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 14:54:24

Project Information:

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

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 51.22m² Plot Reference: Site Reference : Hermitage Lane Plot 28

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))

Target Carbon Dioxide Emission Rate (TER) 17.05 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 11.45 kg/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 35.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 33.6 kWh/m²

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 (no roof)

Openings 1.40 (max. 2.00) 1.40 (max. 3.30)

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 3.00 (design value)

OK Maximum 10.0

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

programmer and at least two room thermostats

Hot water controls: No cylinder thermostat

No cylinder

OK

OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK
8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.91	
Maximum	1.5	OK
MVHR efficiency:	93%	
Minimum	70%	OK
9 Summertime temperature		
Overheating risk (Thames valley):	Medium	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: South West	8.65m²	
Windows facing: South East	4.58m²	
Windows facing: South East Ventilation rate:	4.58m ² 6.00	
_		
Ventilation rate:		

Photovoltaic array

		l Iser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	— <u>03</u> CF L	Strom Softwa					001082 on: 1.0.5.9	
A dalage -	F	Property	Address	Plot 28					
Address: 1. Overall dwelling dime	ensions:								
		Are	a(m²)		Av. He	ight(m)		Volume(m ³	3)
Ground floor			51.22	(1a) x	2	2.5	(2a) =	128.04	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	51.22	(4)					
Dwelling volume		· ·		(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	128.04	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys	0 + 0	+	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	- + -	0	Ī - Ē	0	x 2	20 =	0	(6b)
Number of intermittent fa	ns				0	x ′	10 =	0	(7a)
Number of passive vents				Ē	0	x ′	10 =	0	(7b)
Number of flueless gas fi	res			F	0	X 4	40 =	0	(7c)
Air changes per hour									
•	ys, flues and fans = (6a)+(6b)+(ontinus fr	0		÷ (5) =	0	(8)
Number of storeys in the	een carried out or is intended, proced ne dwelling (ns)	ea 10 (17),	otrierwise	onunue ir	om (9) to ((16)		0	(9)
Additional infiltration	3 \					[(9)-	-1]x0.1 =	0	(10)
	.25 for steel or timber frame o			•	uction			0	(11)
if both types of wall are pudeducting areas of openia	resent, use the value corresponding t pas): if equal user 0.35	o the grea	ter wall are	a (after					
,	floor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
<u>-</u>	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	. ,	-	()		0	(15)
Infiltration rate	250 amaza dia adia adia ada		(8) + (10)					0	(16)
•	q50, expressed in cubic metro ity value, then $(18) = [(17) \div 20] +$	•	•	•	etre or e	envelope	area	3	(17)
· ·	es if a pressurisation test has been do				is being u	sed		0.15	(10)
Number of sides sheltere	ed							2	(19)
Shelter factor			(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	•		(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified f	- 1 		1 .					1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp (22)m= 5.1 5	eed from Table 7 4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7	1	
(22)m= 5.1 5	7.0 4.7 4.3 3.6	J 3.0	3.1	4	1 4.3	I 4.5	4.1		
Wind Factor $(22a)m = (22a)m $	2)m ÷ 4							•	
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltra	ation rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15]	
Calculate effect		•	rate for t	he appli	cable ca	se	•	•	•	•	•	,	
If mechanica			andiv N. (2	2h) _ (22c) v Emy (c	auation (VEVV otho	nuico (22h) - (222)			0.5	(23a)
If balanced with) = (23a)			0.5	(23b)
		-	-	_					21.)	001.) [4 (00 -)	79.05	(23c)
a) If balance						- `	- ^ ` 	í `	 	- 	- `) ÷ 100]]	(24a
(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					i	· · · · · ·	· · ·	i i	<u> </u>	 	Ι ,	1	(24b
(24b)m= 0	0	0	0	0		0	0	0	0	0	0		(240
c) If whole he if (22b)m				•	•				5 v (23h	,)			
(24c)m = 0	0.5 x	0	0	0	0	0	0	0	0	0	0	1	(240
` ''					<u> </u>			<u> </u>				J	(= .0
d) If natural v if (22b)m									0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24d
Effective air	change	rate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	x (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 losses	o and he	ot loop r	oromot	241				•			•	4	
ELEMENT	Gros	·	Openin		Net Ar	A2	U-valı	IΙΔ	AXU		k-value	a	ΑΧk
ELEWIENI	area	_	operiiri m		A,r		W/m2		(W/I	K)	kJ/m²-		kJ/K
Doors					2	х	1.4	=	2.8				(26)
Windows Type	1				8.651	x1,	/[1/(1.4)+	0.04] =	11.47	=			(27)
Windows Type	2				4.579	x1	/[1/(1.4)+	0.04] =	6.07	=			(27)
Walls Type1	41.9	4	13.23	3	28.71	x	0.15	= [4.31	=		$\neg \sqcap$	(29)
Walls Type2	5.62		2		3.62	=	0.14	<u> </u>	0.51	=		7 H	(29)
Total area of e					47.55	=	0						(31)
* for windows and		•	ffective wi	ndow U-va			a formula 1	/[(1/U-valu	ıe)+0.041 a	as aiven in	paragraph	h 3.2	(01)
** include the area							,		, ,	J	7 3 - 1		
Fabric heat los	s, W/K =	= S (A x	U)				(26)(30)) + (32) =				25.16	(33)
Heat capacity	Cm = S(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	452.54	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For design assess				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
can be used instead					ا دناه مدم ما	,							
Thermal bridge	,	•		• .	•	`						5.69	(36)
if details of therma Total fabric hea		are not kn	own (36) =	= 0.05 X (3	1)			(33) +	(36) =			30.85	(37)
Ventilation hea		alculated	l monthly	,				, ,	= 0.33 × (25)m x (5))	30.03	(01)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(38)m= 11.29	11.16	11.03	10.35	10.22	9.54	9.54	9.41	9.81	10.22	10.49	10.76	1	(38)
Heat transfer c				<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	= (37) + (37)	<u> </u>		J	, ,
(39)m= 42.14	42.01	41.87	41.2	41.06	40.39	40.39	40.26	40.66	41.06	41.33	41.6	1	
42.14	72.01	71.07	71.2	71.00	70.38	70.08	1 70.20	<u> </u>	Average =	<u> </u>	<u> </u>	41.17	(39)
								,	go =	20.11(00)1.		/	(55)

