></del>	121.53	115.38	111.38	105.76	100.97	107.1	109.28	115.65	122.84	126.07	]	(72)
Total interna	al gains =				(66	)m + (67)m	ı + (68)m	+ (69)m +	(70)m + (7	71)m + (72)	)m	1	
(73)m= 411.08	3 408.93	395.91	374.99	353.92	333.49	320.14	326.23	336.91	358.04	382.3	400.34	]	(73)
6. Solar gair	ns:							•					
Solar gains are	calculated	using sola	r flux from	Table 6a	and assoc	ciated equa	itions to c	onvert to th	ne applica	ble orienta	tion.		
Orientation:			Area		Flu		_	g_ 	_	FF		Gains	
	Table 6d		m²		1a	ble 6a		Table 6b	_ '	able 6c		(W)	_
Southwest <sub>0.9x</sub>	0.77	X	11	.2	x ;	36.79		0.63	x	0.7	=	126	(79)
Southwest <sub>0.9x</sub>	0.77	X	11	.2	х (	62.67		0.63	х	0.7	=	214.62	(79)
Southwest <sub>0.9x</sub>	0.77	X	11	.2	X 8	35.75		0.63	x	0.7	=	293.65	(79)
Southwest <sub>0.9x</sub>		Х	11	.2	x 1	06.25		0.63	x	0.7	=	363.85	(79)
Southwest <sub>0.9x</sub>	0.77	Х	11	.2	x 1	19.01		0.63	x	0.7	=	407.54	(79)

		_			_		_		_				_
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	X	118.15	ַ וַ	0.63	X	0.7	=	404.59	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	113.91		0.63	X	0.7	=	390.07	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	104.39		0.63	X	0.7	=	357.47	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	92.85	]	0.63	X	0.7	=	317.96	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	69.27	]	0.63	X	0.7	=	237.2	(79)
Southwest <sub>0.9x</sub>	0.77	×	11.	.2	x	44.07	]	0.63	X	0.7	=	150.91	(79)
Southwest <sub>0.9x</sub>	0.77	×	11.	.2	x	31.49	]	0.63	X	0.7	=	107.83	(79)
Northwest 0.9x	0.77	X	2.0	)3	x	11.28	X	0.63	x	0.7	=	6.98	(81)
Northwest 0.9x	0.77	X	2.0	)3	x	22.97	X	0.63	X	0.7	=	14.21	(81)
Northwest 0.9x	0.77	×	2.0	)3	x	41.38	X	0.63	x	0.7	=	25.61	(81)
Northwest <sub>0.9x</sub>	0.77	×	2.0	)3	x	67.96	X	0.63	x	0.7	=	42.06	(81)
Northwest <sub>0.9x</sub>	0.77	×	2.0	)3	x	91.35	X	0.63	x	0.7	=	56.53	(81)
Northwest <sub>0.9x</sub>	0.77	×	2.0	)3	x	97.38	x	0.63	x	0.7	=	60.27	(81)
Northwest <sub>0.9x</sub>	0.77	×	2.0	)3	x	91.1	X	0.63	x	0.7	=	56.38	(81)
Northwest <sub>0.9x</sub>	0.77	×	2.0	)3	x	72.63	X	0.63	x	0.7	=	44.95	(81)
Northwest <sub>0.9x</sub>	0.77	×	2.0	)3	x	50.42	x	0.63	x	0.7	=	31.2	(81)
Northwest <sub>0.9x</sub>	0.77	X	2.0	)3	x	28.07	X	0.63	x	0.7	=	17.37	(81)
Northwest <sub>0.9x</sub>	0.77	×	2.0	)3	x	14.2	X	0.63	x	0.7	=	8.79	(81)
Northwest <sub>0.9x</sub>	0.77	×	2.0	)3	x	9.21	x	0.63	x	0.7	=	5.7	(81)
Solar gains in $(83)$ m= 132.98 Total gains – i $(84)$ m= 544.05	228.83 31 nternal and	9.26	405.9	464.07	464	<del></del>	(83)m 402 728		254.57 612.6	<u> </u>	113.53 513.86		(83) (84)
7. Mean inter	nal tempera	ature (	heating	season	)								
Temperature	during heat	ting p	eriods ir	the livi	ng a	rea from Ta	L L - 0				i		
Utilisation fac	ctor for gains	s for l	iving are				bie 9,	, Th1 (°C)				21	(85)
Jan	Feb I		· · · · · · · · · · · · · · · · · · ·	ea, h1,m	(see		bie 9,	, Th1 (°C)				21	(85)
	1 60 1 1	Mar	Apr	ea, h1,m May	r <del>`</del>			, Th1 (°C)	Oct	Nov	Dec	21	(85)
(86)m= 0.94	<del>                                     </del>	Mar ).85			r <del>`</del>	e Table 9a) un Jul		ug Sep	Oct	Nov 0.91	Dec 0.95	21	(85)
(86)m= 0.94  Mean interna	0.9 0	).85	Apr 0.76	May 0.63	. J	e Table 9a) un Jul 48 0.36	A)	ug Sep 9 0.58	<del>                                     </del>	+		21	
` '	0.9 0	).85	Apr 0.76	May 0.63	. J	e Table 9a) un Jul 48 0.36 v steps 3 to	A)	ug Sep 9 0.58 able 9c)	<del>                                     </del>	+		21	
Mean interna (87)m= 19.42	0.9 0 I temperatu 19.71 20	n.85 re in l	Apr 0.76 iving are 20.49	May 0.63 ea T1 (fo 20.77	0.4 ollow 20.	e Table 9a) un Jul 48 0.36 v steps 3 to 93 20.98	0.3 7 in T	ug Sep 99 0.58 Table 9c) 97 20.87	0.79	0.91	0.95	21	(86)
Mean interna	0.9 0 I temperatu 19.71 20 during heat	n.85 re in l	Apr 0.76 iving are 20.49	May 0.63 ea T1 (fo 20.77	0.4 ollow 20.	e Table 9a) un Jul 48 0.36 v steps 3 to 93 20.98 Iling from Ta	0.3 7 in T	ug Sep 99 0.58 Table 9c) 97 20.87 9, Th2 (°C)	0.79	0.91	0.95	21	(86)
Mean interna (87)m= 19.42  Temperature (88)m= 20.17	0.9 0 Il temperatu 19.71 20 during heat 20.17 20	0.85 re in l 0.08 ting p	Apr 0.76 iving are 20.49 eriods ir 20.19	May 0.63 ea T1 (for 20.77 n rest of 20.19	0.4 ollow 20. dwe	e Table 9a) un Jul 48 0.36 v steps 3 to 93 20.98 Illing from Ta 1.2 20.2	Ai 0.3 7 in T 20.4 able 9	ug Sep 99 0.58 Table 9c) 97 20.87 9, Th2 (°C)	0.79	0.91	0.95 19.37	21	(86)
Mean interna (87)m= 19.42  Temperature (88)m= 20.17  Utilisation fac	0.9 0  I temperatu  19.71 20  during heat  20.17 20  ctor for gains	ne in I 0.08 ting po 0.17	Apr 0.76 iving are 20.49 eriods ir 20.19 est of d	May 0.63 ea T1 (for 20.77 or rest of 20.19 welling,	0.4 ollow 20. dwe 20 h2,m	un Jul 48 0.36 4 steps 3 to 93 20.98  Illing from Ta 20.2  1 (see Table	Ai 0.3 7 in T 20.4 able 9 20.6 9a)	ug Sep  9 0.58  Table 9c)  97 20.87  9, Th2 (°C)  2 20.19	0.79 20.5 20.19	0.91	0.95 19.37 20.18	21	(86)
Mean internation (87)m= 19.42  Temperature (88)m= 20.17  Utilisation fact (89)m= 0.93	0.9 0  I temperatu  19.71 20  during heat  20.17 20  ctor for gains  0.89 0	0.85 re in l 0.08 ting p 0.17 s for r 0.83	Apr 0.76 iving are 20.49 eriods ir 20.19 est of do	May 0.63 ea T1 (for 20.77 or rest of 20.19 welling, 0.59	0.4 20. dwe 20. h2,m	e Table 9a) un Jul 48 0.36 v steps 3 to 93 20.98 Illing from Ta 1.2 20.2 n (see Table 43 0.29	Ai 0.3 7 in T 20.4 able 9 20.6 9a) 0.3	ug Sep  99 0.58  Table 9c)  97 20.87  9, Th2 (°C)  2 20.19	0.79 20.5 20.19	0.91	0.95 19.37	21	(86) (87) (88)
Mean interna (87)m= 19.42  Temperature (88)m= 20.17  Utilisation fac (89)m= 0.93  Mean interna	0.9 0 Il temperatu 19.71 20 during heat 20.17 20 eter for gains 0.89 0	ne in I 0.08 ting p 0.17 s for r	Apr 0.76 iving are 20.49 eriods ir 20.19 est of do 0.73 he rest	May 0.63 ea T1 (for 20.77 or rest of 20.19 welling, 0.59 of dwelling	Jollow 20. dwe 20. h2,m	e Table 9a) un Jul 48 0.36 v steps 3 to 93 20.98 lling from Ta 1.2 20.2 n (see Table 43 0.29	Ai 0.3 7 in T 20.9 able 9 20.9 9 9 0.3 eps 3	ug Sep  99 0.58  Table 9c)  97 20.87  9, Th2 (°C)  2 20.19  32 0.52  to 7 in Table	0.79 20.5 20.19 0.76 e 9c)	0.91 19.9 20.18	0.95 19.37 20.18	21	(86) (87) (88) (89)
Mean internation (87)m= 19.42  Temperature (88)m= 20.17  Utilisation fact (89)m= 0.93	0.9 0 Il temperatu 19.71 20 during heat 20.17 20 eter for gains 0.89 0	0.85 re in l 0.08 ting p 0.17 s for r 0.83	Apr 0.76 iving are 20.49 eriods ir 20.19 est of do	May 0.63 ea T1 (for 20.77 or rest of 20.19 welling, 0.59	0.4 20. dwe 20. h2,m	e Table 9a) un Jul 48 0.36 v steps 3 to 93 20.98 lling from Ta 1.2 20.2 n (see Table 43 0.29	Ai 0.3 7 in T 20.4 able 9 20.6 9a) 0.3	ug Sep 99 0.58  Table 9c) 97 20.87  9, Th2 (°C) 22 20.19  to 7 in Table 18 20.07	0.79 20.5 20.19 0.76 le 9c)	0.91 19.9 20.18 0.89	0.95 19.37 20.18 0.94		(86) (87) (88) (89)
Mean interna (87)m= 19.42  Temperature (88)m= 20.17  Utilisation fact (89)m= 0.93  Mean interna (90)m= 18.06	0.9 0 Il temperatu 19.71 20 during heat 20.17 20 ctor for gains 0.89 0 Il temperatu 18.47 18	n.85 re in l n.0.08 ting p n.17 s for r n.83 re in t 8.99	Apr 0.76 iving are 20.49 eriods ir 20.19 est of de 0.73 he rest 19.56	May 0.63 ea T1 (for 20.77 or rest of 20.19 welling, 0.59 of dwelling, 19.93	Ji	e Table 9a) un Jul 48 0.36 v steps 3 to 93 20.98 Illing from Ta 2.2 20.2 n (see Table 43 0.29 T2 (follow ste 14 20.18	Ai 0.3 7 in T 20.4 able \$ 20.4 e 9a) 0.3 eps 3 20.	ug Sep  99 0.58  Table 9c)  97 20.87  9, Th2 (°C)  2 20.19  10 7 in Table  11 20.07	0.79 20.5 20.19 0.76 le 9c)	0.91 19.9 20.18	0.95 19.37 20.18 0.94	0.34	(86) (87) (88) (89)
Mean interna (87)m= 19.42  Temperature (88)m= 20.17  Utilisation fac (89)m= 0.93  Mean interna (90)m= 18.06	0.9 0  I temperatu  19.71 20  during hear  20.17 20  ctor for gains  0.89 0  I temperatu  18.47 18	ne in l ne in l ne in l ne in r ne in t ne (fo	Apr 0.76 iving are 20.49 eriods ir 20.19 est of do 0.73 he rest 19.56	May 0.63 ea T1 (for 20.77 n rest of 20.19 welling, 0.59 of dwelli 19.93	July 0.4	e Table 9a) un Jul 48 0.36 v steps 3 to 93 20.98 Illing from Ta 1.2 20.2 n (see Table 43 0.29 T2 (follow ste 14 20.18 $0 = \text{fLA} \times \text{T1}$	Ai 0.3 7 in T 20.9 able 9 20.9 9 9 0.3 eps 3 20.	ug Sep  99 0.58  Fable 9c)  97 20.87  9, Th2 (°C)  2 20.19  82 0.52  to 7 in Table  18 20.07	0.79 20.5 20.19 0.76 le 9c) 19.59 fLA = Liv	0.91 19.9 20.18 0.89 18.75 ring area ÷ (-	0.95 19.37 20.18 0.94 17.98 4) =		(86) (87) (88) (89) (90) (91)
Mean interna (87)m= 19.42  Temperature (88)m= 20.17  Utilisation fact (89)m= 0.93  Mean interna (90)m= 18.06	0.9 0 Il temperatu 19.71 20 during heat 20.17 20 ctor for gains 0.89 0 Il temperatu 18.47 18	n.85 re in l n.0.08 ting pr n.17 s for r n.83 re in t 8.99 re (for p.36	Apr 0.76  iving are 20.49  eriods ir 20.19  est of dr 0.73  he rest 19.56  r the wh	May 0.63 ea T1 (for 20.77 n rest of 20.19 welling, 0.59 of dwelling, 19.93 ole dwe 20.22	J   0.4     0.4	e Table 9a) un Jul 48 0.36 v steps 3 to 93 20.98 lling from Ta 1.2 20.2 n (see Table 43 0.29 T2 (follow str 14 20.18  0 = fLA × T1 41 20.46	Ai 0.3 7 in T 20.4 able 9 20.4 20.4 20.4 20.4 + (1 20.4	ug Sep  99 0.58  Table 9c)  97 20.87  9, Th2 (°C)  22 20.19  13 20.07	0.79  20.5  20.19  0.76  e 9c)  19.59  fLA = Liv	0.91  19.9  20.18  0.89  18.75  ring area ÷ (	0.95 19.37 20.18 0.94		(86) (87) (88) (89)

												1	
(93)m= 18.52	18.89	19.36	19.87	20.22	20.41	20.46	20.45	20.34	19.9	19.14	18.45		(93)
8. Space hea													
Set Ti to the return the utilisation			•		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		
Utilisation fac			<u> </u>				5	1					
(94)m= 0.91	0.87	0.81	0.72	0.59	0.44	0.31	0.34	0.53	0.75	0.87	0.92		(94)
Useful gains,	hmGm	, W = (94	4)m x (84	4)m									
(95)m= 496.12	556.44	582.31	562.52	485.5	351.39	240.84	250.88	365.54	459.28	473.6	473.77		(95)
Monthly average	age exte	rnal tem	perature	from T	able 8							ı	
(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		1			ì	- ,	<del>-``</del>	<u> </u>	<del>-</del>			1	(07)
(97)m= 941.52	923.55	846.58	711.61	550.87	369.77	245.53	257.2	400	601.09	783.2	932.76		(97)
Space heatin (98)m= 331.38	g require	196.62	r each n 107.35	48.63	VVh/moni	$\ln = 0.02$	24 x [(97]	)m – (95 0	)m] x (4 105.51	1)m 222.91	341.49		
(98)m= 331.38	240.7	190.02	107.33	40.03		U			<u> </u>		l	1600.50	(98)
				.,			Tota	l per year	(KWII/yeai	) = Sum(9	O)15,912 =	1600.59	╡``
Space heatin	g require	ement in	kWh/m²	<sup>2</sup> /year								21.68	(99)
9b. Energy red	quiremer	nts – Cor	mmunity	heating	scheme								
This part is use Fraction of spa										unity scl	neme.		(301)
•			-		•	_	(Table T	1) 0 11 11	one			0	╡`
Fraction of spa	ace heat	from co	mmunity	system	1 – (30	1) =						1	(302)
The community so									up to four	other heat	sources; ti	he latter	
includes boilers, h Fraction of hea		-			rom power	Stations.	see Appei	iuix C.				1	(303a)
Fraction of total			•		oilers				(3	02) x (303	a) =	1	(304a)
Factor for cont	rol and	charging	method	(Table	4c(3)) fo	r commu	unity hea	ating sys	tem			1	(305)
Distribution los	s factor	(Table 1	2c) for (	commun	ity heatii	ng syste	m					1.05	(306)
Space heating	a											kWh/yea	 r
Annual space	heating	requiren	nent									1600.59	
Space heat fro	m Com	munity b	oilers					(98) x (30	04a) x (30	5) x (306)	=	1680.62	(307a)
Efficiency of se	econdar	y/supple	mentary	heating	system	in % (fro	m Table	4a or A	ppendix	E)		0	(308
Space heating	require	ment fro	m secon	dary/suլ	oplemen	tary sys	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water heating	1												
Annual water h		equirem	ent									2135.76	
If DHW from co													<del>-</del>
Water heat fro		•						(64) x (30	03a) x (30	5) x (306)	=	2242.55	(310a)
Electricity used							0.01	× [(307a).	(307e) +	· (310a)	(310e)] =	39.23	(313)
Cooling Syster	_	•	•									0	(314)
Space cooling	(if there	is a fixe	d cooling	g systen	n, if not e	enter 0)		= (107) ÷	(314) =			0	(315)
Electricity for p							اللاعديد				I		7,000
mechanical ve	ntilation	- palanc	ea, extra	act or po	sitive in	out from	outside					287.05	(330a)