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.82	0.82	0.82	0.8	0.8	0.79	0.79	0.79	0.79	0.8	0.81	0.81		
									Average =	Sum(40) ₁ .	12 /12=	0.8	(40)
Number of day	<u> </u>	1 ·	· ·						l _				
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	irement:								kWh/ye	ear:	
Assumed occu if TFA > 13. if TFA £ 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13.		73		(42)
Annual average Reduce the annual not more that 125	ge hot wa al average	hot water	usage by	5% if the c	lwelling is	designed i			se target o		.15		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i								l geb	1 000	INOV	Dec		
(44)m= 87.06	83.9	80.73	77.56	74.4	71.23	71.23	74.4	77.56	80.73	83.9	87.06		
(11)	1 00.0	1 000	77.00		7 1.20	1 1.20				m(44) ₁₁₂ =	l l	949.77	(44)
Energy content of	f hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			. ,			` ′
(45)m= 129.11	112.92	116.52	101.59	97.48	84.12	77.95	89.44	90.51	105.48	115.14	125.04		
	•								Total = Su	m(45) ₁₁₂ =	-	1245.3	(45)
If instantaneous v	vater heati	ing at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)					
(46)m= 19.37	16.94	17.48	15.24	14.62	12.62	11.69	13.42	13.58	15.82	17.27	18.76		(46)
Water storage		\ ' I - I' -			/\/\ IDO	-1	20.2						
Storage volum	,					•		ame ves	sei		0		(47)
If community hotherwise if no	•			_			, ,	are) ant	ar '∩' in <i>(</i>	47)			
Water storage		not wate	i (uno n	iciuues i	iistaiitai	ieous cc	ATIOI DOII	ers) erik	51 0 111 (71)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro	om watei	r storage	, kWh/ye	ear			(48) x (49)) =		1	10		(50)
b) If manufact			-										
Hot water stor	-			e 2 (kW	h/litre/da	ay)				0.	02		(51)
If community he Volume factor	•		on 4.3								1		(50)
Temperature f			2h							-	.6		(52) (53)
Energy lost fro				oor			(47) v (51)) x (52) x (52) _				, ,
Enter (50) or		_	, KVVII/y	zai			(47) X (31))	JJ) =		03 03		(54) (55)
Water storage	` , ` `	,	for each	month			((56)m = ((55) × (41)	m	<u> </u>	03		(00)
		1			00.00		. , ,	. , , ,	ı		00.04		(EC)
(56)m= 32.01 If cylinder contain	28.92	32.01	30.98	32.01 m = (56)m	30.98 x [(50) = (32.01	32.01	30.98 7)m = (56)	32.01	30.98 H11) is fro	32.01 m Append	iy H	(56)
				· · ·									/F-3\
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit				,	•	` '	, ,						
(modified by		1	ı —	ı —	ı —			<u> </u>		<u> </u>			(=a)
(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)