						_
warm air heating system fans					0	(330b)
pump for solar water heating					0	(330g)
Total electricity for the above, kWh/year		=(330a) + (330b		287.05	(331)	
Energy for lighting (calculated in Appendix	L)				331.54	(332)
Electricity generated by PVs (Appendix M)	(negative quantity)				-749.25	(333)
Electricity generated by wind turbine (Appe	ndix M) (negative quantity)				0	(334)
12b. CO2 Emissions – Community heating	scheme					
		ergy /h/year	Emission fact kg CO2/kWh	_	missions ı CO2/year	
CO2 from other sources of space and wate Efficiency of heat source 1 (%)	r heating (not CHP)  If there is CHP using two fuel	s repeat (363) to (	366) for the second	fuel	94	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x	100 ÷ (367b) x	0.22	=	901.5	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.36	(372)
Total CO2 associated with community syste	ems (363)(3	66) + (368)(372)	)	=	921.86	(373)
CO2 associated with space heating (second	dary) (309) x		0	=	0	(374)
CO2 associated with water from immersion	heater or instantaneous hea	ater (312) x	0.22	=	0	(375)
Total CO2 associated with space and water	r heating (373) + (3	374) + (375) =			921.86	(376)
CO2 associated with electricity for pumps a	and fans within dwelling (33	1)) x	0.52	=	148.98	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	172.07	(379)
Energy saving/generation technologies (33: Item 1	3) to (334) as applicable		0.52 x 0.0°	=	-388.86	(380)
Total CO2, kg/year sur	m of (376)(382) =				854.05	(383)
Dwelling CO2 Emission Rate (38	33) ÷ (4) =				11.57	(384)
El rating (section 14)					90.37	(385)

### **SAP 2012 Overheating Assessment**

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

### Property Details: Plot 34

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: Yes
Number of storeys: 1

Front of dwelling faces: North East

Overshading: Average or unknown

Overhangs: None

Thermal mass parameter: Indicative Value Low

**Night ventilation:** False

Blinds, curtains, shutters:

**Ventilation rate during hot weather (ach):**6 ( Windows fully open)

### Overheating Details:

Summer ventilation heat loss coefficient: 365.39 (P1)

Transmission heat loss coefficient: 49.9

Summer heat loss coefficient: 415.32 (P2)

### Overhangs:

Orientation:	Ratio:	Z_overhangs:
--------------	--------	--------------

South West (SW) 0 1 North West (NW) 0 1

### Solar shading:

Orientation:	Z biinas:	Solar access:	Overnangs:	Z summer:	
South West (SW)	1	0.9	1	0.9	(P8)
North West (NW)	1	0.9	1	0.9	(P8)

### Solar gains:

Orientation		Area	Flux	$\mathbf{g}_{-}$	FF	Shading	Gains
South West (SW)	0.9 x	11.2	119.92	0.63	0.7	0.9	479.99
North West (NW)	0.9 x	2.03	98.85	0.63	0.7	0.9	71.5
						Total	551.49 <b>(P3/P4)</b>

### Internal gains:

	June	July	August
Internal gains	463.63	446.58	454.76
Total summer gains	1044.69	998.07	961.03 <b>(P5)</b>
Summer gain/loss ratio	2.52	2.4	2.31 <b>(P6)</b>
Mean summer external temperature (Thames valley)	16	17.9	17.8
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	19.82	21.6	21.41 <b>(P7)</b>
Likelihood of high internal temperature	Not significant	Slight	Slight

Assessment of likelihood of high internal temperature: Slight

		l Iser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	<u>-                                    </u>	Strom Softwa					0001082 on: 1.0.5.9	
Address	F	Property	Address	Plot 34					
Address: 1. Overall dwelling dime	ensions:								
1. Overall aweiling aime	moiorio.	Are	a(m²)		Av. He	ight(m)		Volume(m <sup>3</sup>	3)
Ground floor				(1a) x		2.5	(2a) =	184.54	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	73.82	(4)					
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	184.54	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys		7 + [	0	] = [	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	<b>-</b>	0	Ī = Ē	0	x2	20 =	0	(6b)
Number of intermittent fa	ins			, L	3	x <sup>2</sup>	10 =	30	(7a)
Number of passive vents	;			Ē	0	x ′	10 =	0	(7b)
Number of flueless gas fi	ires			F	0	X 4	40 =	0	(7c)
				L				_	
				_			Air ch	nanges per ho	our —
	ys, flues and fans = (6a)+(6b)+( peen carried out or is intended, proceed			continuo fr	30		÷ (5) =	0.16	(8)
Number of storeys in the		id 10 (17),	ourer wise t	onunae n	om (9) to	(10)		0	(9)
Additional infiltration						[(9)-	-1]x0.1 =	0	(10)
	.25 for steel or timber frame o			•	ruction			0	(11)
it both types of wall are p deducting areas of openii	resent, use the value corresponding t ngs); if equal user 0.35	o tne grea	ter wall are	a (atter					
•	floor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	•							0	(13)
Percentage of windows Window infiltration	s and doors draught stripped		0.25 - [0.2	v (14) ± 1	1001 -			0	(14)
Infiltration rate			(8) + (10)	. ,	-	+ (15) =		0	(15)
	q50, expressed in cubic metre	es per h					area	3	(17)
•	lity value, then $(18) = [(17) \div 20] + (18)$	•		•		•		0.31	(18)
	es if a pressurisation test has been do	ne or a de	gree air pe	rmeability	is being u	sed			
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0.0 <b>75</b> x (1	19)1 =			2	(19) (20)
Infiltration rate incorporate	ting shelter factor		(21) = (18		/1			0.85	(21)
Infiltration rate modified f	•		. , .					0.27	(=./
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7					-		•	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2.	2)m ÷ 4								
<u> </u>	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18	]	
				<u> </u>		<u> </u>		J	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.34	0.33	0.33	0.29	0.29	0.25	0.25	0.25	0.27	0.29	0.3	0.31		
Calculate effect If mechanica		-	rate for t	пе арріі	саріе са	se						0	(23
If exhaust air he	eat pump i	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	) = (23a)			0	(23
If balanced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h	) =				0	(23
a) If balance	d mech	anical ve	entilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (22	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
b) If balance	d mech	anical ve	ntilation	without	heat red	covery (N	ЛV) (24t	)m = (22	2b)m + (	23b)	-	-	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h				•	•							-	
if (22b)n		<u> </u>	hen (240	<u> </u>	ŕ –	· · · · ·	<del>É È</del>	ŕ	· ` `	<del></del>		1	
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)n									0.51				
(24d)m = 0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.51 [(2	0.54	0.54	0.54	0.55	]	(24
Effective air		<u> </u>			<u> </u>	<u> </u>		<u> </u>				J	,
(25)m= 0.56	0.56	0.55	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.54	0.55	]	(25
		<u> </u>					<u> </u>					J	
3. Heat losse		•			<b>.</b>								A 3/ 1
ELEMENT	Gros area	_	Openin m		Net Ar A ,r		U-val W/m2		A X U (W/I	<b>(</b> )	k-value kJ/m²-l		A X k kJ/K
Doors		` ,			2	x	1.4		2.8	$\stackrel{\prime}{\Box}$			(26)
Windows Type	<del>.</del> 1				11.20		/[1/( 1.4 )+	0.04] =	14.86	Ħ			(27)
Windows Type					2.025	ऱ .	/[1/( 1.4 )+	0.04] =	2.68	=			(27
Walls Type1	48.4	13	13.23	3	35.2	x	0.15		5.28	=			(29
Walls Type2	25.5		2		23.52		0.14	<b>=</b>	3.33	<b>=</b>		7 H	(29
Roof	73.8		0	=	73.82	_	0.1	╡┇	7.38	<b>믁</b> ;		<b>-</b>	(30
Total area of e					147.7	=	0.1		7.00				(31
* for windows and			ffective wi	ndow U-va			r formula 1	/[(1/U-valu	ıe)+0.04] a	ns given in	paragraph	1 3.2	(01)
** include the area								•	, -	J	, , ,		
Fabric heat los	s, W/K	= S (A x	U)				(26)(30)	+ (32) =				36.33	(33)
Heat capacity	Cm = S(	(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	1486.3	7 (34
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	Low		100	(35
For design assess can be used inste				construct	ion are no	t known pi	ecisely the	indicative	values of	TMP in T	able 1f		
Thermal bridge				ısina Ar	nendix k	<						13.6	(36
if details of therma	•	,			•	`						13.0	(30
Total fabric he			()	(-	,			(33) +	(36) =			49.93	(37
Ventilation hea	at loss ca	alculated	l monthly	/				(38)m	= 0.33 × (	25)m x (5	)		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 33.94	33.81	33.67	33.05	32.93	32.39	32.39	32.29	32.6	32.93	33.17	33.42		(38)
Heat transfer of	coefficier	nt, W/K						(39)m	= (37) + (37)	38)m		_	
(39)m= 83.87	83.74	83.61	82.98	82.86	82.32	82.32	82.22	82.53	82.86	83.1	83.35	]	
		•			•	•	•	•		Sum(39) <sub>1</sub>	-	82.98	(39)

eat loss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	· (4)			
0)m= 1.14	1.13	1.13	1.12	1.12	1.12	1.12	1.11	1.12	1.12	1.13	1.13		
umber of day	s in moi	oth (Tahl	le 1a)					,	Average =	Sum(40) <sub>1.</sub>	12 /12=	1.12	(40
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41
4. Water heat	ing enei	gy requi	rement:								kWh/ye	ar:	
ssumed occu if TFA > 13.9 if TFA £ 13.9	N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13.		34		(42
nnual averag educe the annua ot more that 125	l average	hot water	usage by	5% if the a	welling is	designed t			se target o		.38		(43
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ot water usage ir	i litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
4)m= 103.82	100.04	96.26	92.49	88.71	84.94	84.94	88.71	92.49	96.26	100.04	103.82	4400.50	
nergy content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x D	OTm / 3600			m(44) <sub>112</sub> = ables 1b, 1	<u></u>	1132.53	(44
5)m= 153.95	134.65	138.95	121.14	116.23	100.3	92.94	106.65	107.93	125.78	137.3	149.1		
inotantanagua	otor hooti	na ot point	of upo (no	hot woto	r otorogo)	ontor O in	hayaa (16		Total = Su	m(45) <sub>112</sub> =		1484.92	(4
instantaneous w	0	ng at point	0			0	0		l 0	0			(4)
6)m= 0 /ater storage	-	U	0	0	0	0	U	0	0	U	0		(4)
torage volum	e (litres)	includin	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(4
community h	•			•			` '			\			
therwise if no /ater storage		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er 'O' in (	47)			
i) If manufacti		eclared le	oss facto	or is kno	wn (kWł	n/day):					0		(4
emperature fa	actor fro	m Table	2b								0		(4
nergy lost fro		•	•				(48) x (49)	) =			0		(5
<ul> <li>) If manufactor</li> <li>ot water stora</li> </ul>			-										(5
community h	•			6 Z (KVV)	ii/iiti <del>c</del> /ua	iy <i>)</i>					0		(5
olume factor	_										0		(5
emperature fa	actor fro	m Table	2b								0		(5
nergy lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(5
Enter (50) or (	54) in (5	55)									0		(5
/ater storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)	m				
6)m= 0  cylinder contains	0 dedicate	0 d solar sto	0 rage, (57)ı	0 m = (56)m	0 x [(50) – (	0 H11)] ÷ (5	0 0), else (5	0 7)m = (56)	0 m where (	0 H11) is fro	0 m Appendix	ίΗ	(5
7)m= 0	0	0	0	0	0	0	0	0	0	0	0		(5
rimary circuit	loss (an	nual) fro	m Table	. 3	<u> </u>	!	Į.	ļ	I		0		(58
rimary circuit	•	•			59)m = (	(58) ÷ 36	65 × (41)	m			-		<b>\</b>
(modified by	factor fi	om Tabl	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	r thermo	stat)			

Combi loss ca	alculated	for each	month (	(61)m =	(60) ± 3	65 <b>v</b> (41	)m						
(61)m= 0		0	0	0	00) . 0	0	) o	T 0	0	0	0	1	(61)
	uired for	water h	Leating ca	alculated	L I for eac	h month	(62)m	$= 0.85 \times 0$	 (45)m +	(46)m +	(57)m +	ו - (59)m + (61)m	
(62)m= 130.86	·	118.1	102.97	98.8	85.26	79	90.66		106.91	116.7	126.73	]	(62)
Solar DHW input	ı	using App	endix G or	· Appendix	H (nega	ive quantity	y) (enter	'0' if no sola	r contribu	tion to wate	er heating)	) L	
(add additiona													
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(63)
Output from v	vater hea	ter					•	•	•	•	•	•	
(64)m= 130.86	114.45	118.1	102.97	98.8	85.26	79	90.66	91.74	106.91	116.7	126.73	]	
	•		•			•	0	utput from w	ater heate	er (annual)	112	1262.19	(64)
Heat gains fro	om water	heating,	kWh/m	onth 0.2	5 ′ [0.85	5 × (45)m	ı + (61	m] + 0.8	k [(46)m	+ (57)m	+ (59)m	ı ]	
(65)m= 32.72	28.61	29.53	25.74	24.7	21.31	19.75	22.66	22.93	26.73	29.18	31.68	]	(65)
include (57	)m in cald	culation (	of (65)m	only if c	ylinder	is in the	dwellin	g or hot w	ater is f	rom com	munity h	- neating	
5. Internal g	jains (see	e Table 5	and 5a	):									
Metabolic gai	ns (Table	e 5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m= 116.75	116.75	116.75	116.75	116.75	116.75	116.75	116.7	116.75	116.75	116.75	116.75	1	(66)
Lighting gains	s (calcula	ted in Ap	pendix	L, equat	ion L9 d	or L9a), a	lso se	e Table 5			-	-	
(67)m= 18.77	16.67	13.56	10.27	7.67	6.48	7	9.1	12.21	15.51	18.1	19.3	]	(67)
Appliances ga	ains (calc	ulated ir	Append	dix L, eq	uation L	.13 or L1	3a), al	so see Ta	ble 5			•	
(68)m= 206.03	208.17	202.79	191.32	176.84	163.23	154.14	152	157.39	168.86	183.34	196.94	]	(68)
Cooking gains	s (calcula	ted in A	ppendix	L, equat	ion L15	or L15a	), also	see Table	5			-	
(69)m= 34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	]	(69)
Pumps and fa	ans gains	(Table 5	ōa)					•				-	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)		-	-			-	-	
(71)m= -93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	]	(71)
Water heating	g gains (T	able 5)	-				-	-	-	-	-	-	
(72)m= 43.97	42.58	39.69	35.75	33.2	29.6	26.55	30.46	31.85	35.92	40.52	42.58	]	(72)
Total interna	l gains =				(66	s)m + (67)m	n + (68)r	n + (69)m +	(70)m + (7	71)m + (72)	)m	-	
(73)m= 326.81	325.45	314.06	295.36	275.74	257.34	245.71	249.5	259.48	278.32	299.98	316.85	]	(73)
6. Solar gair	ns:												
Solar gains are		•	r flux from	Table 6a	and asso	ciated equa	ations to	convert to th	ne applica		tion.		
Orientation:			Area		Flo	ux ible 6a		g_ Table 6b	т	FF		Gains	
	Table 6d		m²				, –	Table ob	_ '	able 6c		(W)	,
Southwest <sub>0.9x</sub>		X	11	.2	x	36.79	ļĻ	0.63	x	0.7	=	126	(79)
Southwest <sub>0.9x</sub>	•	X	11	.2	х	62.67	ļĻ	0.63	x	0.7	=	214.62	(79)
Southwest <sub>0.9x</sub>		X	11	.2	х	85.75	ļ <u></u>	0.63	x	0.7	=	293.65	(79)
Southwest <sub>0.9x</sub>		Х	11	.2	х	106.25	ļ L	0.63	x	0.7	=	363.85	(79)
Southwest <sub>0.9x</sub>	0.77	X	11	.2	X ·	119.01		0.63	X	0.7	=	407.54	(79)