Combiless	olouloto d	for ooolo	month	(64)m	(CO) . 2	GE (44	١,,,,						
Combi loss of (61)m= 0	alculated	or each	0	0	(60) ÷ 3	05 × (41	0	0	0	0	0]	(61)
			<u> </u>	<u> </u>		<u> </u>					<u> </u>	J (59)m + (61)m	(0.)
(62)m= 184.3		171.8	155.08	152.75	137.61	133.22	144.7		160.76	168.64	180.31	(59)111 + (61)111	(62)
Solar DHW inpu		<u> </u>	L	<u> </u>		l						l	(- /
(add addition										ion to wat	or riodaling)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from	water hea	ter				!	•				!	ı	
(64)m= 184.3	9 162.85	171.8	155.08	152.75	137.61	133.22	144.7	2 144.01	160.76	168.64	180.31		
	•	•		•		•	0	utput from w	ater heate	r (annual)	112	1896.14	(64)
Heat gains fr	om water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m] + 0.8	x [(46)m	+ (57)m	+ (59)m	1	
(65)m= 87.15	77.49	82.97	76.57	76.63	70.76	70.14	73.96	72.89	79.29	81.08	85.8		(65)
include (57	7)m in cal	culation	of (65)m	only if c	ylinder i	s in the	dwellin	g or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	e Table 5	and 5a):									
Metabolic ga	ins (Table	e 5). Wat	ts										
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3		(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equat	on L9 o	r L9a), a	lso se	e Table 5					
(67)m= 13.41	11.91	9.68	7.33	5.48	4.63	5	6.5	8.72	11.08	12.93	13.78		(67)
Appliances g	ains (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), al	so see Ta	ıble 5		_		
(68)m= 150.3	9 151.95	148.02	139.64	129.08	119.14	112.51	110.9	5 114.88	123.25	133.82	143.75		(68)
Cooking gair	ns (calcula	ted in A	ppendix	L, equat	ion L15	or L15a), also	see Table	5	-	-		
(69)m= 31.63	31.63	31.63	31.63	31.63	31.63	31.63	31.63	31.63	31.63	31.63	31.63		(69)
Pumps and f	ans gains	(Table 5	5a)										
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)							•	
(71)m= -69.04	4 -69.04	-69.04	-69.04	-69.04	-69.04	-69.04	-69.0	4 -69.04	-69.04	-69.04	-69.04		(71)
Water heatin	g gains (T	Table 5)										•	
(72)m= 117.1	4 115.31	111.51	106.35	103	98.28	94.27	99.41	101.24	106.58	112.61	115.32		(72)
Total interna	al gains =	:			(66)m + (67)m	n + (68)r	n + (69)m +	(70)m + (7	71)m + (72))m	_	
(73)m= 329.8	2 328.06	318.1	302.22	286.45	270.94	260.67	265.7	5 273.73	289.8	308.25	321.74		(73)
6. Solar gai													
Solar gains are		-					itions to	convert to the	ne applical		tion.		
Orientation:	Access F Table 6d		Area m²		Flu Ta	ıx ble 6a		g_ Table 6b	т	FF able 6c		Gains (W)	
0 41 4							, –		_ '			` '	7
Southeast 0.9x		X	4.5	58	x (36.79] X	0.63	x	0.7	=	51.49	<u> </u> (77)
Southeast 0.9x	-	X	4.5	58	X (62.67	X	0.63	x	0.7	_ =	87.71	<u> </u> (77)
Southeast 0.9x	0.77	X	4.5			35.75]	0.63		0.7	=	120	<u> </u> (77)
Southeast 0.9x		X	4.5		-	06.25	X	0.63	x	0.7	=	148.69	<u> </u> (77)
Southeast 0.9x	0.77	X	4.5	58	x 1	19.01	X	0.63	X	0.7	=	166.54	(77)

F		_							_				_
Southeast 0.9x	0.77	X	4.5	i8	X	118.15	X	0.63	X	0.7	=	165.34	(77)
Southeast _{0.9x}	0.77	X	4.5	i8	X	113.91	X	0.63	X	0.7	=	159.4	(77)
Southeast _{0.9x}	0.77	X	4.5	i8	X	104.39	X	0.63	X	0.7	=	146.08	(77)
Southeast _{0.9x}	0.77	X	4.5	i8	x	92.85	X	0.63	X	0.7	=	129.94	(77)
Southeast 0.9x	0.77	X	4.5	i8	X	69.27	X	0.63	X	0.7	=	96.93	(77)
Southeast _{0.9x}	0.77	X	4.5	i8	X	44.07	X	0.63	X	0.7	=	61.67	(77)
Southeast 0.9x	0.77	X	4.5	i8	X	31.49	X	0.63	X	0.7		44.06	(77)
Southwest _{0.9x}	0.77	x	8.6	i5	x	36.79]	0.63	X	0.7	=	97.28	(79)
Southwest _{0.9x}	0.77	X	8.6	i5	x	62.67]	0.63	X	0.7	=	165.7	(79)
Southwest _{0.9x}	0.77	x	8.6	i5	x	85.75]	0.63	X	0.7	=	226.72	(79)
Southwest _{0.9x}	0.77	x	8.6	i5	x ·	106.25]	0.63	x	0.7	=	280.91	(79)
Southwest _{0.9x}	0.77	x	8.6	i5	x ·	119.01		0.63	X	0.7	=	314.65	(79)
Southwest _{0.9x}	0.77	x	8.6	i5	X	118.15		0.63	x	0.7	=	312.37	(79)
Southwest _{0.9x}	0.77	x	8.6	i5	X	113.91		0.63	x	0.7	=	301.16	(79)
Southwest _{0.9x}	0.77	x	8.6	i5	x	104.39]	0.63	x	0.7	=	275.99	(79)
Southwest _{0.9x}	0.77	x	8.6	i5	x	92.85]	0.63	x	0.7	_	245.49	(79)
Southwest _{0.9x}	0.77	x	8.6	i5	x	69.27]	0.63	x	0.7	=	183.13	(79)
Southwest _{0.9x}	0.77	x	8.6	i5	x	44.07		0.63	x	0.7	=	116.52	(79)
Southwest _{0.9x}	0.77	x	8.6	i5	X	31.49		0.63	x	0.7	=	83.25	(79)
Solar gains in (83)m= 148.77 Total gains – i (84)m= 478.59	253.41 34 nternal and	46.72	429.6	481.19	477.71		(83)m 422 687		280.07 569.86	-	127.31]	(83) (84)
7. Mean inter	nal temper	ature	(heating	season)								
Temperature			`		<i></i>	from Tal	olo O						(85)
Utilisation fac	tor for gain	s for I	iving are				ים אוכ	, Th1 (°C)				21	(00)
Jan	Feb		· • · · · · · · · · · · · · · · · · · ·	∍a, h1,m	(see T		JIE 9	, Th1 (°C)				21	
	1 . ~~ 1	Mar	Apr	ea, h1,m May	(see T			, Th1 (°C)	Oct	Nov	Dec		(00)
(86)m = 0.89	 	Mar).73			`	able 9a)		ug Sep	Oct	Nov 0.83	Dec 0.9	21	(86)
` /	0.82).73	Apr 0.61	May 0.47	Jun 0.34	able 9a) Jul 0.24	0.2	ug Sep 27 0.42	_	+		21	
(86)m= 0.89 Mean interna (87)m= 19.9	0.82 ().73	Apr 0.61	May 0.47	Jun 0.34	able 9a) Jul 0.24	0.2	ug Sep 27 0.42 Table 9c)	_	0.83			
Mean interna (87)m= 19.9	0.82 (l temperatu 20.21 2	0.73 Ire in I	Apr 0.61 iving are 20.78	May 0.47 ea T1 (fo 20.92	Jun 0.34 ollow ste 20.98	able 9a) Jul 0.24 eps 3 to 7	0.2 7 in T 20.	ug Sep 27 0.42 Table 9c) 99 20.96	0.65	0.83	0.9	21	(86)
Mean interna	0.82 (I temperatu 20.21 2 during hea	0.73 Ire in I	Apr 0.61 iving are 20.78	May 0.47 ea T1 (fo 20.92	Jun 0.34 ollow ste 20.98	able 9a) Jul 0.24 eps 3 to 7	0.2 7 in T 20.	ug Sep 27 0.42 Table 9c) 99 20.96 9, Th2 (°C)	0.65	0.83	0.9		(86)
Mean interna (87)m= 19.9 Temperature (88)m= 20.23	0.82 (1) temperature 20.21 2 during hear 20.24 2	0.73 Ire in I 0.52 ting p	Apr 0.61 iving are 20.78 eriods ir 20.25	May 0.47 ea T1 (fc 20.92 n rest of 20.25	Jun 0.34 collow stee 20.98 dwelling 20.26	able 9a) Jul 0.24 eps 3 to 7 21 g from Ta 20.26	A 0.27 in T 20.	ug Sep 27 0.42 Table 9c) 99 20.96 9, Th2 (°C)	20.77	0.83	0.9 19.84		(86)
Mean interna (87)m= 19.9 Temperature (88)m= 20.23 Utilisation fac	0.82 (I temperatu 20.21 2 during hea 20.24 2 etor for gain	0.73 lire in 1 0.52 ting p 0.24	Apr 0.61 iving are 20.78 eriods ir 20.25 est of d	May 0.47 ea T1 (for 20.92 n rest of 20.25 welling, l	Jun 0.34 collow sto 20.98 dwelling 20.26 h2,m (s	able 9a) Jul 0.24 eps 3 to 7 21 g from Ta 20.26 eee Table	A 0.2 7 in T 20. able 9 20.	ug Sep 27 0.42 Table 9c) 99 20.96 9, Th2 (°C) 27 20.26	20.77	20.32	0.9		(86) (87) (88)
Mean internal (87)m= 19.9 Temperature (88)m= 20.23 Utilisation factors (89)m= 0.87	0.82 (1) temperature 20.21 2 during hear 20.24 2 eter for gain 0.8 (1)	0.73 lire in 1 0.52 ting p 0.24 s for r	Apr 0.61 iving are 20.78 eriods ir 20.25 est of doubles	May 0.47 ea T1 (for 20.92 n rest of 20.25 welling, 1 0.44	Jun 0.34 collow sto 20.98 dwelling 20.26 h2,m (s	able 9a) Jul 0.24 eps 3 to 7 21 g from Ta 20.26 eee Table 0.2	A 0.2 7 in T 20. able 9 20. 9a) 0.2	ug Sep 27 0.42 Table 9c) 99 20.96 9, Th2 (°C) 27 20.26	0.65 20.77 20.25 0.62	0.83	0.9 19.84		(86)
Mean interna (87)m= 19.9 Temperature (88)m= 20.23 Utilisation fac (89)m= 0.87 Mean interna	0.82 (l temperatu 20.21 2 during hea 20.24 2 etor for gain 0.8 (l temperatu	0.73 Ire in 1 0.52 ting p 0.24 s for r 0.71 Ire in t	Apr 0.61 iving are 20.78 eriods ir 20.25 est of d 0.58 the rest	May 0.47 ea T1 (for 20.92 n rest of 20.25 welling, 1 0.44 of dwelli	Jun 0.34 collow ster 20.98 dwelling 20.26 h2,m (s 0.3 ing T2 (able 9a) Jul 0.24 eps 3 to 7 21 g from Ta 20.26 eee Table 0.2 follow ste	A 0.2 7 in T 20. able 9 20. 9a) 0.2 eps 3	ug Sep 27 0.42 Table 9c) 99 20.96 9, Th2 (°C) 27 20.26 23 0.38 to 7 in Tabl	0.65 20.77 20.25 0.62 e 9c)	20.32 20.25 0.81	0.9 19.84 20.24 0.89		(86) (87) (88) (89)
Mean internal (87)m= 19.9 Temperature (88)m= 20.23 Utilisation factors (89)m= 0.87	0.82 (l temperatu 20.21 2 during hea 20.24 2 etor for gain 0.8 (l temperatu	0.73 lire in 1 0.52 ting p 0.24 s for r	Apr 0.61 iving are 20.78 eriods ir 20.25 est of doubles	May 0.47 ea T1 (for 20.92 n rest of 20.25 welling, 1 0.44	Jun 0.34 collow sto 20.98 dwelling 20.26 h2,m (s	able 9a) Jul 0.24 eps 3 to 7 21 g from Ta 20.26 eee Table 0.2	A 0.2 7 in T 20. able 9 20. 9a) 0.2	ug Sep 27 0.42 Table 9c) 99 20.96 9, Th2 (°C) 27 20.26 23 0.38 to 7 in Table 26 20.22	0.65 20.77 20.25 0.62 e 9c)	0.83 20.32 20.25 0.81	0.9 19.84 20.24 0.89		(86) (87) (88) (89)
Mean internal (87)m= 19.9 Temperature (88)m= 20.23 Utilisation fact (89)m= 0.87 Mean internal (90)m= 18.78	0.82 (1) temperature 20.21 2 during hear 20.24 2 etor for gain 0.8 (1) 1 temperature 19.21 1	0.73 re in 1 0.52 ting p 0.24 s for r 0.71 re in 1 9.63	Apr 0.61 iving are 20.78 eriods ir 20.25 est of dr 0.58 che rest 19.99	May 0.47 ea T1 (for 20.92 n rest of 20.25 welling, 10.44 of dwelling 20.17	Jun 0.34 collow std 20.98 dwelling 20.26 h2,m (s 0.3 ing T2 (able 9a) Jul 0.24 eps 3 to 7 21 g from Ta 20.26 eee Table 0.2 follow ste 20.26	A 0.2 7 in T 20. able 9 20. 9a) 0.2 eps 3 20.	ug Sep 27 0.42 Table 9c) 99 20.96 9, Th2 (°C) 27 20.26 23 0.38 to 7 in Table 26 20.22	0.65 20.77 20.25 0.62 e 9c)	20.32 20.25 0.81	0.9 19.84 20.24 0.89	0.45	(86) (87) (88) (89)
Mean interna (87)m= 19.9 Temperature (88)m= 20.23 Utilisation fac (89)m= 0.87 Mean interna (90)m= 18.78	0.82 (1) temperatu 20.21 2 during heat 20.24 2 eter for gain 0.8 (1) temperatu 19.21 1	0.73 Ire in 1 0.52 ting p 0.24 s for r 0.71 Ire in 1 9.63	Apr 0.61 iving are 20.78 eriods ir 20.25 est of d 0.58 the rest 19.99	May 0.47 ea T1 (for 20.92 n rest of 20.25 welling, I 0.44 of dwelli 20.17	Jun 0.34 collow ster 20.98 dwelling 20.26 h2,m (s 0.3 ing T2 (20.25 lling) =	able 9a) Jul 0.24 eps 3 to 7 21 g from Ta 20.26 eee Table 0.2 follow ste 20.26	A 0.2 7 in T 20. able 9 20. 9a) 0.2 eps 3 20. + (1	ug Sep 27 0.42 Table 9c) 99 20.96 9, Th2 (°C) 27 20.26 23 0.38 to 7 in Table 26 20.22	0.65 20.77 20.25 0.62 le 9c) 19.99 FLA = Liv	0.83 20.32 20.25 0.81 19.37 ring area ÷ (-	0.9 19.84 20.24 0.89 18.7 4) =		(86) (87) (88) (89) (90) (91)
Mean internal (87)m= 19.9 Temperature (88)m= 20.23 Utilisation fact (89)m= 0.87 Mean internal (90)m= 18.78	0.82 (1) temperatu 20.21 2 during hea 20.24 2 etor for gain 0.8 (1) 1 temperatu 19.21 1 temperatu 19.66 2	0.73 re in 1 0.52 ting p 0.24 s for r 0.71 re in 1 9.63 re (fo 0.03	Apr 0.61 iving ard 20.78 eriods ir 20.25 est of dr 0.58 the rest 19.99 r the wh 20.34	May 0.47 ea T1 (for 20.92 n rest of 20.25 welling, 10.44 of dwelling 20.17	Jun 0.34 collow stee 20.98 dwelling 20.26 h2,m (s 0.3 ing T2 (20.25 lling) = 20.58	able 9a) Jul 0.24 eps 3 to 7 21 g from Ta 20.26 eee Table 0.2 follow ste 20.26 fLA × T1 20.59	A 0.2 7 in T 20. able 9 20. 9a) 0.2 eps 3 20. + (1 20.	ug Sep 27 0.42 Table 9c) 99 20.96 9, Th2 (°C) 27 20.26 23 0.38 to 7 in Tabl 26 20.22 f fLA) x T2 59 20.55	0.65 20.77 20.25 0.62 e 9c) 19.99 fLA = Liv	0.83 20.32 20.25 0.81 19.37 ring area ÷ (-	0.9 19.84 20.24 0.89		(86) (87) (88) (89)