_					_		_						_
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	X	118.15		0.63	X	0.7	=	404.59	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	113.91		0.63	X	0.7	=	390.07	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	104.39		0.63	X	0.7	=	357.47	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	92.85		0.63	X	0.7	=	317.96	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	69.27		0.63	x	0.7	=	237.2	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	44.07		0.63	x	0.7	=	150.91	(79)
Southwest <sub>0.9x</sub>	0.77	x	11.	.2	x	31.49		0.63	x	0.7	=	107.83	(79)
Northwest <sub>0.9x</sub>	0.77	X	2.0	)3	x	11.28	X	0.63	x	0.7	=	6.98	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	22.97	х	0.63	x	0.7	=	14.21	(81)
Northwest 0.9x	0.77	x	2.0	)3	x	41.38	х	0.63	х	0.7	=	25.61	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	67.96	x	0.63	x	0.7	=	42.06	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	91.35	x	0.63	x	0.7	=	56.53	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x [	97.38	x	0.63	x	0.7	=	60.27	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x [	91.1	x	0.63	x	0.7	_ =	56.38	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x [	72.63	x	0.63	x	0.7		44.95	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x [	50.42	<b>x</b>	0.63	x	0.7		31.2	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x [	28.07	x	0.63	x	0.7	_ =	17.37	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x [	14.2	x	0.63	x	0.7	=	8.79	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x [	9.21	<b>x</b>	0.63	x	0.7		5.7	(81)
_													
Solar gains in	watts, calc	ulated	for eacl	h month			(83)m	n = Sum(74)m .	(82)m			-	
(83)m= 132.98		19.26	405.9	464.07		4.86 446.4		.42 349.17	254.57	159.7	113.53		(83)
Total gains – i			<del>`                                    </del>	<u> </u>	·	<del></del>	_			_		1	
(84)m= 459.79	554.28 6	33.32	701.26	739.81	72	2.2 692.10	6 652	.01 608.65	532.89	459.69	430.38		(84)
7. Mean inter	nal temper	ature	(heating	season	)								
Temperature	during hea	ting p	eriods ir	n the livi	na a	roo from T	-1.1- 0						<u> </u>
Utilisation fac	tor for gain	s for I			iig a	ilea iloili i	abie 9,	, Th1 (°C)				21	(85)
Jan		3 101 1	iving are		•				ı			21	(85)
	Feb	Mar	iving are Apr		(se		)	, Th1 (°C) ug Sep	Oct	Nov	Dec	21	
(86)m= 0.96				ea, h1,m	(se	e Table 9a	)	ug Sep	Oct 0.87	Nov 0.95	Dec 0.97	21	(85)
(86)m= 0.96  Mean interna	0.94	Mar <sub>0.9</sub>	Apr 0.84	ea, h1,m May 0.74	se J	e Table 9a un Jul .6 0.47	) A	ug Sep 51 0.7	<del>                                     </del>	+		21	
` '	0.94 I temperatu	Mar <sub>0.9</sub>	Apr 0.84	ea, h1,m May 0.74	(se J ollow	e Table 9a un Jul .6 0.47	) 0.5 7 in T	ug Sep 51 0.7 able 9c)	<del>                                     </del>	0.95		21	
Mean interna	0.94 I temperatu 18.99 1	Mar 0.9 ure in 1 9.44	Apr 0.84 living are	ea, h1,m May 0.74 ea T1 (fo	o (se	e Table 9a un Jul .6 0.47 v steps 3 to .78 20.92	) Ai 0.5	ug Sep 51 0.7 Table 9c) 89 20.65	0.87	0.95	0.97	21	(86)
Mean interna (87)m= 18.67	0.94 Il temperatu 18.99 1 during hea	Mar 0.9 ure in 1 9.44	Apr 0.84 living are 19.99	ea, h1,m May 0.74 ea T1 (fo	o (se	e Table 9a un Jul .6 0.47 v steps 3 to .78 20.92	) Ai 0.5	ug Sep 51 0.7 Table 9c) 89 20.65 9, Th2 (°C)	0.87	0.95	0.97	21	(86)
Mean interna (87)m= 18.67  Temperature (88)m= 19.97	0.94 Il temperatu 18.99 1 during hea 19.97 1	Mar 0.9 ure in 1 9.44 ting p 9.97	Apr 0.84 living are 19.99 eriods ir 19.98	ea, h1,m May 0.74 ea T1 (for 20.46 n rest of 19.98	ollow 20 dwe	e Table 9a un Jul .6 0.47 v steps 3 to .78 20.92 elling from .99 19.99	) Al 0.5 O 7 in T 20.6 Table \$ 19.6	ug Sep 51 0.7 Table 9c) 89 20.65 9, Th2 (°C)	20.03	0.95	0.97	21	(86)
Mean interna (87)m= 18.67 Temperature	0.94 I temperatu 18.99 1 during hea 19.97 1 ctor for gain	Mar 0.9 ure in 1 9.44 ting p 9.97	Apr 0.84 living are 19.99 eriods ir 19.98	ea, h1,m May 0.74 ea T1 (for 20.46 n rest of 19.98	ollow 20 dwe 19	e Table 9a un Jul .6 0.47 v steps 3 to .78 20.92 elling from .99 19.99	) Al 0.5 O 7 in T 20.6 Table \$ 19.6	ug Sep 51 0.7 Table 9c) 89 20.65 9, Th2 (°C) 99 19.99	20.03	0.95	0.97	21	(86)
Mean internation (87)m= 18.67  Temperature (88)m= 19.97  Utilisation fact (89)m= 0.96	0.94  I temperatu  18.99  1 during hea  19.97  1 ctor for gain  0.93	Mar 0.9 ure in 1 9.44 ting p 9.97 s for r 0.89	Apr 0.84 living are 19.99 eriods ir 19.98 rest of do 0.82	ea, h1,m  May  0.74  ea T1 (for 20.46  n rest of 19.98  welling,  0.7	(se   J   0   0   0   0   0   0   0   0   0	e Table 9a un Jul .6 0.47 v steps 3 to .78 20.92 elling from .99 19.99 n (see Tab 54 0.38	) Al 0.5 0.5 7 in T 20.6 19.0 19.0 19.0 19.0 19.0 19.0 19.0 19.0	ug Sep 51 0.7  Table 9c) 89 20.65  9, Th2 (°C) 99 19.99	0.87 20.03 19.98	19.24	0.97 18.6 19.98	21	(86) (87) (88)
Mean interna (87)m= 18.67  Temperature (88)m= 19.97  Utilisation fac (89)m= 0.96  Mean interna	0.94 Il temperatu 18.99 1 during hea 19.97 1 ctor for gain 0.93 Il temperatu	Mar   0.9	Apr 0.84 living are 19.99 eriods ir 19.98 rest of do 0.82 the rest	ea, h1,m May 0.74 ea T1 (for 20.46 n rest of 19.98 welling, 0.7 of dwelli	(se   J   0   0   0   0   0   0   0   0   0	e Table 9a un Jul .6 0.47 v steps 3 to .78 20.92 elling from .99 19.99 n (see Tab 54 0.38	Al 0.5  O 7 in T 20.6  Table 9  O 0.4  Steps 3	ug Sep 51 0.7  Table 9c) 89 20.65  9, Th2 (°C) 99 19.99  12 0.64  10 7 in Table	0.87 20.03 19.98 0.85	0.95 19.24 19.98	0.97 18.6 19.98	21	(86) (87) (88) (89)
Mean internation (87)m= 18.67  Temperature (88)m= 19.97  Utilisation fact (89)m= 0.96	0.94 Il temperatu 18.99 1 during hea 19.97 1 ctor for gain 0.93 Il temperatu	Mar 0.9 ure in 1 9.44 ting p 9.97 s for r 0.89	Apr 0.84 living are 19.99 eriods ir 19.98 rest of do 0.82	ea, h1,m  May  0.74  ea T1 (for 20.46  n rest of 19.98  welling,  0.7	(se   J   0   0   0   0   0   0   0   0   0	e Table 9a un Jul .6 0.47 v steps 3 to .78 20.92 elling from .99 19.99 n (see Tab 54 0.38	Al 0.5  O 7 in T 20.6  Table 9  O 0.4  Steps 3	ug Sep 51 0.7 Table 9c) 89 20.65 9, Th2 (°C) 99 19.99 42 0.64 4 to 7 in Table 94 19.75	0.87  20.03  19.98  0.85  le 9c)  19.18	0.95 19.24 19.98	0.97 18.6 19.98 0.96		(86) (87) (88) (89)
Mean internal (87)m= 18.67  Temperature (88)m= 19.97  Utilisation fact (89)m= 0.96  Mean internal (90)m= 17.85	0.94  I temperatule 18.99	Mar 0.9 ure in 1 9.44 ting p 9.97 s for r 0.89 ure in 1 18.6	Apr 0.84 living are 19.99 eriods in 19.98 rest of do 0.82 the rest 19.13	ea, h1,m May 0.74 ea T1 (for 20.46 n rest of 19.98 welling, 0.7 of dwelling, 19.57	(se   J   0   0   0   0   0   0   0   0   0	e Table 9a un Jul .6 0.47 v steps 3 to .78 20.92 elling from .99 19.99 n (see Tab 54 0.38 Γ2 (follow see Tab .85 19.95	Al 0.5  O 7 in T 20.4  Table 9 19.4  O 4  Steps 3 19.4	ug Sep 51 0.7  Fable 9c) 89 20.65  9, Th2 (°C) 99 19.99  12 0.64  1 to 7 in Table 94 19.75	0.87  20.03  19.98  0.85  le 9c)  19.18  fLA = Liv	0.95 19.24 19.98 0.94	0.97 18.6 19.98 0.96	0.34	(86) (87) (88) (89)
Mean interna (87)m= 18.67  Temperature (88)m= 19.97  Utilisation fac (89)m= 0.96  Mean interna (90)m= 17.85	0.94  I temperatulation 18.99  during head 19.97  ctor for gain 0.93  I temperatulation 18.16	Mar 0.9	Apr 0.84 living are 19.99 eriods ir 19.98 rest of do 0.82 the rest 19.13	ea, h1,m May 0.74 ea T1 (for 20.46 n rest of 19.98 welling, 0.7 of dwelling, 19.57	dwee  h2,n  0.  ling  19	e Table 9a  un Jul  .6 0.47  v steps 3 to  .78 20.92  elling from  .99 19.99  n (see Tab  54 0.38  Γ2 (follow s  .85 19.95	Al 0.5  7 in T 20.6  Table 9  19.6  19.6  19.6  19.6  19.6  19.6  19.6  19.6  19.6  19.6	ug Sep 51 0.7  Fable 9c) 89 20.65  9, Th2 (°C) 99 19.99  42 0.64  4 to 7 in Tab 94 19.75  - fLA) × T2	0.87  20.03  19.98  0.85  le 9c)  19.18  fLA = Liv	0.95  19.24  19.98  0.94  18.42  ring area ÷ (-	0.97 18.6 19.98 0.96 17.78 4) =		(86) (87) (88) (89) (90) (91)
Mean internal (87)m= 18.67  Temperature (88)m= 19.97  Utilisation fact (89)m= 0.96  Mean internal (90)m= 17.85	0.94  Il temperatu 18.99	Mar   0.9	Apr 0.84 living are 19.99 eriods ir 19.98 rest of do 0.82 the rest 19.13 r the wh	ea, h1,m May 0.74 ea T1 (for 20.46 n rest of 19.98 welling, 0.7 of dwelling, 19.57	(se   J   0   0   0   0   0   0   0   0   0	e Table 9a un Jul .6 0.47 v steps 3 to .78 20.92 elling from .99 19.99 n (see Tab 54 0.38 T2 (follow s .85 19.95 ) = fLA × T .17 20.28	All 0.5  All 0.5  7 in T  20.1  Table 9  0.4  steps 3  11 + (1  20.1	ug Sep 51 0.7  Table 9c) 89 20.65  9, Th2 (°C) 99 19.99  12 0.64  1 to 7 in Table 94 19.75  — fLA) × T2 26 20.06	0.87  20.03  19.98  0.85  le 9c)  19.18  fLA = Liv	0.95  19.24  19.98  0.94  18.42  ring area ÷ (	0.97 18.6 19.98 0.96		(86) (87) (88) (89)

(93)m=	18.13	18.44	18.89	19.42	19.87	20.17	20.28	20.26	20.06	19.47	18.7	18.06		(93)
` '			uirement		10.07	20.17	20.20	20.20	20.00	10.47	10.7	10.00		()
					re ohtair	ned at st	en 11 of	Table 9b	n so tha	t Ti m-(	76)m an	d re-calc	ulate	
				using Ta		ieu at st	ер 11 ог	Table 31	), 30 tria	t 11,111—(	r O)III air	u re-caic	uiate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac		ains, hm	<u> </u>			Į.		•					
(94)m=	0.95	0.92	0.87	0.8	0.69	0.55	0.41	0.45	0.65	0.83	0.92	0.95		(94)
Usefu	ıl gains,	hmGm .	W = (94	4)m x (8	4)m		!	!						
(95)m=	434.55	507.77	552.49	560.91	512.73	396.67	283.02	291.8	392.73	442.41	423.31	409.9		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8	ļ	<u>!</u>						
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	loss rate	for mea	an intern	al tempe	erature,	Lm,W =	=[(39)m :	x [(93)m-	– (96)m	1				
(97)m=	1159.7	1133.91			676.98	458.25	302.87	317.67	491.68	735.07	963.79	1155.35		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97)	m – (95	)m] x (4	1)m			
(98)m=	539.51	420.76	359.63	224.84	122.2	0	0	0	0	217.74	389.15	554.61		
				I	<u>Į</u>			Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	2828.45	(98)
Space	n hoatin	a roquir	omont in	kWh/m²	2/voor				. ,	` ,	,	, , , , , , , , , , , , , , , , , , ,	20.20	(99)
•		•			ува							L	38.32	(99)
8c. Sp	pace co	oling rec	uiremen	nt										
Calcu				August.	l .		1			_				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
		<u> </u>			1	<del></del>	i e	and exte				Ó		(100)
(100)m=	0	0	0	0	0	773.82	609.17	624.87	0	0	0	0		(100)
		tor for lo		i	i							<del>- 1</del>		(151)
(101)m=		0	0	0	0	0.79	0.85	0.83	0	0	0	0		(101)
1				(100)m x	<u> </u>	1						1		
(102)m=	0	0	0	0	0	611.36	516.46	516.64	0	0	0	0		(102)
1								e Table				1		
(103)m=		0	0	0	0	930.82	893.98	848.49	0	0	0	0		(103)
						dwelling,	continu	ous ( kW	h') = 0.02	24 x [(10	03)m – (	102)m] x	(41)m	
`	04)m to	2ero II (		3 × (98	í –	230.01	280.87	246.89	0	0	0			
(104)m=	U	U	0	0	0	230.01	200.07	240.69	0 <b>T</b> -1-1	0	0	0		7(101)
Coolog	I fraction	,								= Sum(	104) area ÷ (4	=	757.78	(104) (105)
			able 10b	`					10=	cooled	aiea - (²	+) = [	1	(103)
(106)m=		0	0	0	0	0.25	0.25	0.25	0	0	0	0		
(100)	Ů	ŭ	ŭ			0.20	0.20	0.20		' = Sum(		=	0	(106)
Space	cooling	requirer	nent for	month =	: (104)m	× (105)	× (106)r	m	rotai	= <i>Gam</i> (	I <del>MT</del> )	_ [		(100)
(107)m=		0	0	0	0	57.5	70.22	61.72	0	0	0	0		
( - /		-	-				<u> </u>	<u> </u>	Total	= Sum(		=	189.44	(107)
Cnass	ممانمم	roguiron	nant in l	\\/\b/m2/	(00°					`	160081 )	_ 		<b>≓</b>
•		•		(Wh/m²/)					` '	÷ (4) =			2.57	(108)
				alculated	only un	der spec	cial cond	litions, se				,		
Fabrio	Energy	/ Efficier	псу						(99) -	+ (108) =	=		40.88	(109)

### **SAP Input**

Address:

**England** Located in: Region: Thames valley

**UPRN:** 

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

New dwelling design stage Assessment type:

New dwelling Transaction type: Tenure type: Unknown Related party disclosure: No related party Thermal Mass Parameter: Indicative Value Low

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

PCDF Version: 466

Flat Dwelling type:

Detachment:

2020 Year Completed:

Floor Location: Floor area:

Storey height: 73.816 m<sup>2</sup> 2.5 m Floor 0

25.101 m<sup>2</sup> (fraction 0.34)

Living area:

North East Front of dwelling faces:

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

Solid Manufacturer NE SW Manufacturer Windows double-glazed

Yes NW Manufacturer Windows double-glazed Yes

Name:	Gap:	Frame Factor	: g-value:	U-value:	Area:	No. of Openings:
NE	mm	0	0	1.4	2	1
SW	16mm or more	0.7	0.63	1.4	11.205	1

0.63 2.025 NW 16mm or more 0.7 1.4 1 Width: Location: Orient: Name:

Type-Name: Height: North East Corridor Wall NF **External Wall** South West SW 0 0 NW **External Wall** North West 0

Average or unknown Overshading:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elemen	<u>ts</u>						
External Wall	48.426	13.23	35.2	0.15	0	False	N/A
Corridor Wall	25.52	2	23.52	0.15	0.4	False	N/A
Flat Roof	73.816	0	73.82	0.1	0		N/A
Internal Flances	L_						

Internal Elements

Party Elements

User-defined (individual PSI-values) Y-Value = 0.0921 Thermal bridges:

> Length **Psi-value**

Other lintels (including other steel lintels) 7.73 0.293 E2

### **SAP Input**

	26.7	0.049	E4	Jamb
	43.347	0.065	E7	Party floor between dwellings (in blocks of flats)
	11.6	0.078	E16	Corner (normal)
[Approved]	2.9	-0.09	E17	Corner (inverted internal area greater than external area)
	2.9	0.096	E25	Staggered party wall between dwellings
[Approved]	2.9	0.06	E18	Party wall between dwellings
	7.747	0.107	E24	Eaves (insulation at ceiling level - inverted)
	7.65	0.56	E15	Flat roof with parapet
	17.211	0	P3	Intermediate floor between dwellings (in blocks of flats)
	4.179	0.24	P4	Roof (insulation at ceiling level)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery

Number of wet rooms: Kitchen + 2

Ductwork: Insulation, rigid

Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

Main heating system:

Main heating system: Community heating schemes

Heat source: Community boilers

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

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

Boiler interlock: Yes

Main heating Control:

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

thermostats

Control code: 2312

Secondary heating system:

Secondary heating system: None

Water heating

Water heating: From main heating system

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

Others:

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

Low energy lights: 100%

Terrain type: Low rise urban / suburban

EPC language: English Wind turbine: No

Photovoltaics: Photovoltaic 1

Installed Peak power: 0.91 Tilt of collector: 30°

Overshading: None or very little

# **SAP Input**

Collector Orientation: South West

Assess Zero Carbon Home:

Nο

Stroma Name: Stroma FSAP 2012   Stroma Number: STR0001082			User_[	Details:						
## Acade   Section   Secti										
Area(m²)			Property	Address	: Plot 34	ļ				
Area(m²)   Av. Height(m)   Volume(m²)										
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)   T3.82   (1a) x   Z.5   (2a) =	1. Overall dwelling dime	ensions:	Α	- ( 2)		A., 11.	: l- 4 / '	`	\/ = l = /	o\
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+(1n)	Ground floor				l <sub>(1a) x</sub>			_		<u>`</u>
Dwelling volume		3)+(1b)+(1c)+(1d)+(1a)+ (1			<u> </u>				104.54	
2. Ventilation rate:    main   heating   heati		a)+(1b)+(1c)+(1a)+(1c)+(1	'''	73.82	J	.) . (20) . (26	4) . (26) .	(2n)		<b>_</b>
Number of chimneys					(3a)+(3b	0)+(3C)+(3C	a)+(3e)+	(3n) =	184.54	(5)
Number of chimneys	2. Ventilation rate:	main seconda	rv	other		total			m³ ner hou	ır
Number of open flues  0 + 0 + 0 = 0 x20 = 0 (6b)  Number of intermittent fans  Number of passive vents  Number of passive vents  0 x10 = 0 (7b)  Number of flueless gas fires  Air changes per hour  Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30 + (5) = 0.16 (8)  If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)  Number of storeys in the dwelling (ns)  Additional infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction  If both types of well are present, use the value corresponding to the greater well area (after deducting areas of openings); if equal use 0.35  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0 25 - [0.2 × (14) + 100] = 0 (15)  Infiltration rate (8) + (10) + (11) + (12) + (13) + (15) = 0 (15)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)  If based on air permeability value, then (18) = [(17) + 20]+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  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	N. sala and A.P. sala a	heating heating					<u> </u>	. 40	-	_
Number of intermittent fans    3	·		ᆜ  =	0	╛╘	0			0	(6a)
Number of passive vents	Number of open flues	0 + 0	+	0	_ = [	0		(20 =	0	(6b)
Number of flueless gas fires    0	Number of intermittent fa	ins				3	)	(10 =	30	(7a)
Air changes per hour	Number of passive vents	3				0	)	(10 =	0	(7b)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30	Number of flueless gas f	ires				0	)	(40 =	0	(7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 30								A : l		
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.) (01)	( <del>-</del> ) ( <del>-</del> 1)	( <del>-</del> )	_				nanges per no	_
Number of storeys in the dwelling (ns)		•			continue fi		(16)	÷ (5) =	0.16	(8)
Additional infiltration			eu 10 (17),	Oli lei Wise (	continue n	OIII (9) 10	(10)		0	(9)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35  If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  0.25 - [0.2 × (14) ÷ 100] =  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) =  O (15)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 × (19)] =  (20) = 1.5 (0.075 × (19)] =  (21) = (18) × (20) =  D.85 (20)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4	Additional infiltration						[(9	9)-1]x0.1 =		<b>—</b>
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0   0 (12)	Structural infiltration: 0	.25 for steel or timber frame of	or 0.35 fc	r mason	ry consti	ruction			0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0  If no draught lobby, enter 0.05, else enter 0  Percentage of windows and doors draught stripped  Window infiltration  Infiltration rate  (8) + (10) + (11) + (12) + (13) + (15) = 0  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor  (20) = 1 - [0.075 x (19)] = 0.85 (20)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7  Wind Factor (22a)m = (22)m ÷ 4	• • • • • • • • • • • • • • • • • • • •		to the grea	iter wall are	ea (after					
Percentage of windows and doors draught stripped  Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0.25 - [0.2 \times$	=		0.1 (seal	ed), else	enter 0				0	(12)
Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0.015$ Infiltration rate $(8) \div (10) \div (11) \div (12) \div (13) \div (15) = 0.016$ Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area $5.017$ If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ $0.41$	If no draught lobby, en	ter 0.05, else enter 0							0	(13)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0$ (16)  Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ 0.41 (18)  Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.85$ (20)  Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.35$ (21)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= $5.1$ $5$ $4.9$ $4.4$ $4.3$ $3.8$ $3.8$ $3.7$ $4$ $4.3$ $4.5$ $4.7$ Wind Factor $(22a)m = (22)m \div 4$	Percentage of window	s and doors draught stripped							0	(14)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area  If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] = $ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = $ Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7 $(22)m = 5.1  5  4.9  4.4  4.3  3.8  3.8  3.7  4  4.3  4.5  4.7$ Wind Factor $(22a)m = (22)m \div 4$									0	(15)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$ , otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] =$ $(20) = 1 - [0.075 \times (19)] =$ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) =$ $(21) = (18) \times (20) =$ Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7 $(22)m = 5.1 + 5 + 4.9 + 4.4 + 4.3 + 3.8 + 3.8 + 3.8 + 3.7 + 4 + 4.3 + 4.5 + 4.7$ Wind Factor $(22a)m = (22)m \div 4$		50							0	= ' '
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used  Number of sides sheltered  Shelter factor $(20) = 1 - [0.075 \times (19)] = $ $(21) = (18) \times (20) = $ Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = $ $(21) = (18) \times (20) = $ O.35  (21)  Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7 $(22)m = 5.1  5  4.9  4.4  4.3  3.8  3.8  3.7  4  4.3  4.5  4.7$ Wind Factor (22a)m = (22)m $\div$ 4		• • •	•	•	•	etre of e	envelop	e area		=
Number of sides sheltered Shelter factor $ (20) = 1 - [0.075 \times (19)] = $ $ (20) = 1 - [0.075 \times (19)] = $ $ (20) = 1 - [0.075 \times (19)] = $ $ (20) = 1 - [0.075 \times (19)] = $ $ (20) = 1 - [0.075 \times (19)] = $ $ (21) = (18) \times (20) = $ $ (22) = (18) \times (20) = $ $ (23) = (18) \times (20) = $ $ (24) = (18) \times (20) = $ $ (22) = (20) = (20) \times (20) = $ $ (22) = (20) = (20) \times (20) = $ $ (22) = (20) = (20) \times (20) = $ $ (22) = (20) \times (20) = $	•	•				is being u	sed		0.41	(18)
Infiltration rate incorporating shelter factor				,	•	J			2	(19)
Infiltration rate modified for monthly wind speed  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Monthly average wind speed from Table 7  (22)m= $5.1$ $5$ $4.9$ $4.4$ $4.3$ $3.8$ $3.8$ $3.7$ $4$ $4.3$ $4.5$ $4.7$ Wind Factor (22a)m = (22)m $\div$ 4	Shelter factor			(20) = 1 -	[0.075 x (	19)] =			0.85	(20)
Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           Monthly average wind speed from Table 7           (22)m=         5.1         5         4.9         4.4         4.3         3.8         3.7         4         4.3         4.5         4.7           Wind Factor (22a)m = (22)m ÷ 4	·	•		(21) = (18	s) x (20) =				0.35	(21)
Monthly average wind speed from Table 7 (22)m= $\begin{bmatrix} 5.1 & 5 & 4.9 & 4.4 & 4.3 & 3.8 & 3.8 & 3.7 & 4 & 4.3 & 4.5 & 4.7 \end{bmatrix}$ Wind Factor (22a)m = (22)m $\div$ 4		<del></del>	1	1 .	Ι _	T -	1	i _	1	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			Jul	Aug	Sep	Oct	Nov	Dec		
Wind Factor (22a)m = (22)m ÷ 4	<del> </del>	<del> </del>	1	T	1 .	1	T	1	1	
	(22)m= 5.1 5	4.9   4.4   4.3   3.8	3.8	3.7	<u> </u>	4.3	4.5	4.7	J	
(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18	Wind Factor (22a)m = (2	2)m ÷ 4								
	(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18	]	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m						
0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.32	0.35	0.38	0.39	0.41			
Calculate effecture of the Calculate of		•	rate for t	he appli	cable ca	se	-		-	-	-			$\neg$
If exhaust air h			andiv N (2	3h) - (23s	a) v Emy (e	Aguation (1	NSN other	nwisa (23h	) <i>- (</i> 23a)				0	=
If balanced with		0 11	, ,	, (	, ,		,, ,	`	) = (25a)				0	$\frac{1}{2}$
a) If balance		-	-	_					Dh\m ı (	22h) v [	1 (22a)	. 1001	0	(2
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	- 100 <u>]</u>		(2
b) If balance			<u> </u>									J		·
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]		(2
c) If whole h	ouse ex	tract ver	tilation o	or positiv	re input v	ventilatio	on from c	utside	<u>I</u>			ı		
if (22b)n	n < 0.5 ×	(23b), t	hen (24	c) = (23b	); other	wise (24	c) = (22b	) m + 0.	5 × (23b	o)		_		
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0			(2
d) If natural									o =1					
if (22b)n	1	<del>-                                    </del>	· ·		r .				r	0.50	0.50	1		(2
24d)m= 0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58			(2
Effective air	change <sub>0.6</sub>	rate - er 0.59	iter (24a 0.57	) or (24k 0.57	0) or (24)	c) or (24 0.56	d) in box	0.56	0.57	0.58	0.58	1		(2
23)111= 0.0	0.0	0.59	0.57	0.57	0.30	0.30	0.55	0.50	0.57	0.56	0.56			(2
3. Heat losse	s and he	eat loss p	paramet	er:										
LEMENT	Gros area		Openin		Net Ar A ,r		U-valı W/m2		A X U (W/	K)	k-value kJ/m²-l		A Z kJ	X k /K
oors		( /			2	x	1		2					(2
Vindows Type	e 1				11.20	5 x1,	/[1/( 1.4 )+	0.04] =	14.86	=				(2
Vindows Type					2.025	x1,	/[1/( 1.4 )+	0.04] =	2.68	=				(2
Valls Type1	48.4	13	13.2	3	35.2	×	0.18	[	6.34	<b>=</b>		<b>¬</b>		) (2
Valls Type2	25.5	52	2		23.52	2 x	0.18	<u> </u>	4.23			<b>=</b>		(2
Roof	73.8	32	0	=	73.82	<u> </u>	0.13	=	9.6	<b>=</b>		≓ ¦		(3
otal area of e					147.7	=								<b>—</b> )` (3
for windows and			effective wi	ndow U-va			formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	3.2		(-
* include the area	as on both	sides of in	nternal wal	ls and par	titions									
abric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				3	9.7	(3
leat capacity	Cm = S(	(Axk)						((28)	.(30) + (3	2) + (32a)	(32e) =	14	36.37	(3
hermal mass	parame	eter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		2	:50	(3
For design assess an be used inste				construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in T	able 1f			
hermal bridge				usina Ar	pendix l	<						1:	2.53	(3
details of therma	•	,			•							<u>'</u>		(``
otal fabric he	at loss							(33) +	(36) =			52	2.24	(3
entilation 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= 36.54	36.3	36.07	34.98	34.78	33.83	33.83	33.65	34.19	34.78	35.19	35.62			(3
leat transfer of	coefficier	nt, W/K						(39)m	= (37) + (	38)m				
39)m= 88.77	88.54	88.3	87.22	87.01	86.06	86.06	85.89	86.43	87.01	87.42	87.86			
	•	•	•		-	-	-			Sum(39) <sub>1</sub>	12 /12=	8.	7.22	(3

Heat loss para	ameter (I	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m= 1.2	1.2	1.2	1.18	1.18	1.17	1.17	1.16	1.17	1.18	1.18	1.19		
	•			ı		ı	ı		Average =	Sum(40) <sub>1</sub> .	12 /12=	1.18	(40)
Number of day	<u> </u>	nth (Tab	le 1a)					1	1	i	ı		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assumed occi if TFA > 13. if TFA £ 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13.		34		(42)
Annual average Reduce the annu- not more that 125	al average	hot water	usage by	$5\%$ if the $\alpha$	lwelling is	designed t	` ,		se target o		0.66		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage	in litres pe	r day for ea			ctor from	Table 1c x				l	ļ.		
(44)m= 98.62	95.04	91.45	87.87	84.28	80.69	80.69	84.28	87.87	91.45	95.04	98.62		
	•					_	- /			m(44) <sub>112</sub> =		1075.9	(44)
Energy content of													
(45)m= 146.26	127.92	132	115.08	110.42	95.29	88.3	101.32	102.53	119.49	130.43	141.64		(45)
If instantaneous v	vater heati	ng at point	of use (no	o hot water	storage),	enter 0 in	boxes (46		Total = Su	m(45) <sub>112</sub> =	=	1410.68	(45)
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage	loss:			<u> </u>		<u> </u>	<u> </u>						
Storage volum	ne (litres)	) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	•			•			` '						
Otherwise if no		hot wate	er (this ir	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	47)			
Water storage a) If manufact		eclared I	oss facto	or is kno	wn (kWł	n/dav):					0		(48)
Temperature f					(	, , .					0		(49)
Energy lost fro				ear			(48) x (49)	) =			0		(50)
b) If manufac		-	-		or is not	known:	. , , , ,						(==)
Hot water stor	•			le 2 (kW	h/litre/da	ay)					0		(51)
If community he Volume factor	_		on 4.3								0		(52)
Temperature f			2b							<b>—</b>	0		(53)
Energy lost fro				ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or		_	,				, , , ,	, , , ,	,		0		(55)
Water storage	loss cal	culated f	for each	month			((56)m = (	(55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit	,	•			59)m = (	(58) ÷ 36	65 × (41)	m					
(modified by	/ factor f	rom Tab	le H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss calculated for each month (61)m = (60) $\div$ 365 × (41)m													
(61)m= 0	0	0	0	01)111 =	00) -	0	) o	T 0	0	Ιο	0	1	(61)
												J · (59)m + (61)m	(- /
(62)m= 124.32		112.2	97.82	93.86	80.9		86.12	_	101.57	110.87	120.4	1	(62)
Solar DHW input			<u> </u>	<u> </u>			ļ			1		]	(- /
(add additiona										non to wat	or riodiirig)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from v	vater hea	ter	<u> </u>	<u> </u>			<u>.                                    </u>	<u>I</u>	<u>!</u>	1	<u> </u>	ı	
(64)m= 124.32		112.2	97.82	93.86	80.9	9 75.05	86.12	87.15	101.57	110.87	120.4	]	
	1	l .	<u>!</u>	<u>!</u>			0	ıtput from w	ater heate	er (annual)	112	1199.08	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ′ [0.	85 × (45)m	1 + (61)	m] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	 . ]	_
(65)m= 31.08	27.18	28.05	24.45	23.46	20.2	<del></del>	21.53	<del>-</del>	25.39	27.72	30.1	1	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating													
5. Internal gains (see Table 5 and 5a):													
Metabolic gai	·			,									
Jan	Feb	Mar	Apr	May	Ju	n Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 116.75	116.75	116.75	116.75	116.75	116.	75 116.75	116.7	116.75	116.75	116.75	116.75		(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L	or L9a), a	lso se	Table 5				•	
(67)m= 18.77	16.67	13.56	10.27	7.67	6.48	3 7	9.1	12.21	15.51	18.1	19.3	]	(67)
Appliances ga	ains (calc	ulated ir	Append	dix L, eq	uatior	L13 or L1	3a), al	so see Ta	ble 5	•	•	•	
(68)m= 206.03	208.17	202.79	191.32	176.84	163.2	23 154.14	152	157.39	168.86	183.34	196.94	]	(68)
Cooking gains	s (calcula	ted in A	ppendix	L, equat	ion L	15 or L15a	), also	see Table	5	!		•	
(69)m= 34.68	34.68	34.68	34.68	34.68	34.6	8 34.68	34.68	34.68	34.68	34.68	34.68	1	(69)
Pumps and fa	ıns gains	(Table 5	5а)			•	•	•	•	•	•	•	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)	•	•		•	•		•	
(71)m= -93.4	-93.4	-93.4	-93.4	-93.4	-93.	4 -93.4	-93.4	-93.4	-93.4	-93.4	-93.4		(71)
Water heating	gains (T	able 5)					•	•	•	•		•	
(72)m= 41.77	40.45	37.7	33.96	31.54	28.1	2 25.22	28.94	30.26	34.13	38.5	40.46		(72)
Total interna	l gains =		•	•		66)m + (67)n	n + (68)n	n + (69)m +	(70)m + (7	71)m + (72)	)m	•	
(73)m= 324.61	323.32	312.07	293.57	274.08	255.8	36 244.38	248.0	257.89	276.52	297.96	314.72	]	(73)
6. Solar gain	is:												
Solar gains are	calculated	using sola	r flux from	Table 6a	and as	sociated equa	ations to	convert to th	ne applica	ble orienta	tion.		
Orientation:		actor	Area			Flux		g_ Table Ch	-	FF		Gains	
	Table 6d		m²			Table 6a	, –	Table 6b	_ '	able 6c		(W)	_
Southwest <sub>0.9x</sub>	0.77	Х	11	.2	x	36.79	<u> </u>	0.63	x	0.7	=	126	(79)
Southwest <sub>0.9x</sub>	0.77	X	11	.2	x	62.67	l L	0.63	X	0.7	=	214.62	(79)
Southwest <sub>0.9x</sub>	0.77	X	11	.2	x	85.75	<u> </u>	0.63	x [	0.7	=	293.65	(79)
Southwest <sub>0.9x</sub>	0.77	X	11	.2	X	106.25	] [	0.63	x	0.7	=	363.85	(79)
Southwest <sub>0.9x</sub>	0.77	X	11	.2	X	119.01		0.63	X	0.7	=	407.54	(79)