(00) 40.00	1 40 00		00.04	00.5	00.50	00.50	00.50	00.55	00.04	400	40.04	1	(93)
(93)m= 19.28 8. Space hea	19.66	20.03	20.34	20.5	20.58	20.59	20.59	20.55	20.34	19.8	19.21		(93)
Set Ti to the				e obtair	ned at ste	ep 11 of	Table 9	o, so tha	t Ti.m=(76)m an	d re-calc	culate	
the utilisation			•						, (•	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fa		1	i		i	i	i	i	i	i	i	1	
(94)m= 0.86	0.79	0.7	0.58	0.45	0.32	0.22	0.24	0.39	0.62	0.8	0.87		(94)
Useful gains	1	· `	r ·		007.00	400.00	407.54	054.57	050.00	000.04	000 47	1	(OE)
(95)m= 410.58		466.09	425.23	345.08	237.63	160.32	167.51	254.57	352.69	386.91	392.47		(95)
Monthly aver	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rat										7.1	7.2		(00)
(97)m= 631.33	1	566.54	471.47	361.55	241.35	161.15	168.65	262.36	399.87	524.83	624.38		(97)
Space heatir	ļ	l	r each m		Nh/mont	th = 0.02	1 <u> </u>	L)m] x (4	L 1)m	<u> </u>		
(98)m= 164.24		74.74	33.3	12.25	0	0	0	0	35.1	99.31	172.54		
	!					Į.	Tota	l per year	(kWh/yea) = Sum(9	8) _{15,912} =	699.83	(98)
Space heatir	ng require	ement in	kWh/m²	/year								13.66	(99)
9b. Energy re	quiremer	nts – Coi	mmunity	heating	scheme								
This part is us	ed for sp	ace hea	ating, spa	ace cool	ing or wa	ater heat				unity sch	neme.		_
Fraction of sp	ace heat	from se	condary,	supplen/	nentary l	neating ((Table 1 ⁻	1) '0' if n	one			0	(301)
Fraction of sp	ace heat	from co	mmunity	system	1 – (301	1) =						1	(302)
The community s									up to four	other heat	sources; t	he latter	
includes boilers, Fraction of he		-			rom powei	r stations.	See Appei	ndix C.				1	(303a)
Fraction of tot	al space	heat fro	m Comn	nunity bo	oilers				(3	02) x (303	a) =	1	(304a)
Factor for con	trol and	charging	method	(Table	4c(3)) fo	r commi	unity hea	ating sys	tem			1	(305)
Distribution lo	ss factor	(Table 1	12c) for c	commun	ity heatir	ng syste	m					1.05	(306)
Space heatin	a											kWh/yea	 r
Annual space	_	requiren	nent									699.83	7
Space heat from	om Comi	munity b	oilers					(98) x (30	04a) x (30	5) x (306)	=	734.82	(307a)
Efficiency of s	econdar	y/supple	mentary	heating	system	in % (fro	m Table	4a or A	ppendix	E)		0	(308
Space heating	g require	ment fro	m secon	dary/su	oplemen	tary sys	tem	(98) x (30	01) x 100 ·	÷ (308) =		0	(309)
Water heatin	α										'		
Annual water	_	equirem	ent									1896.14	
If DHW from o		•											_ _
Water heat fro		•								5) x (306) :		1990.95	(310a)
Electricity use							0.01	× [(307a).	(307e) +	(310a)((310e)] =	27.26	(313)
Cooling Syste	m Energ	y Efficie	ncy Ration	0								0	(314)
Space cooling	g (if there	is a fixe	ed cooling	g systen	n, if not e	enter 0)		= (107) ÷	(314) =			0	(315)
Electricity for							ء ادامه رو					· 	7(220-1)
mechanical ve	enulation	- palano	eu, extra	act of po	isilive in	put Irom	outside					177.68	(330a)

				_
warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/year	=(330a)	+ (330b) + (330g) =	177.68	(331)
Energy for lighting (calculated in Appendix	L)		236.78	(332)
Electricity generated by PVs (Appendix M)	(negative quantity)		-518.71	(333)
Electricity generated by wind turbine (Appe	ndix M) (negative quantity)		0	(334)
12b. CO2 Emissions – Community heating	scheme			
	Energy kWh/year	Emission factor kg CO2/kWh	or Emissions kg 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 fuels repeat (363) to (366) for the second	fuel 94	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (36	7b) x 0.22	= 626.35	(367)
Electrical energy for heat distribution	[(313) x	0.52	= 14.15	(372)
Total CO2 associated with community syste	ems (363)(366) + (368	8)(372)	= 640.49	(373)
CO2 associated with space heating (second	dary) (309) x	0	= 0	(374)
CO2 associated with water from immersion	heater or instantaneous heater (3	12) x 0.22	= 0	(375)
Total CO2 associated with space and water	r heating (373) + (374) + (375)	5) =	640.49	(376)
CO2 associated with electricity for pumps a	nd fans within dwelling (331)) x	0.52	92.22	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	= 122.89	(379)
Energy saving/generation technologies (33: Item 1	3) to (334) as applicable	0.52 x 0.01	-269.21	(380)
Total CO2, kg/year sur	n of (376)(382) =		586.39	(383)
Dwelling CO2 Emission Rate (38	3) ÷ (4) =		11.45	(384)