_					_		-		_				_
Southwest <sub>0.9x</sub>	0.77	X	11	.2	x L	118.15	_	0.63	X	0.7	=	404.59	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	113.91	]	0.63	X	0.7	=	390.07	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	104.39	]	0.63	X	0.7	=	357.47	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	92.85	]	0.63	X	0.7	=	317.96	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x [	69.27	]	0.63	x	0.7	=	237.2	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	44.07		0.63	X	0.7	=	150.91	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	х	31.49		0.63	x	0.7	=	107.83	(79)
Northwest <sub>0.9x</sub>	0.77	X	2.0	)3	x [	11.28	x	0.63	x	0.7	=	6.98	(81)
Northwest <sub>0.9x</sub>	0.77	X	2.0	)3	x [	22.97	x	0.63	x	0.7	=	14.21	(81)
Northwest 0.9x	0.77	X	2.0	)3	x [	41.38	x	0.63	x	0.7	=	25.61	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x $\lceil$	67.96	x	0.63	x	0.7	=	42.06	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x T	91.35	x	0.63	x	0.7	=	56.53	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x $\lceil$	97.38	x	0.63	x	0.7	=	60.27	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	91.1	x	0.63	x	0.7		56.38	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x [	72.63	x	0.63	x	0.7		44.95	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x F	50.42	x	0.63	x	0.7		31.2	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x [	28.07	X	0.63	×	0.7		17.37	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x [	14.2	X	0.63	x	0.7		8.79	(81)
Northwest <sub>0.9x</sub>	0.77	×	2.0	)3	x	9.21	x	0.63	×	0.7		5.7	(81)
_					_		_	<u> </u>					_
Solar gains in	watts, calc	culated	for eacl	h month			(83)m	n = Sum(74)m .	(82)m				
(83)m= 132.98	· · ·	319.26	405.9	464.07		446.45	402	.42 349.17	254.5	7 159.7	113.53		(83)
Total gains – i	nternal and	d solar	(84)m =	(73)m -	1 /01	2/m wotto	•				•	•	
		a oolal	(0 1)	(. 0)	+ (00	o)m, wans						_	
(84)m= 457.59		631.33	699.48	738.15	·	).72 690.83	650	.49 607.05	531.09	9 457.66	428.25		(84)
(84)m= 457.59 7. Mean inter	552.16	631.33	699.48	738.15	720	<del></del>	650	.49 607.05	531.09	9 457.66	428.25		(84)
	552.16 6	631.33 rature (	699.48 (heating	738.15 season	720	0.72 690.83			531.09	9 457.66	428.25	21	(84)
7. Mean inter	552.16 6 mal tempel during hea	rature (	699.48 (heating	738.15 season	720 ) ng a	0.72 690.83 rea from Tal			531.09	9 457.66	428.25	21	
7. Mean inter Temperature	552.16 6 mal tempel during hea	rature (	699.48 (heating	738.15 season	720 ) ng ai (see	0.72 690.83 rea from Tal	ble 9		531.09		428.25 Dec	21	
7. Mean inter Temperature Utilisation fac	552.16 contact temper during heater for gain	rature ( ating pe	699.48 (heating eriods in ving are	738.15 season the livinga, h1,m	720 ) ng ai (see	rea from Tale Table 9a) un Jul	ble 9	, Th1 (°C)				21	
7. Mean inter Temperature Utilisation fac  Jan  (86)m= 1	552.16 emperormal temperormal	rature ( ating points for li Mar 0.98	699.48 (heating eriods in the control of the contro	738.15  season the livin ea, h1,m May 0.87	720 ) ng ai (see	rea from Tal e Table 9a) un Jul 71 0.54	ble 9,	, Th1 (°C) ug Sep 59 0.82	Oct	Nov	Dec	21	(85)
7. Mean inter Temperature Utilisation fac	nal temper during head ctor for gain Feb 0.99	rature ( ating points for li Mar 0.98	699.48 (heating eriods in the control of the contro	738.15  season the livin ea, h1,m May 0.87	720 ) ng ai (see Ji o.:	rea from Tal e Table 9a) un Jul 71 0.54	ble 9,	, Th1 (°C)  ug Sep  69 0.82  Table 9c)	Oct	Nov 0.99	Dec	21	(85)
7. Mean inter Temperature Utilisation fac  Jan (86)m= 1  Mean interna (87)m= 19.71	nal temper during head ctor for gain Feb 0.99 I temperat	rature ( ating pens for li Mar 0.98  ure in l 20.17	699.48 (heating eriods in Apr 0.95 iving are 20.51	738.15  season the livin ea, h1,m May 0.87  ea T1 (for 20.79	720 ) ng ai (see 0.5 ollow 20.	rea from Tale Table 9a) un Jul 71 0.54 v steps 3 to 7	Al 0.5	Sep 0.82 able 9c) 98 20.88	Oct 0.97	Nov 0.99	Dec 1	21	(85)
7. Mean inter Temperature Utilisation fac  Jan  (86)m= 1  Mean interna (87)m= 19.71  Temperature	stor for gain Feb 0.99 I temperat 19.89 during hea	rature ( ating points for li Mar 0.98 ure in l 20.17 ating points	699.48 (heating eriods in Apr 0.95 iving are 20.51 eriods ir	738.15  season the livin ea, h1,m May 0.87 ea T1 (fc 20.79 rest of	720 ) ng ai (see 0.5 ollow 20.	rea from Tale Table 9a) un Jul 71 0.54 steps 3 to 995 20.99	Al 0.57 in T 20.	Sep 9 0.82 Sable 9c) 98 20.88 9, Th2 (°C)	Oct 0.97 20.51	Nov 0.99 20.04	Dec 1 1 19.68	21	(85) (86) (87)
7. Mean inter Temperature Utilisation fac  Jan  (86)m= 1  Mean interna  (87)m= 19.71  Temperature  (88)m= 19.92	stor for gain Feb 0.99 I temperat 19.89 during head 19.92	rature ( ating pens for li Mar 0.98 ure in l 20.17 ating pens for li 19.92	699.48 (heating eriods in Apr 0.95 iving are 20.51 eriods in 19.93	738.15  season the livin ea, h1,m May 0.87  ea T1 (fc 20.79  rest of 19.94	7200 ) nng ai (see Ji) 0 0 20 dwee 19	rea from Tale Table 9a) un Jul 71 0.54 v steps 3 to 7.95 20.99 Illing from Tale 95 19.95	Al 0.57 in T 20.	Sep 9 0.82 Sable 9c) 98 20.88 9, Th2 (°C)	Oct 0.97	Nov 0.99 20.04	Dec 1	21	(85)
7. Mean inter Temperature Utilisation fact  Jan (86)m= 1  Mean interna (87)m= 19.71  Temperature (88)m= 19.92  Utilisation fact	stor for gain  respectively. The state of th	rature ( ating pens for li Mar 0.98 ure in l 20.17 ating pens for r	699.48 (heating eriods ir ving are 0.95 iving are 20.51 eriods ir 19.93 est of decrease of	roseason the living a, h1,m May 0.87 ea T1 (for 20.79 rest of 19.94 welling,	7200 ) ng al i (see	rea from Tale Table 9a) un Jul 71 0.54 v steps 3 to 7 95 20.99 Illing from Ta 95 19.95 n (see Table	Al 0.57 in T 20. able 9 19.	Sep 0.82  Table 9c) 98 20.88 9, Th2 (°C) 95 19.94	Oct 0.97 20.51	Nov 0.99 20.04	Dec 1 1 19.68 19.93	21	(85) (86) (87) (88)
7. Mean inter Temperature Utilisation fac  Jan  (86)m= 1  Mean interna  (87)m= 19.71  Temperature  (88)m= 19.92	stor for gain Feb 0.99 I temperat 19.89 during head 19.92	rature ( ating pens for li Mar 0.98 ure in l 20.17 ating pens for li 19.92	699.48 (heating eriods in Apr 0.95 iving are 20.51 eriods in 19.93	738.15  season the livin ea, h1,m May 0.87  ea T1 (fc 20.79  rest of 19.94	7200 ) nng ai (see Ji) 0 0 20 dwee 19	rea from Tale Table 9a) un Jul 71 0.54 v steps 3 to 7 95 20.99 Illing from Ta 95 19.95 n (see Table	Al 0.57 in T 20.	Sep 0.82  Table 9c) 98 20.88 9, Th2 (°C) 95 19.94	Oct 0.97 20.51	Nov 0.99 20.04	Dec 1 1 19.68	21	(85) (86) (87)
7. Mean intermal Temperature Utilisation factors  Jan (86)m= 1  Mean internal (87)m= 19.71  Temperature (88)m= 19.92  Utilisation factors (89)m= 1  Mean internal	stor for gain services of the	rature ( ating points for li Mar 0.98 ure in l 20.17 ating points for r 0.98 ure in t 0.98 ure in t	699.48 (heating eriods in Apr 0.95 iving are 20.51 eriods in 19.93 est of do 0.93 he rest	738.15  season the livin ea, h1,m May 0.87 ea T1 (for 20.79 n rest of 19.94 welling, 0.82 of dwelling	7200 ) ng al i (see	rea from Tale Table 9a) un Jul 71 0.54 v steps 3 to 7.95 20.99 Illing from Tale 95 19.95 n (see Table 61 0.41	Al 0.57 in T 20. able 9 19. 9a) 0.4	Sep  99  98  20.88  97  7h2 (°C)  98  19.94  16  0.75  10  17  18  18  19  19  19  10  10  10  10  10  10  10	Oct 0.97 20.51 19.94 0.95 e 9c)	Nov 0.99 20.04 19.93	Dec 1 19.68 19.93	21	(85) (86) (87) (88) (89)
7. Mean inter Temperature Utilisation fact  Jan  (86)m= 1  Mean interna  (87)m= 19.71  Temperature  (88)m= 19.92  Utilisation fact  (89)m= 1	stor for gain services of the	rature ( ating pens for li Mar 0.98 ure in l 20.17 ating pens for r 0.98	699.48 (heating eriods ir ving are 20.51 eriods ir 19.93 est of do 0.93	roseason the living th	7200 ) ng al i (see	rea from Tale Table 9a) un Jul 71 0.54 v steps 3 to 7 .95 20.99 Illing from Ta .95 19.95 n (see Table 61 0.41	Al 0.57 in T 20. able 9 19. 9a) 0.4	Sep 0.82  Table 9c) 98 20.88  9, Th2 (°C) 95 19.94  to 7 in Table 94 19.88	Oct 0.97 20.51 19.94 0.95 e 9c) 19.55	Nov 0.99 20.04 19.93	Dec 1 19.68 19.93		(85) (86) (87) (88) (89) (90)
7. Mean intermal Temperature Utilisation factors  Jan (86)m= 1  Mean internal (87)m= 19.71  Temperature (88)m= 19.92  Utilisation factors (89)m= 1  Mean internal	stor for gain services of the	rature ( ating points for li Mar 0.98 ure in l 20.17 ating points for r 0.98 ure in t 0.98 ure in t	699.48 (heating eriods in Apr 0.95 iving are 20.51 eriods in 19.93 est of do 0.93 he rest	738.15  season the livin ea, h1,m May 0.87 ea T1 (for 20.79 n rest of 19.94 welling, 0.82 of dwelling	7200 ) ng al i (see	rea from Tale Table 9a) un Jul 71 0.54 v steps 3 to 7.95 20.99 Illing from Tale 95 19.95 n (see Table 61 0.41	Al 0.57 in T 20. able 9 19. 9a) 0.4	Sep 0.82  Table 9c) 98 20.88  9, Th2 (°C) 95 19.94  to 7 in Table 94 19.88	Oct 0.97 20.51 19.94 0.95 e 9c) 19.55	Nov 0.99 20.04 19.93	Dec 1 19.68 19.93	0.34	(85) (86) (87) (88) (89)
7. Mean intermal Temperature Utilisation factors  Jan (86)m= 1  Mean internal (87)m= 19.71  Temperature (88)m= 19.92  Utilisation factors (89)m= 1  Mean internal	stor for gair  letter f	rature ( ating pens for li Mar 0.98 ure in l 20.17 ating pens for r 0.98 ure in t 19.92	699.48 (heating eriods in Apr 0.95 iving are 20.51 eriods in 19.93 est of do 0.93 he rest 19.54	738.15  season the livin ea, h1,m May 0.87 ea T1 (for 20.79 n rest of 19.94 welling, 0.82 of dwelling, 19.79	7200 ) ng al i (see	rea from Tal e Table 9a) un Jul 71 0.54 v steps 3 to 7 .95 20.99 Illing from Ta .95 19.95 n (see Table 61 0.41 T2 (follow ste .92 19.94	Al 0.5 7 in T 20. able 9 19. 9a) 0.4 eps 3	Th1 (°C)  ug Sep  99 0.82  Table 9c)  98 20.88  9, Th2 (°C)  95 19.94  16 0.75  to 7 in Table  194 19.88	Oct 0.97 20.51 19.94 0.95 e 9c) 19.55	Nov 0.99 20.04 19.93	Dec 1 19.68 19.93		(85) (86) (87) (88) (89) (90)
7. Mean inter Temperature Utilisation fact  Jan  (86)m= 1  Mean interna (87)m= 19.71  Temperature (88)m= 19.92  Utilisation fact (89)m= 1  Mean interna (90)m= 18.75	nal temper during head temperate tor for gain lemperate 19.89 during head 19.92 etor for gain lemperate 18.93 lemperate 19.26	rature ( ating pens for li Mar 0.98 ure in l 20.17 ating pens for r 0.98 ure in t 19.21 ure (for	699.48 (heating eriods in ving are 20.51 eriods in 19.93 est of do 0.93 he rest 19.54  r the wh	738.15  season the livin ea, h1,m May 0.87 ea T1 (for 20.79 n rest of 19.94 welling, 0.82 of dwelling, 19.79 ole dwe 20.13	7200 ) ng al i (see	rea from Tal e Table 9a) un Jul 71 0.54 v steps 3 to 7 .95 20.99 Illing from Ta .95 19.95 n (see Table 61 0.41 T2 (follow ste .92 19.94  ) = fLA × T1 .27 20.3	All 0.5 7 in T 20. able 9 19. 9a) 0.4 eps 3 19. + (1 20	Sep  99  0.82  Table 9c)  98  20.88  9, Th2 (°C)  95  19.94  16  0.75  to 7 in Tabl  94  19.88  1  - fLA) × T2  3  20.22	Oct 0.97 20.51 19.94 0.95 e 9c) 19.55 LA = Liv	Nov 0.99 20.04 19.93 0.99 19.09 ving area ÷ (4	Dec 1 19.68 19.93		(85) (86) (87) (88) (89) (90)

(93)m=	19.07	19.26	19.53	19.87	20.13	20.27	20.3	20.3	20.22	19.87	19.41	19.05		(93)
` '			uirement		20.13	20.21	20.5	20.5	20.22	19.07	13.41	19.00		(00)
					ro obtair	and at et	on 11 of	Table 0	b, so tha	t Ti m_/	76)m an	d re-calc	vulato	
			or gains			ieu ai sii	ер птог	Table 3	0, 50 tila	t 11,111—(	r Ojiii aii	u ie-caic	uiaie	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	<u> </u>										
(94)m=	1	0.99	0.98	0.93	0.83	0.64	0.46	0.51	0.77	0.95	0.99	1		(94)
Usefu	ıl gains,	hmGm	, W = (9 <sup>2</sup>	4)m x (8	4)m	ļ.	ļ.						l	
(95)m=	455.78	546.69	615.56	651.69	611.75	462.91	314.72	328.69	467.4	505.88	453.68	427.01		(95)
Month	nly avera	age exte	rnal tem	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	loss rate	for me	an intern	al tempo	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m	]				
(97)m=	1311.39	1271.44	1150.9	956.81	733.68	488.06	318.41	334.76	528.82	807.03	1076.35	1304.34		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m	_		
(98)m=	636.58	487.03	398.29	219.69	90.72	0	0	0	0	224.06	448.32	652.74		
								Tota	l per year	(kWh/yea	r) = Sum(9	8) <sub>15,912</sub> =	3157.43	(98)
Space	e heatin	g require	ement in	kWh/m²	²/year								42.77	(99)
·		• •	quiremen		,									
			July and		Soo Tol	blo 10b								
Calcu	Jan	Feb	Mar	August. Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat				<u> </u>		L	L		ernal ten					
(100)m=	0	0	0	0	0	809.01	636.88	652.76	0	0	0	0		(100)
	ation fac	tor for lo	ss hm		l	l	l	1	l .		1	l		
(101)m=		0	0	0	0	0.88	0.94	0.92	0	0	0	0		(101)
Usefu	ıl loss, h	ımLm (V	vatts) = (	(100)m x	(101)m	!	ļ	!	ļ		!	ļ		
(102)m=	0	0	0	0	0	715.63	597.57	600.91	0	0	0	0		(102)
Gains	s (solar g	gains ca	lculated	for appli	cable w	eather re	egion, se	e Table	10)				l	
(103)m=		0	0	0	0	929.34	892.65	846.96	0	0	0	0		(103)
Space	e coolin	g require	ement fo	r month,	whole o	lwelling,	continu	ous ( kW	h' = 0.02	24 x [(10	03)m – (	102)m ] :	x (41)m	
set (1	04)m to	zero if (	(104)m <	3 × (98	)m									
(104)m=	0	0	0	0	0	153.87	219.54	183.06	0	0	0	0		_
										= Sum(		=	556.47	(104)
	fraction								f C =	cooled	area ÷ (4	4) =	1	(105)
		<u> </u>	able 10b	<del>i                                      </del>		0.05	0.05						1	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		7,,,,,
Space	cooling	roquiro	ment for	month	. (104)~	√ (10E\	v (10e)-	m	ı otal	! = Sum(	1U4)	=	0	(106)
(107)m=		requirer 0	0	0	0	38.47	54.88	45.77	0	0	0	0		
(101)111=						J 50.41	J-4.00	75.77		= Sum(		=	120.40	(107)
0	aa-!!		man # 1 : 1	AA/I- / 2/							16961 )	_	139.12	┥
		•	ment in k						` '	÷ (4) =			1.88	(108)
		•	, i	alculated	only un	der spec	cial conc	litions, s	ee sectio	<u> </u>				
Fabrio	c Energy	y Efficier	ncy						(99) -	+ (108) :	=		44.66	(109)
Targe	et Fabri	c Energ	y Efficie	ency (TF	EE)								51.36	(109)