El rating (section 14)

(385)

91.83

SAP 2012 Overheating Assessment

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

Property Details: Plot 28

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: Yes
Number of storeys: 1

Front of dwelling faces: North West

Overshading: Average or unknown

None

Thermal mass parameter: Indicative Value Low

False

Blinds, curtains, shutters:

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

Overheating Details

Night ventilation:

Summer ventilation heat loss coefficient: 253.51 (P1)

Transmission heat loss coefficient: 30.8

Summer heat loss coefficient: 284.36 (P2)

Overhangs:

Overhangs:

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

South West (SW) 0 1 South East (SE) 0 1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South West (SW)	1	0.9	1	0.9	(P8)
South East (SE)	1	0.9	1	0.9	(P8)

Solar gains

Orientation		Area	Flux	g _	FF	Shading	Gains
South West (SW)	0.9 x	8.65	119.92	0.63	0.7	0.9	370.59
South East (SE)	0.9 x	4.58	119.92	0.63	0.7	0.9	196.15
						Total	566.74 (P3/P4)

Internal gains.

	June	July	August
Internal gains	369.28	356.29	362.85
Total summer gains	964.22	923.03	891.55 (P5)
Summer gain/loss ratio	3.39	3.25	3.14 (P6)
Mean summer external temperature (Thames valley)	16	17.9	17.8
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.69	22.45	22.24 (P7)
Likelihood of high internal temperature	Slight	Medium	Medium

Assessment of likelihood of high internal temperature: Medium

		l Iser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	- 036 FL	Strom Softwa					001082 on: 1.0.5.9	
.	F	Property	Address	Plot 28					
Address: 1. Overall dwelling dime	ensions:								
The Overall awailing all the		Are	a(m²)		Av. He	ight(m)		Volume(m ³	3)
Ground floor			51.22	(1a) x	2	2.5	(2a) =	128.04	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	51.22	(4)			-		
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	128.04	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys	0 + 0	+	0	= [0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	- + -	0	Ī - [0	x	20 =	0	(6b)
Number of intermittent fa	ins				2	x -	10 =	20	(7a)
Number of passive vents	3			Ē	0	x '	10 =	0	(7b)
Number of flueless gas f	ires			Ē	0	X 4	40 =	0	(7c)
				L					
				_			Air ch	anges per ho	_
	ys, flues and fans = (6a)+(6b)+(been carried out or is intended, procee			continue fr	20		÷ (5) =	0.16	(8)
Number of storeys in t		, a to (11),	ouror wido (orianao n	0111 (0) 10	(10)		0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber frame o			•	ruction			0	(11)
if both types of wall are p deducting areas of openi	resent, use the value corresponding t nas): if eaual user 0.35	o the grea	ter wall are	a (after					
,	floor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
Percentage of window	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)					0	(16)
,	q50, expressed in cubic metro	-	•	•	etre of e	envelope	area	3	(17)
•	lity value, then $(18) = [(17) \div 20] + (18) = [(17) \div 20]$:- <i>h</i> - :			0.31	(18)
Number of sides sheltere	es if a pressurisation test has been do ed	ne or a de	gree air pe	тпеавшц	is being u	sea		2	(19)
Shelter factor	,,		(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18) x (20) =				0.26	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m <i>÷ 4</i>								
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		
	1 1 1 1 1 1 1 1 1 1		1					I	