		Hear	Details:						
Access Name:	Zahid Ashraf	USEI		- Mirror	hau.		CTDO	001082	
Assessor Name: Software Name:	Stroma FSAP 2012		Stroma Softwa					n: 1.0.5.9	
			y Address:						
Address :									
1. Overall dwelling dime	ensions:		4 0						
Ground floor		Ar	ea(m²) 73.82	(1a) x		<b>ight(m)</b> 2.5	(2a) =	Volume(m³	(3a)
Total floor area TFA = (1	2)+(1b)+(1c)+(1d)+(1c)-	 - (1p) [		(4)				104.54	
	a)+(1b)+(1c)+(1d)+(1e)-	F(111)	73.82		)T(3C)T(3C	d)+(3e)+	(3n) -		7,5
Dwelling volume				(3a)+(3b)	)+(30)+(30	ı)+(3e)+	.(311) =	184.54	(5)
2. Ventilation rate:	main sec	condary	other		total			m³ per hou	r
Number of chimneys	heating he	ating +	0	1 = [	0	x 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0	]	0		20 =	0	(6b)
Number of intermittent fa			0	J <u> </u>			10 =	-	(7a)
Number of passive vents				Ļ	0		10 =	0	= ' '
·				Ļ	0		40 =	0	(7b)
Number of flueless gas f	ires				0	^	-	0	(7c)
							Air ch	anges per ho	ur
Infiltration due to chimne	ys, flues and fans = (6a)	+(6b)+(7a)+(7b)	+(7c) =	Γ	0		÷ (5) =	0	(8)
	peen carried out or is intended	, proceed to (17	), otherwise o	ontinue fr	om (9) to	(16)			<u>-</u> -
Number of storeys in the Additional infiltration	ne dwelling (ns)					[(9).	-1]x0.1 =	0	(9)
	.25 for steel or timber fra	ame or 0.35 f	or masonr	y constr	uction	[(0)	17.0.1 -	0	(11)
	resent, use the value correspo	onding to the gre	ater wall area	a (after			!		_
deducting areas of openial If suspended wooden to	ngs);	d) or 0.1 (sea	aled), else	enter 0			İ	0	(12)
If no draught lobby, en	,	, (	,,					0	(13)
Percentage of window	s and doors draught stri	pped						0	(14)
Window infiltration			0.25 - [0.2			. (45)		0	(15)
Infiltration rate	q50, expressed in cubic	motros por	(8) + (10) ·				oroo	0	= (16)
If based on air permeabil	•	•	•	•	elle oi e	rivelope	alea	0.15	(17)
·	es if a pressurisation test has b				is being u	sed		00	
Number of sides sheltere Shelter factor	ed		(20) = 1 - [	0 075 v (1	(Q)1 <b>—</b>			2	(19)
Infiltration rate incorporate	ting shelter factor		$(20) = 1 \cdot 1$ $(21) = (18)$		9)] =			0.85	(20)
Infiltration rate modified f	_		(= 1)	(=0)				0.13	(21)
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7	•							
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m = 1.27   1.25	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		
		-				•		1	

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(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	]	
Calculate effect If mechanica		_	rate for t	he appli	cable ca	se					•		(23a
If exhaust air he			endix N. (2	3b) = (23a	a) × Fmv (e	eguation (N	N5)) othe	rwise (23b	) = (23a)			0.5	(23k
If balanced with									, (200)			79.05	(230
a) If balance		•	•	J		`		,	2h)m + (	23h) <b>v</b> [	1 – (23c)		(230
(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	ntilation	without	heat red	coverv (N	и ЛV) (24b	)m = (22	2b)m + (	23b)	<u> </u>	J	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24)
c) If whole h					•				.5 × (23b	) )	!	1	
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(240
d) If natural if (22b)n					•				0.5]	!	!	1	
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
Effective air	change	rate - er	iter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)				_	
(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)
3. Heat losse	s and he	eat loss r	paramet	ėr.									
ELEMENT	Gros	·	Openin		Net Ar	ea	U-valı	re	AXU		k-value	9	ΑΧk
	area	$(m^2)$	'n		A ,r	m²	W/m2	K	(W/	K)	kJ/m²-	K	kJ/K
Doors					2	X	1.4	= [	2.8				(26)
Windows Type	e 1				11.20	5 x1	/[1/( 1.4 )+	0.04] =	14.86				(27)
Windows Type	2				2.025	x1	/[1/( 1.4 )+	0.04] =	2.68				(27)
Walls Type1	48.4	3	13.2	3	35.2	X	0.15	= [	5.28				(29)
Walls Type2	25.5	52	2		23.52	<u>x</u>	0.14	= [	3.33				(29)
Roof	73.8	32	0		73.82	<u>x</u>	0.1	= [	7.38				(30)
Total area of e	lements	, m²			147.7	6							(31)
* for windows and ** include the area						ated using	formula 1	/[(1/U-valu	ıe)+0.04] á	as given in	paragrapl	n 3.2	
abric heat los	ss, W/K =	= S (A x	U)				(26)(30)	+ (32) =				36.33	(33)
Heat capacity	Cm = S(	(Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	1486.37	7 (34)
Thermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For design assess can be used inste				construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
Thermal bridge	es : S (L	x Y) cal	culated (	using Ap	pendix I	<						13.6	(36)
if details of therma		are not kn	own (36) =	= 0.05 x (3	1)								
Total fabric he									(36) =			49.93	(37)
Ventilation hea									= 0.33 × (	1		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	-	(20
38)m= 16.28	16.08	15.89	14.92	14.73	13.76	13.76	13.56	14.14	14.73	15.11	15.5	J	(38
Heat transfer of					T _	T _	T _		= (37) + (	·	Γ_	1	
(39)m= 66.21	66.02	65.82	64.85	64.66	63.69	63.69	63.49	64.08	64.66	65.05	65.43	01.5	
									Average =	Sum(39)₁	12 /12=	64.8	(39)

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.9	0.89	0.89	0.88	0.88	0.86	0.86	0.86	0.87	0.88	0.88	0.89		
		!						,	Average =	Sum(40) <sub>1</sub> .	12 /12=	0.88	(40)
Number of day	·							_	<u> </u>				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ar:	
Assumed occurring TFA > 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (¯	TFA -13		34		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the a	welling is	designed t			se target o		.38		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage				,									
(44)m= 103.82	100.04	96.26	92.49	88.71	84.94	84.94	88.71	92.49	96.26	100.04	103.82		
	ļ							-	Total = Su	m(44) <sub>112</sub> =	= [	1132.53	(44)
Energy content of	f hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x C	Tm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 153.95	134.65	138.95	121.14	116.23	100.3	92.94	106.65	107.93	125.78	137.3	149.1		_
If instantaneous v	water heati	na at noint	of use (no	hot water	etoraga)	enter∩in	hoves (16		Total = Su	m(45) <sub>112</sub> =	= [	1484.92	(45)
	1		,		,		` '						(40)
(46)m= 23.09 Water storage	20.2 ! loss:	20.84	18.17	17.44	15.05	13.94	16	16.19	18.87	20.59	22.36		(46)
Storage volum		) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community I	neating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if n	o stored	hot wate	er (this in	cludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	47)			
Water storage													
a) If manufac				or is kno	wn (kWh	n/day):					0		(48)
Temperature f											0		(49)
Energy lost fro		•					(48) x (49)	) =		1	10		(50)
<ul><li>b) If manufact</li><li>Hot water stor</li></ul>			-							0	02		(51)
If community I	•			- (	.,	-77				<u>_</u>	.02		(= -)
Volume factor	from Ta	ble 2a								1.	.03		(52)
Temperature f	factor fro	m Table	2b							0	.6		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter (50) or	(54) in (	55)								1.	.03		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)ı	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	хН	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	 3							0		(58)
Primary circuit	`	,			59)m = (	(58) ÷ 36	65 × (41)	m					
(modified by	y factor f	rom Tab	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$													
(61)m= 0	0	0	0	0	00) -	0 0	) T o	T 0	0	0	0	1	(61)
	l			alculated	l for es	ch month						J · (59)m + (61)m	` ,
(62)m= 209.2	<del></del>	194.22	174.63	171.51	153.79		161.9		181.06	190.79	204.37	1	(62)
Solar DHW inpu		<u> </u>		. Appendix	<u> </u>							<u></u>	` ,
(add addition											,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from	water hea	ter	ļ.				ļ.		·!	·!		_	
(64)m= 209.2		194.22	174.63	171.51	153.79	9 148.22	161.9	3 161.42	181.06	190.79	204.37	1	
		<u>!</u>	!	l .	<u> </u>		C	utput from w	ater heate	er (annual)	12	2135.76	(64)
Heat gains f	rom water	heating,	, kWh/m	onth 0.2	5 ´ [0.8	85 × (45)m	า + (61	)m] + 0.8	x [(46)m	+ (57)m	+ (59)m	 n ]	_
(65)m= 95.4°		90.42	83.07	82.87	76.15	<del></del>	79.6	<del>`                                    </del>	86.04	88.45	93.8	1	(65)
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating													
5. Internal	gains (see	e Table 5	and 5a	):	-								
Metabolic ga	ins (Table	e 5), Wat	ts										
Jar	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	]	
(66)m= 140.1	1 140.11	140.11	140.11	140.11	140.1	1 140.11	140.1	1 140.11	140.11	140.11	140.11	]	(66)
Lighting gair	ns (calcula	ted in Ap	opendix	L, equat	ion L9	or L9a), a	also se	e Table 5				_	
(67)m= 46.93	3 41.69	33.9	25.67	19.19	16.2	17.5	22.7	30.53	38.77	45.25	48.24	]	(67)
Appliances (	gains (calc	ulated ir	n Append	dix L, eq	uation	L13 or L1	3a), a	lso see Ta	ble 5		_	_	
(68)m= 307.5	1 310.71	302.66	285.55	263.94	243.6	3 230.06	226.8	7 234.91	252.03	273.64	293.95	]	(68)
Cooking gair	ns (calcula	ited in A	ppendix	L, equat	ion L1	5 or L15a	), also	see Table	5	-	-	_	
(69)m= 51.35	5 51.35	51.35	51.35	51.35	51.35	51.35	51.3	5 51.35	51.35	51.35	51.35	]	(69)
Pumps and	fans gains	(Table 5	5a)									_	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)						-	_	
(71)m= -93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	]	(71)
Water heating	ng gains (T	able 5)		-	-			-		-	-	_	
(72)m= 128.2	4 126.06	121.53	115.38	111.38	105.70	6 100.97	107.	1 109.28	115.65	122.84	126.07	]	(72)
Total intern	al gains =				(6	66)m + (67)n	n + (68)	m + (69)m +	(70)m + (7	71)m + (72)	)m	_	
(73)m= 580.7	4 576.5	556.15	524.64	492.55	463.6	3 446.58	454.7	6 472.77	504.49	539.78	566.3	]	(73)
6. Solar gai	ns:												
Solar gains ar	e calculated	using sola	r flux from	Table 6a	and ass	ociated equa	ations to	convert to the	ne applica		tion.		
Orientation:	Access F Table 6d		Area m²			lux able 6a		g_ Table 6b	т	FF able 6c		Gains	
					'	able ba		Table 6b	_ '	able oc		(W)	,
Southwest <sub>0.9</sub>		X	11	.2	X	36.79	ļĻ	0.63	x	0.7	=	126	(79)
Southwest <sub>0.9</sub>	<u> </u>	X	11	.2	X	62.67	ļĻ	0.63	x	0.7	=	214.62	(79)
Southwest <sub>0.9</sub>	<u> </u>	X	11	.2	x	85.75	Ţ	0.63	x	0.7	=	293.65	(79)
Southwest <sub>0.9</sub>		X	11	.2	x	106.25	Ţ	0.63	x	0.7	=	363.85	(79)
Southwest <sub>0.9</sub>	0.77	X	11	.2	X	119.01	J L	0.63	X	0.7	=	407.54	(79)

_													
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	X	118.15	]	0.63	X	0.7	=	404.59	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	113.91	]	0.63	x	0.7	=	390.07	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	104.39		0.63	X	0.7	=	357.47	(79)
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	92.85		0.63	X	0.7	=	317.96	(79)
Southwest <sub>0.9x</sub>	0.77	x	11.	.2	x	69.27		0.63	X	0.7	=	237.2	(79)
Southwest <sub>0.9x</sub>	0.77	х	11.	.2	x	44.07		0.63	X	0.7	=	150.91	(79)
Southwest <sub>0.9x</sub>	0.77	х	11.	.2	x	31.49		0.63	X	0.7	=	107.83	(79)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	11.28	x	0.63	x	0.7	=	6.98	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	22.97	x	0.63	X	0.7	=	14.21	(81)
Northwest 0.9x	0.77	X	2.0	)3	x	41.38	x	0.63	X	0.7	=	25.61	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	67.96	x	0.63	X	0.7	=	42.06	(81)
Northwest <sub>0.9x</sub>	0.77	X	2.0	)3	x	91.35	x	0.63	x	0.7	=	56.53	(81)
Northwest <sub>0.9x</sub>	0.77	X	2.0	)3	x	97.38	x	0.63	x	0.7	=	60.27	(81)
Northwest <sub>0.9x</sub>	0.77	X	2.0	)3	x	91.1	x	0.63	X	0.7	=	56.38	(81)
Northwest <sub>0.9x</sub>	0.77	X	2.0	)3	x	72.63	x	0.63	x	0.7	=	44.95	(81)
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	50.42	x	0.63	X	0.7	=	31.2	(81)
Northwest <sub>0.9x</sub>	0.77	X	2.0	)3	x	28.07	x	0.63	X	0.7	=	17.37	(81)
Northwest <sub>0.9x</sub>	0.77	X	2.0	)3	x	14.2	x	0.63	x	0.7	=	8.79	(81)
Northwest <sub>0.9x</sub>	0.77	х	2.0	)3	x	9.21	x	0.63	X	0.7	=	5.7	(81)
Solar gains in							(83)m	s = Sum(74)m.	(82)m			Ī	
(83)m= 132.98	<u> </u>	319.26	405.9	464.07	464		402	.42 349.17	254.5	7 159.7	113.53		(83)
Total gains – i			` '		Ò	<del></del>	_	•		-		1	( <b>5</b> .1)
(84)m= 713.72	805.33	875.41	930.54	956.62	928	.49 893.03	857.	.18 821.93	759.00	6 699.48	679.83		(84)
7. Mean inter	nal tempe	erature	(heating	season	)								_
Temperature	during he	ating p	eriods ir	the livi	ng ar	ea from Ta	able 9,	Th1 (°C)				21	(85)
Utilisation fac	<u>_</u>	- 1	iving are	ea, h1,m	(see	Table 9a)	1				<del></del>	ı	
Jan	Feb	Mar	Apr	May	<del>                                     </del>	ın Jul	+	ug Sep	Oct	+	Dec		
(86)m= 0.89	0.85	0.79	0.69	0.56	0.4	0.31	0.3	0.5	0.71	0.84	0.9		(86)
Mean interna	l temperat	ture in I	iving are	ea T1 (fo	ollow	steps 3 to	7 in T	able 9c)				•	
(87)m= 19.75	19.99	20.29	20.62	20.83	20.	95 20.99	20.9	98 20.91	20.64	20.16	19.7		(87)
Temperature	during he	ating p	eriods ir	rest of	dwe	ling from T	able 9	9, Th2 (°C)					
				20.19	20	.2 20.2	20.	.2 20.19	20.19	20.18	20.18		(88)
(88)m= 20.17	20.17	20.17	20.19	20.10									
	<u> </u>					(see Table	 е 9а)	<u> </u>		<u>.</u>			
(88)m= 20.17  Utilisation factors (89)m= 0.88	<u> </u>					<u> </u>	e 9a)	28 0.45	0.68	0.82	0.89		(89)
Utilisation fac	otor for gai	ins for r	est of d	welling, 0.53	h2,m 0.3	0.25	0.2	<u> </u>		0.82	0.89		(89)
Utilisation fac	otor for gai	ins for r	est of d	welling, 0.53	h2,m 0.3	0.25 2 (follow st	0.2	to 7 in Tabl			0.89		(89) (90)
Utilisation faction (89)m= 0.88  Mean interna	tor for gai	ins for r 0.77 ture in t	est of do	welling, 0.53 of dwell	h2,m 0.3	0.25 2 (follow st	0.2 teps 3	to 7 in Tabl	e 9c) 19.77		18.46	0.34	, ,
Utilisation fact (89)m= 0.88  Mean internat (90)m= 18.52	o.83 l temperat	ins for r 0.77 ture in t 19.28	est of d 0.66 he rest 19.72	welling, 0.53 of dwelli 20.01	h2,m 0.3 ing T 20.	0.25 2 (follow st 16 20.19	0.2 teps 3	to 7 in Tabl	e 9c) 19.77	19.11	18.46	0.34	(90)
Utilisation fact (89)m= 0.88  Mean internation (90)m= 18.52  Mean internation (90)m= 18.52	tor for gai	ins for r 0.77 ture in t 19.28	est of do 0.66 the rest 19.72	welling, 0.53 of dwelli 20.01	h2,m 0.3 ing T 20.	$\begin{array}{c c} \hline 37 & 0.25 \\ \hline 2 & \text{(follow st} \\ 16 & 20.19 \\ \hline = & \text{fLA} \times \text{T1} \end{array}$	0.2 teps 3 20.	to 7 in Tabl 19 20.11 f - fLA) × T2	e 9c) 19.77 LA = Liv	19.11 ving area ÷ (-	18.46	0.34	(90)
Utilisation fact (89)m= 0.88  Mean internat (90)m= 18.52	tor for gai 0.83 I temperat 18.86 I temperat 19.24	ins for r 0.77 ture in t 19.28 ture (fo	est of do 0.66 the rest 19.72 r the wh	welling, 0.53 of dwelli 20.01 ole dwe	h2,m 0.3 ing T 20.	0.25 2 (follow st 16 20.19 = fLA × T1 43 20.46	0.2 deps 3 20.	to 7 in Tabl 19 20.11  - fLA) × T2 46 20.39	e 9c) 19.77 LA = Liv	19.11 ving area ÷ (4	18.46	0.34	(90)

				•	•	•		•		•	· · · · · · · · · · · · · · · · · · ·		
(93)m= 18.94	19.24	19.62	20.03	20.29	20.43	20.46	20.46	20.39	20.07	19.47	18.88		(93)
8. Space hea													
Set Ti to the the utilisation			•		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		
Utilisation fac		L		1				1					
(94)m= 0.85	0.81	0.75	0.65	0.53	0.39	0.27	0.3	0.46	0.67	0.81	0.87		(94)
Useful gains,	hmGm	, W = (9	4)m x (8	4)m			•						
(95)m= 610.19	653.6	656.24	608.19	507.38	358.37	242.79	253.6	379.56	508.84	563.95	589.56		(95)
Monthly aver	age exte	ernal tem	perature	from Ta	able 8		,					ı	
(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	1	1	<del></del>									1	(07)
(97)m= 969.07	946.76	863.78	721.6	555.32	371.09	245.88	257.7	402.75	612.03	804.51	960.52		(97)
Space heatin (98)m= 267.01	g require	154.41	81.66	35.67	/vn/mon	$\ln = 0.02$	24 X [(97]	)m – (95 0	)MJ X (4 76.77	1)m 173.2	275.99		
(96)11= 207.01	197	134.41	01.00	33.07	U	0		l per year		<u> </u>	<u> </u>	1261.72	(98)
				.,			TULA	прегуеат	(KVVII/yeai	) = Sum(9	O)15,912 =		亅`
Space heatin	g requir	ement in	kVVh/m²	/year								17.09	(99)
9b. Energy red			· ·	Ĭ									
This part is use Fraction of spa										unity sch	neme.	0	(301)
·			•		-	_	(Table I	1) 0 11 11	one			0	╡```
Fraction of spa	ace heat	from co	mmunity	system	1 – (30	1) =						1	(302)
The community so									up to four	other heat	sources; ti	he latter	
includes boilers, here		-			rom power	stations.	see Appei	iuix C.				1	(303a)
Fraction of total			-		oilers				(3	02) x (303	a) =	1	(304a)
Factor for conf	trol and	charging	method	(Table	4c(3)) fo	r commı	unity hea	nting sys	tem			1	(305)
Distribution los	ss factor	(Table 1	12c) for (	commun	ity heatii	ng syste	m					1.05	(306)
Space heating	q											kWh/yea	_ r
Annual space	_	requiren	nent									1261.72	7
Space heat fro	m Com	munity b	oilers					(98) x (30	04a) x (30	5) x (306) :	=	1324.81	(307a)
Efficiency of se	econdar	y/supple	mentary	heating	system	in % (fro	m Table	4a or A	ppendix	E)		0	(308
Space heating	require	ment fro	m secon	dary/su	oplemen	tary sys	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water heating	ני												
Annual water		requirem	ent									2135.76	
If DHW from c													<del>-</del>
Water heat fro		•						(64) x (30	03a) x (30	5) x (306) :	=	2242.55	(310a)
Electricity used for heat distribution $0.01 \times [(307a)(307e) + (310a)(310e)] = $											35.67	(313)	
Cooling System	_	-	•									0	(314)
Space cooling	(if there	is a fixe	ed cooling	g systen	n, if not e	enter 0)		= (107) ÷	(314) =			0	(315)
Electricity for p											Ī		7,000
mechanical ve	ntilation	- baland	cea, extra	act or po	sitive in	put from	outside					287.05	(330a)

warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/yea	ar	=(330a) + (330b) + (330g) =	287.05	(331)
Energy for lighting (calculated in Appe	ndix L)		331.54	(332)
Electricity generated by PVs (Appendi	x M) (negative quantity)		-749.25	(333)
Electricity generated by wind turbine (	Appendix M) (negative quantity)		0	(334)
10b. Fuel costs – Community heating	scheme			
	<b>Fuel</b> kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating from CHP	(307a) x	4.24 x 0.01 =	56.17	(340a)
Water heating from CHP	(310a) x	4.24 × 0.01 =	95.08	(342a)
		Fuel Price		
Pumps and fans	(331)	13.19 × 0.01 =	37.00	(349)
Energy for lighting	(332)	13.19 × 0.01 =	43.73	(350)
Additional standing charges (Table 12)	)		120	(351)
Energy saving/generation technologies  Total energy cost	s = (340a)(342e) + (345)(354) =		352.85	(355)
11b. SAP rating - Community heating			332.83	(000)
				(2.7.2)
Energy cost deflator (Table 12) Energy cost factor (ECF)	$[(355) \times (356)] \div [(4) + 45.0] =$			(356) (357)
SAP rating (section12)	[(000) (000)] ( [(0) (000)]			(358)
12b. CO2 Emissions – Community hea	ating scheme		32.0	(000)
	En	ergy Emission facto		
		Vh/year kg CO2/kWh	kg CO2/year	
CO2 from other sources of space and Efficiency of heat source 1 (%)		Is repeat (363) to (366) for the second for	uel 94	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x	100 ÷ (367b) x 0.22	<b>=</b> 819.73	(367)
Electrical energy for heat distribution	[(313) x	0.52	= 18.51	(372)
Total CO2 associated with community	systems (363)(3	366) + (368)(372)	= 838.25	(373)
CO2 associated with space heating (s	econdary) (309) x	0	= 0	(374)
CO2 associated with water from imme	rsion heater or instantaneous he	eater (312) x 0.22	= 0	(375)
Total CO2 associated with space and	water heating (373) + (373)	374) + (375) =	838.25	(376)
CO2 associated with electricity for pun	nps and fans within dwelling (33	(1)) x 0.52	= 148.98	(378)
CO2 associated with electricity for ligh		0.52	= 172.07	(379)
, ,	ting (332))) x	0.52	172.07	(3. 5)
Energy saving/generation technologies				
Energy saving/generation technologies			-388.86	(380)

Dwelling CO2 Emission Rate (383) ÷ (4) =				10.44	(384)
El rating (section 14)				91.31	(385)
13b. Primary Energy – Community heating scheme					
	Energy kWh/year	Primary factor		Energy /h/year	
Energy from other sources of space and water heating (not Cl Efficiency of heat source 1 (%)	HP) ing two fuels repeat (363) to	(366) for the second t	fuel [	94	(367a)
Energy associated with heat source 1 [(307b	)+(310b)] x 100 ÷ (367b) x	1.22	= [	4629.98	(367)
Electrical energy for heat distribution	[(313) x		= [	109.52	(372)
Total Energy associated with community systems	(363)(366) + (368)(37	2)	= [	4739.5	(373)
if it is negative set (373) to zero (unless specified otherwise	, see C7 in Appendix C	C)		4739.5	(373)
Energy associated with space heating (secondary)	(309) x	0	= [	0	(374)
Energy associated with water from immersion heater or instar	taneous heater(312) x	1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =		[	4739.5	(376)
Energy associated with space cooling	(315) x	3.07	= [	0	(377)
Energy associated with electricity for pumps and fans within d	welling (331)) x	3.07	= [	881.25	(378)
Energy associated with electricity for lighting	(332))) x	3.07	= [	1017.84	(379)
Energy saving/generation technologies Item 1		3.07 × 0.01	=	-2300.19	(380)
Total Primary Energy, kWh/year sum of (376	)(382) =			4338.39	(383)

		Llea	r Details:						
A consequently and	004000								
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	<b>)</b>	Stroma Softwa					001082 on: 1.0.5.9	
Software Hame.	Ottoma i Orti 2012		ty Address:				VCISIO	71. 1.0.0.0	
Address :		·							
1. Overall dwelling dime	ensions:								
Ground floor		A	rea(m²)	(4.5)		ight(m)	7(0-)	Volume(m <sup>3</sup>	<u>-</u>
	\ \ (41\) \ (4\) \ \ (4\) \ \ (4\)			(1a) x	2	2.5	(2a) =	184.54	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)·	+(1n)	73.82	(4)					_
Dwelling volume				(3a)+(3b)	)+(3c)+(3c	d)+(3e)+	.(3n) =	184.54	(5)
2. Ventilation rate:	main se	condary	other		total			m³ per hou	ır
N. selven of all leaves a	heating he	eating		, –			40 I		_
Number of chimneys	0 +	0 +	0	] = [	0		40 =	0	(6a)
Number of open flues	0 +	0 +	0	] = [	0		20 =	0	(6b)
Number of intermittent fa				L	3	X '	10 =	30	(7a)
Number of passive vents	3			L	0	X '	10 =	0	(7b)
Number of flueless gas fi	ires				0	X 4	40 =	0	(7c)
							Air ch	anges per ho	our
Infiltration due to chimne	vs_flues and fans = (6a)	)+(6b)+(7a)+(7b	)+(7c) =	Г	30		÷ (5) =	0.16	(8)
	peen carried out or is intended			ontinue fr			- (0) =	0.16	(0)
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or timber frugger or steel or steel or steel or steel or steel or steel or timber frugger or steel or ste			•	uction			0	(11)
deducting areas of openi		onding to the gr	eater wan are	a (aner					
If suspended wooden	floor, enter 0.2 (unseale	d) or 0.1 (se	aled), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
· ·	s and doors draught stri	pped						0	(14)
Window infiltration			0.25 - [0.2					0	(15)
Infiltration rate			(8) + (10)					0	(16)
•	q50, expressed in cubic	-	•	•	etre of e	envelope	area	5	(17)
If based on air permeabil	es if a pressurisation test has i				is heina u	sad .		0.41	(18)
Number of sides sheltere		occir done or a	acgree an per	modelinty	io boilig a	oou		2	(19)
Shelter factor			(20) = 1 -	0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporate	ting shelter factor		(21) = (18)	x (20) =				0.35	(21)
Infiltration rate modified f	or monthly wind speed						•		
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	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								
<u> </u>	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		
					<u> </u>			J	

0.45	0.44	e (allowi	0.39	0.38	0.33	0.33	0.32	0.35	0.38	0.39	0.41	1	
Calculate effec	-						0.32	0.55	0.36	0.39	0.41	J	
If mechanica	ıl ventila	tion:										0	(2
If exhaust air he	eat pump i	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	wise (23b	) = (23a)			0	(2
If balanced with	heat reco	overy: effici	ency in %	allowing f	or in-use fa	actor (from	Table 4h	) =				0	(2
a) If balance	d mecha	anical ve	ntilation	with he	at recove	ery (MVI	HR) (24a	m = (22)	2b)m + (2	23b) × [	1 – (23c)	÷ 100]	
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(2
b) If balance						- •	<del>- ^ `</del>	<u> </u>	<del></del>	<del></del>	1	1	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole he				•	•				F (00)	,			
if (22b)m 24c)m= 0	1 < 0.5 ×	(23b), t	nen (240 0	$\frac{(230)}{0}$	o); otnerv	vise (24	c) = (220)	0) m + 0.	· ` `	0	Ι ,	1	(2
,									0	U	0	J	(4
d) If natural v if (22b)m				•					0.51				
24d)m= 0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	]	(2
Effective air	change	rate - er	ıter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)	ļ.	<u>I</u>	!	J	
25)m= 0.6	0.6	0.59	0.57	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.58	]	(2
							l				1	1	
3. Heat losses	_	·			Not Am		امدالا		AXU		بريامير با	_	ΑΧk
ELEMENT	Gros area	_	Openin m		Net Ar A ,n		U-valı W/m2		(W/F	<b>〈</b> )	k-value kJ/m²-		kJ/K
Doors					2	x	1	=	2	Ì			(2
Vindows Type	1				11.20	5 x1	/[1/( 1.4 )+	0.04] =	14.86	Ħ			(2
Vindows Type	2				2.025	x1,	/[1/( 1.4 )+	0.04] =	2.68	=			(2
Valls Type1	48.4	3	13.23	3	35.2	x	0.18		6.34	<b>=</b>			(2
Valls Type2	25.5	i2	2		23.52	<u> </u>	0.18	<b>=</b>	4.23	F i		<b>-</b>	(2
Roof	73.8	2	0	=	73.82	=	0.13	=	9.6	≓ i		<b></b>	(;
otal area of e					147.7	=							^` (;
for windows and			ffective wi	ndow U-va			formula 1	/[(1/U-valu	ıe)+0.04] a	ns given in	paragraph	n 3.2	(
* include the area								-,	, -	Ü	, , ,		
abric heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				39.7	7 (:
leat capacity	Cm = S(	Axk)			((28)(30) + (32) + (32a						(32e) =	1486	.37
Thermal mass	parame	ter (TMF	P = Cm ÷	· TFA) ir	n kJ/m²K			Indica	tive Value:	Medium		250	) (:
For design assess				construct	ion are not	known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
an be used instea Thermal bridge				ısina Ar	nendix k	(						12.5	53 (5
details of therma	,	•		• .	•	`						12.5	3 (
otal fabric hea			()		• /			(33) +	(36) =			52.2	24 (
entilation hea	it 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= 36.54	36.3	36.07	34.98	34.78	33.83	33.83	33.65	34.19	34.78	35.19	35.62		(;
Heat transfer c	oefficier	nt, W/K						(39)m	= (37) + (3	38)m		-	
			07.00	87.01	86.06	86.06	85.89	86.43	87.01	87.42	87.86	1	
89)m= 88.77	88.54	88.3	87.22	07.01	00.00	00.00	00.00	00.43	07.01	07.72	07.00		

leat lo	ss para	meter (H	HLP), W	m²K					(40)m	= (39)m ÷	- (4)			
10)m=	1.2	1.2	1.2	1.18	1.18	1.17	1.17	1.16	1.17	1.18	1.18	1.19		
ممسا	r of dov	a in ma	ath /Tab	lo 1o\					,	Average =	Sum(40) <sub>1</sub>	12 /12=	1.18	(40
lullibe	Jan	Feb	nth (Tab Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
l1)m=	31	28	31	30	31	30	31	31	30 30	31	30	31		(4
,	<u> </u>		<u> </u>		0.					<u> </u>				•
4 W.	ter heat	ing ener	gy requi	rement:								kWh/ye	ar.	
				rement.								KVVII/yC	,ai.	
if TF	ed occu A > 13.9 A £ 13.9	N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		34		(4.
				ge in litre						se target o		).66		(4
		_		day (all w		_	-			J				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ot wate	er usage ir	litres per	day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)			•			
14)m=	98.62	95.04	91.45	87.87	84.28	80.69	80.69	84.28	87.87	91.45	95.04	98.62		_
norav (	content of	hot water	used - cal	culated m	onthly – 1	100 v Vd r	n v nm v F	Tm / 3600			m(44) <sub>112</sub> = ables 1b, 1	L	1075.9	(4
	i				•		<del> </del>	<del> </del>	<del> </del>	·	·			
5)m=	146.26	127.92	132	115.08	110.42	95.29	88.3	101.32	102.53	119.49	130.43 m(45) <sub>112</sub> =	141.64	1410.68	(4
instant	aneous w	ater heatii	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		10tal = 5u	III(43) <sub>112</sub> =	- [	1410.00	(_
l6)m=	21.94	19.19	19.8	17.26	16.56	14.29	13.24	15.2	15.38	17.92	19.57	21.25		(4
	storage						<u> </u>	<u> </u>	<u> </u>	ļ	<u> </u>			
torag	e volum	e (litres)	includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(4
	•	-		nk in dw	_			' '	a = a \ a = a + a	(O' : (	(A <b>7</b> )			
	storage		not wate	er (this in	iciuaes i	nstantar	ieous co	ווטט וטווזו	ers) ente	er o in (	(47)			
	_		eclared I	oss facto	or is kno	wn (kWh	n/day):				1.	39		(4
empe	rature fa	actor fro	m Table	2b							0.	54		(4
nergy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)	) =		0.	75		(5
•				ylinder I										
		•	factor fr ee secti	om Tabl	e 2 (KWI	n/litre/da	ıy)					0		(5
	e factor	•		JII 4.5								0		(5
empe	rature fa	actor fro	m Table	2b								0		(5
nergy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(5
Enter	(50) or (	54) in (5	55)								0.	75		(5
/ater	storage	loss cal	culated 1	or each	month			((56)m = (	55) × (41)	m				
66)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		(5
cylinde	er contains	dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	x 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		(5
rimar	v circuit	loss (an	nual) fro	m Table	2 3		•	•	•	•		0		(5
	•	,	,	for each		59)m = (	(58) ÷ 36	65 × (41)	m					•
	-			le H5 if t	•		. ,	, ,		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		(5

Combiles s	الم مذمان بمان	for oook	ma a matha	(C1)	(00) . 0(	CF (44)	\						
Combi loss ca	liculated 0	or each	0	0	(6U) ÷ 30	05 × (41)	0	T 0	0	Ιο	0	1	(61)
		<u> </u>					<u> </u>					] · (59)m + (61)m	(01)
(62)m= 192.85	170	178.59	160.17	157.02	140.38	134.89	147.92		166.09	175.53	188.24	(39)III + (61)III ]	(62)
Solar DHW input		<u> </u>		<u> </u>		<u> </u>				ļ		J	(02)
(add additiona									i contribu	ion to wate	or ricating)		
(63)m= 0	0	0	0	0	0	0	0		0	0	0	]	(63)
Output from w	ıater hea	ter				ļ						J	
(64)m= 192.85	170	178.59	160.17	157.02	140.38	134.89	147.92	147.62	166.09	175.53	188.24	]	
	Į	<u> </u>	ļ.	<u> </u>		<u>!</u>	Ou	tput from w	ater heate	r (annual)₁	12	1959.29	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	m] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	]	_
(65)m= 85.91	76.2	81.17	74.34	73.99	67.76	66.63	70.97	70.17	77.01	79.44	84.37	]	(65)
include (57)	m in cald	culation of	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is f	rom com	munity h	neating	
5. Internal g	ains (see	e Table 5	and 5a	):									
Metabolic gair	,			,									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m= 116.75	116.75	116.75	116.75	116.75	116.75	116.75	116.75	116.75	116.75	116.75	116.75	]	(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	on L9 o	r L9a), a	lso see	Table 5		-		-	
(67)m= 18.77	16.67	13.56	10.27	7.67	6.48	7	9.1	12.21	15.51	18.1	19.3	]	(67)
Appliances ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5	_	-	-	
(68)m= 206.03	208.17	202.79	191.32	176.84	163.23	154.14	152	157.39	168.86	183.34	196.94	]	(68)
Cooking gains	(calcula	ited in A	ppendix	L, equat	ion L15	or L15a	, also s	ee Table	5	-	-		
(69)m= 34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	34.68	]	(69)
Pumps and fa	ns gains	(Table 5	ōa)									_	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g. ev	vaporatio	n (nega	tive valu	es) (Tab	le 5)							_	
(71)m= -93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4	-93.4		(71)
Water heating	gains (T	able 5)										_	
(72)m= 115.47	113.39	109.09	103.25	99.45	94.11	89.56	95.38	97.45	103.5	110.34	113.4	]	(72)
Total internal	gains =	:			(66)	)m + (67)m	+ (68)m	+ (69)m +	(70)m + (7	'1)m + (72)	)m 	_	
(73)m= 401.3	399.27	386.47	365.85	344.99	324.84	311.73	317.51	328.08	348.9	372.8	390.67		(73)
6. Solar gain													
Solar gains are		•				•	tions to o		ne applical		tion.		
Orientation:	Access F Table 6d		Area m²		Flu Tal	ıx ble 6a		g_ Table 6b	т	FF able 6c		Gains (W)	
_							ı —					. ,	1,70
Southwesto s	0.77	X	11			36.79	┆╶┝	0.63	_  ×	0.7	=	126	(79)
Southwesto ou	0.77	X	11			62.67	╎├	0.63	×	0.7	=	214.62	(79)
Southwesto.9x	0.77	X	11			35.75	╎├	0.63	×	0.7	=	293.65	[(79)
Southwesto.9x	0.77	X	11		<b>—</b>	06.25	╎├	0.63		0.7	=	363.85	(79)
Southwest <sub>0.9x</sub>	0.77	X	11	.2	x 1	19.01		0.63	x	0.7	=	407.54	(79)

		_												_			
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	11	18.15		0.63	X	0.7	=	404.59	(79)			
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	11	13.91		0.63	X	0.7	=	390.07	(79)			
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	10	04.39		0.63	X	0.7	=	357.47	(79)			
Southwest <sub>0.9x</sub>	0.77	X	11.	.2	x	9	2.85		0.63	X	0.7	=	317.96	(79)			
Southwest <sub>0.9x</sub>	0.77	x	11.	.2	x	6	9.27		0.63	X	0.7	=	237.2	(79)			
Southwest <sub>0.9x</sub>	0.77	x	11.	.2	x	4	4.07		0.63	x	0.7		150.91	(79)			
Southwest <sub>0.9x</sub>	0.77	x	11.	.2	x	3	1.49		0.63	x	0.7	=	107.83	(79)			
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	1	1.28	X	0.63	х	0.7	=	6.98	(81)			
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	2	2.97	X	0.63	х	0.7	=	14.21	(81)			
Northwest 0.9x	0.77	x	2.0	)3	x	4	1.38	x	0.63	x	0.7		25.61	(81)			
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	6	7.96	х	0.63	x	0.7	_	42.06	(81)			
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	х	9	1.35	x	0.63	x	0.7	_	56.53	(81)			
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	9	7.38	x	0.63	x	0.7	=	60.27	(81)			
Northwest <sub>0.9x</sub>	0.77	×	2.0	)3	x	ç	91.1	x	0.63	x	0.7		56.38	(81)			
Northwest <sub>0.9x</sub>	0.77	x	2.0	)3	x	7.	2.63	x	0.63	x	0.7		44.95	(81)			
Northwest 0.9x	0.77	×	2.0	)3	x	5	0.42	х	0.63	x	0.7	=	31.2	(81)			
Northwest 0.9x	0.77	×	2.0	)3	x	2	8.07	х	0.63	x	0.7	=	17.37	(81)			
Northwest 0.9x	0.77	×	2.0	)3	х	1	14.2	х	0.63	x	0.7	=	8.79	(81)			
Northwest 0.9x	0.77	×	2.0	)3	x	9	9.21	x	0.63	×	0.7		5.7	(81)			
Solar gains in	watts, calcu	ulated	for eacl	h month				(83)m	= Sum(74)m .	(82)m			_				
(83)m= 132.98	228.83 31	19.26	405.9	464.07	46	64.86	446.45	402	.42 349.17	254.5	7 159.7	113.53		(83)			
Total gains – i	nternal and	solar	(84)m =	= (73)m ·	+ (8	33)m ,	watts				_		•				
(84)m= 534.28	628.1 70	)5.72	771.76	809.06	78	89.7	758.18	719	.93 677.24	603.4	532.5	504.2		(84)			
7. Mean inter	nal tempera	ature (	heating	season	)	7. Mean internal temperature (heating season)											
Temperature	during heat	Temperature during heating periods in the living area from Table 9, Th1 (°C)  21 (85)															
Utilisation fac	Utilisation factor for gains for living area, h1,m (see Table 9a)												21	(85)			
	tor for gains	٠.			•			ole 9,	Th1 (°C)				21	(85)			
Jan		٠.			(se				Th1 (°C)	Oct	Nov	Dec	21	(85)			
(86)m= Jan	Feb I	s for li	iving are	ea, h1,m	(se	е Та	ble 9a)		ug Sep	Oct	Nov 0.99	Dec 1	21	(85)			
	Feb 1	s for li Mar	Apr 0.93	ea, h1,m May 0.83	(se	ee Ta Jun 0.66	Jul 0.49	Aı 0.5	ug Sep 4 0.78	_	+		21				
(86)m= 1	Feb I 0.99 0 temperatu	s for li Mar	Apr 0.93	ea, h1,m May 0.83	(SE	ee Ta Jun 0.66	Jul 0.49	Aı 0.5	ug Sep 4 0.78 Table 9c)	_	0.99		21				
(86)m= 1  Mean interna (87)m= 19.8	Feb I 0.99 0 1 temperatu 19.99 20	s for li Mar 0.97 re in l	Apr 0.93 iving are 20.57	ea, h1,m May 0.83 ea T1 (fo		Jun 0.66 w ster	Jul 0.49 os 3 to 7 20.99	0.5 ' in T	ug Sep 4 0.78 able 9c) 99 20.91	0.95	0.99	1	21	(86)			
(86)m= 1  Mean interna	Feb I 0.99 0 I temperatu 19.99 20 during heat	s for li Mar 0.97 re in l	Apr 0.93 iving are 20.57	ea, h1,m May 0.83 ea T1 (fo	ollov	Jun 0.66 w ster	Jul 0.49 os 3 to 7 20.99	0.5 ' in T	ug Sep 64 0.78 Fable 9c) 99 20.91 9, Th2 (°C)	0.95	0.99	1	21	(86)			
(86)m= 1  Mean interna (87)m= 19.8  Temperature (88)m= 19.92	Feb I 0.99 0 I temperatu 19.99 20 during heat 19.92 19	s for li Mar 0.97 re in l 0.25 ting po	Apr 0.93 iving are 20.57 eriods ir 19.93	ea, h1,m May 0.83 ea T1 (for 20.83 n rest of 19.94	ollov dwe	Jun 0.66 w ste 0.96 elling	Jul 0.49 ps 3 to 7 20.99 from Ta 19.95	0.57 in T 20.99 tble 9	ug Sep 64 0.78 Fable 9c) 99 20.91 9, Th2 (°C)	0.95 20.58	0.99	1 19.77	21	(86)			
Mean interna (87)m= 19.8  Temperature (88)m= 19.92  Utilisation fac	Feb I 0.99 0 I temperatu 19.99 20 during heat 19.92 19 etor for gains	s for li Mar  0.97  re in l 0.25  ting pe 9.92  s for re	Apr 0.93 iving are 20.57 eriods ir 19.93	ea, h1,m  May  0.83  ea T1 (for 20.83  rest of 19.94  welling,	0   0   0   0   0   0   0   0   0   0	Jun 0.66 w ste 0.96 elling 9.95 m (se	Jul 0.49 ps 3 to 7 20.99 from Ta 19.95 ee Table	Au 0.5 7 in T 20.9 ble 9 19.9	ug Sep 4 0.78  able 9c) 99 20.91  9, Th2 (°C) 95 19.94	0.95 20.58 19.94	0.99	1 19.77	21	(86)			
(86)m= 1  Mean internal (87)m= 19.8  Temperature (88)m= 19.92  Utilisation fact (89)m= 0.99	Feb   I   0.99   0   0   0   0   0   0   0   0   0	s for li Mar  0.97  re in l 0.25  ting pe 9.92  s for re 0.97	Apr 0.93 iving are 20.57 eriods ir 19.93 est of do 0.91	ea, h1,m  May  0.83  ea T1 (for 20.83  n rest of 19.94  welling,  0.78	(SE   0   0   0   0   0   0   0   0   0	uster of the second of the sec	Jul 0.49 ps 3 to 7 20.99 from Ta 19.95 re Table 0.38	Au 0.57 in T 20.9 19.9 9a) 0.4	ug Sep 4 0.78  Table 9c) 99 20.91  0, Th2 (°C) 95 19.94	0.95 20.58 19.94	0.99	19.77	21	(86) (87) (88)			
Mean interna (87)m= 19.8  Temperature (88)m= 19.92  Utilisation fac (89)m= 0.99  Mean interna	Feb	s for li Mar  0.97  re in l 0.25  ting pe 9.92  s for re 0.97  re in t	Apr 0.93 iving are 20.57 eriods ir 19.93 est of do 0.91 the rest	ea, h1,m  May  0.83  ea T1 (for 20.83  rest of 19.94  welling,  0.78  of dwelli	(SE   0   0   0   0   0   0   0   0   0	use Ta Jun 0.66 w step 0.96 elling 9.95 m (se 0.57	Jul 0.49 ps 3 to 7 20.99 from Ta 19.95 ee Table 0.38 bllow ste	Au 0.57 in T 20.9 ible 9 19.9 0.4	ug Sep 4 0.78  Table 9c) 99 20.91  0, Th2 (°C) 95 19.94  12 0.69  to 7 in Table	0.95 20.58 19.94 0.93 le 9c)	0.99	1 19.77 19.93	21	(86) (87) (88) (89)			
(86)m= 1  Mean internal (87)m= 19.8  Temperature (88)m= 19.92  Utilisation fact (89)m= 0.99	Feb	s for li Mar  0.97  re in l 0.25  ting pe 9.92  s for re 0.97	Apr 0.93 iving are 20.57 eriods ir 19.93 est of do 0.91	ea, h1,m  May  0.83  ea T1 (for 20.83  n rest of 19.94  welling, 0.78	(SE   0   0   0   0   0   0   0   0   0	uster of the second of the sec	Jul 0.49 ps 3 to 7 20.99 from Ta 19.95 re Table 0.38	Au 0.57 in T 20.9 19.9 9a) 0.4	ug Sep 4 0.78  Table 9c) 99 20.91  0, Th2 (°C) 95 19.94  10 7 in Table 94 19.88	0.95 20.58 19.94 0.93 le 9c)	0.99 20.13 19.93 0.99	1 19.77 19.93		(86) (87) (88) (89)			
Mean internation (87)m= 19.8  Temperature (88)m= 19.92  Utilisation fact (89)m= 0.99  Mean internation (90)m= 18.34	Feb   I   0.99   0   0   1 temperatu   19.99   20   19.92   19   20   20   20   20   20   20   20   2	s for li Mar  0.97  re in l 0.25  ting po 9.92  s for r 0.97  re in t 8.99	Apr 0.93 iving are 20.57 eriods ir 19.93 eest of do 0.91 the rest 19.45	ea, h1,m May 0.83 ea T1 (for 20.83 n rest of 19.94 welling, 0.78 of dwelling, 19.77	(se   0   0   0   19   19   19   19   19	ee Ta Jun 0.66 w ste 0.96 elling 9.95 m (se 0.57 T2 (fo	Jul 0.49 ps 3 to 7 20.99 from Ta 19.95 e Table 0.38 ollow ste 19.94	Au 0.5  ' in T 20.9  ble \$ 19.9  0.4  eps 3	ug Sep 4 0.78  Table 9c) 99 20.91  0, Th2 (°C) 95 19.94  12 0.69  15 7 in Table 194 19.88	0.95 20.58 19.94 0.93 le 9c)	0.99	1 19.77 19.93	0.34	(86) (87) (88) (89)			
Mean internation (86)m= 1  Mean internation (87)m= 19.8  Temperature (88)m= 19.92  Utilisation fact (89)m= 0.99  Mean internation (90)m= 18.34  Mean internation (18.34)	Feb	s for li Mar  0.97  re in l 0.25  ting pe 9.92  s for re 0.97  re in t 8.99	Apr 0.93 iving are 20.57 eriods ir 19.93 est of do 0.91 the rest 19.45 r the wh	ea, h1,m May 0.83 ea T1 (for 20.83 n rest of 19.94 welling, 0.78 of dwelling, 19.77	(se   0   0   0   0   0   0   0   0   0	ee Ta Jun 0.66 w stel 0.96 elling 9.95 m (se 0.57 T2 (fc 9.92	Jul 0.49 ps 3 to 7 20.99 from Ta 19.95 re Table 0.38 pllow ste 19.94  A × T1	Ai 0.5 ' in T 20.9 bble \$ 19.9 0.4 eps 3 19.9	ug Sep 4 0.78  Table 9c) 99 20.91  9, Th2 (°C) 95 19.94  12 0.69  to 7 in Table 94 19.88  — fLA) × T2	0.95  20.58  19.94  0.93  le 9c)  19.47  fLA = Liv	0.99 20.13 19.93 0.99 18.83 ving area ÷ (-	1 19.77 19.93 1 18.3 4) =		(86) (87) (88) (89) (90) (91)			
Mean internation (87)m= 19.8  Temperature (88)m= 19.92  Utilisation fact (89)m= 0.99  Mean internation (90)m= 18.34	Feb	s for li Mar  0.97  re in l 0.25  ting per 9.92  s for r 0.97  re in t 8.99  re (for	Apr 0.93 iving are 20.57 eriods ir 19.93 est of do 0.91 the rest 19.45 r the wh	ea, h1,m May 0.83 ea T1 (for 20.83 n rest of 19.94 welling, 0.78 of dwelling 19.77	(SE   0   0   0   0   0   0   0   0   0	ee Ta Jun 0.66  w ste 0.96 elling 9.95  m (se 0.57  T2 (fc 9.92	Jul 0.49 ps 3 to 7 20.99 from Ta 19.95 re Table 0.38 pllow ste 19.94  A × T1 20.3	Ai 0.5 ' in T 20.9 19.8 19.9 0.4 19.9 + (1 20.9	ug Sep 4 0.78  Table 9c) 99 20.91  0, Th2 (°C) 95 19.94  12 0.69  15 7 in Table 94 19.88	0.95 20.58 19.94 0.93 le 9c) 19.47 fLA = Liv	0.99 20.13 19.93 0.99 18.83 ving area ÷ (4	1 19.77 19.93		(86) (87) (88) (89)			

8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a	(93)								
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate									
the utilisation factor for gains using Table 9a									
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec									
Utilisation factor for gains, hm:									
(94)m= 0.99 0.98 0.96 0.91 0.79 0.6 0.42 0.46 0.72 0.93 0.98 0.99	(94)								
Useful gains, hmGm , W = (94)m x (84)m									
(95)m= 529.91 617.06 678.14 698.94 637.73 470.29 316.02 330.92 485.17 558.79 523.45 501	(95)								
Monthly average external temperature from Table 8	(00)								
(96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2	(96)								
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]	(07)								
(97)m= 1290.44 1255.16 1140.97 953.51 733.71 488.42 318.52 334.93 529.59 804.62 1064 1282.69	(97)								
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m  (98)m= 565.84 428.81 344.35 183.29 71.41 0 0 0 182.9 389.19 581.58									
	1,000								
Total per year (kWh/year) = Sum(98) <sub>15,912</sub> = 2747.36	(98)								
Space heating requirement in kWh/m²/year 37.22	(99)								
9a. Energy requirements – Individual heating systems including micro-CHP)									
Space heating:									
Fraction of space heat from secondary/supplementary system 0	(201)								
Fraction of space heat from main system(s) (202) = 1 - (201) =	(202)								
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] = 1$	(204)								
Efficiency of main space heating system 1	(206)								
Efficiency of secondary/supplementary heating system, %	(208)								
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/yea	r								
Space heating requirement (calculated above)									
565.84 428.81 344.35 183.29 71.41 0 0 0 182.9 389.19 581.58									
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$	(211)								
605.18 458.62 368.28 196.03 76.37 0 0 0 195.61 416.25 622.01									
Total (kWh/year) =Sum(211) <sub>15,1012</sub> = 2938.35	(211)								
Space heating fuel (secondary), kWh/month									
$= \{[(98)m \times (201)] \} \times 100 \div (208)$									
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0									
Total (kWh/year) =Sum(215) <sub>15,1012</sub> = 0	(215)								
Water heating	•								
Output from water heater (calculated above)									
192.85     170     178.59     160.17     157.02     140.38     134.89     147.92     147.62     166.09     175.53     188.24	_								
Efficiency of water heater 79.8	(216)								
(217)m= 87.52 87.18 86.54 85.17 82.86 79.8 79.8 79.8 79.8 85.07 86.88 87.63	(217)								
Fuel for water heating, kWh/month									
$(219) m = (64) m \times 100 \div (217) m$									
(219)m= 220.36	1,								
Total = Sum(219a) <sub>112</sub> = 2326.66	(219)								
Annual totals kWh/year kWh/year Space heating fuel used, main system 1 2938.35	1								
Space heating fuel used, main system 1 2938.35	J								

Water heating fuel used			2326.66
Electricity for pumps, fans and electric keep-hot			
central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	a)(230g) =	75 (231)	
Electricity for lighting			331.54 (232)
12a. CO2 emissions – Individual heating systems	s including micro-CHP		
	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	<b>Emissions</b> kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	634.68 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	502.56 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1137.24 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	172.07 (268)
Total CO2, kg/year	sum	of (265)(271) =	1348.24 (272)
TER =			18.26 (273)