Adjusted infilti	ation rat	e (allowi	ing for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.33	0.33	0.32	0.29	0.28	0.25	0.25	0.24	0.26	0.28	0.29	0.31		
Calculate effe		•	rate for t	he appli	cable ca	se	•		•	•	•		
If mechanic If exhaust air h			andiv N (2	3h) - (23a	a) × Fmv (4	auation (1	J5)) other	wise (23h) - (232)			0	(23
If balanced wit) = (23a)			0	(23
		•	•	J		`		•	0l-\ /	00h) [4	(00-)	0	(23
a) If balance	ea mech	anicai ve	entilation 0	with nea	at recove	ery (IVIVI	1R) (24a	0 = (22)	2b)m + (0	23b) x [*	1 – (23c) 0) ÷ 100]]	(24
		L										J	(2-
b) If balance	ea mech	anicai ve	o nulation	without 0	neat rec	overy (r	0	0)m = $(22$	0 (d2	230)	0	1	(24
		<u> </u>										J	(2
c) If whole h	n < 0.5 ≯				•				5 x (23h)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
d) If natural	ventilatio	on or wh	ole hous	e nositiv	/e input	ventilatio	n from l	oft				J	
,	n = 1, the				•				0.5]				
24d)m= 0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55]	(24
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)					
25)m= 0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55]	(2
2. Hoot loos	o and he	at loss i	acramat	0.51	•							•	
3. Heat losse					Not Am		اميراا		A V I I		المراجع الما	_	A V I.
LEMENT	Gros area	_	Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²-	-	A X k kJ/K
Doors		` '			2	x	1.4	=	2.8	<u></u>			(26
Vindows Type	e 1				8.651	x1	/[1/(1.4)+	0.04] =	11.47	╡			(27
Vindows Type	e 2				4.579	ऱ .	/[1/(1.4)+	0.041 =	6.07	=			(27
Valls Type1	41.9	24	13.23	3	28.71	_	0.15		4.31	╡ ┌			(29
Valls Type2	5.6		2		3.62	=	0.13	-	0.51	믁 ¦		┥ 누	(29
otal area of						=	0.14	[0.51				
for windows and		•	offoctivo wi	ndow I I ve	47.55		ı formula 1	/[/1/ L valu	(0) 1 0 041 6	ne aivon in	naraaranl	5 2 2	(3
* include the are						ateu using	TOTTIUIA I	/[((C)+0.04] a	is giveri iii	paragrapi	13.2	
abric heat lo	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				25.16	(3:
leat capacity	Cm = S	(A x k)						((28)	.(30) + (32	2) + (32a).	(32e) =	452.5	4 (34
hermal mass	parame	ter (TMI	= Cm ÷	TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35
or design asses	sments wh	ere the de	tails of the	construct	ion are no	known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
an be used inste													
hermal bridg	,	,		• .	•	<						5.69	(36
details of thermotate of table of the details of th		are not kr	own (36) =	= 0.05 x (3	11)			(33) +	(36) =				
		alaulatas	المعمدال							0E\m v (E)		30.85	(3.
entilation he	i				1,,,,	1, ,1	۸			25)m x (5)	 	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	(38
38)m= 23.45	23.36	23.27	22.86	22.78	22.42	22.42	22.35	22.56	22.78	22.94	23.1	J	(30
leat transfer	r	 					1		= (37) + (37)		ı	1	
39)m= 54.3	54.21	54.12	53.71	53.63	53.27	53.27	53.2	53.4	53.63	53.78	53.95	1	
	•	•								Sum(39) ₁		53.7	(39

Heat loss para	meter (l	HLP). W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.06	1.06	1.06	1.05	1.05	1.04	1.04	1.04	1.04	1.05	1.05	1.05		
` /				<u> </u>	<u> </u>	<u> </u>	<u> </u>		L Average =	Sum(40) _{1.}	12 /12=	1.05	(40)
Number of day	s in mo	nth (Tabl	e 1a)							, ,			
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 heat	ina ene	rav reaui	rement:								kWh/ye	ear:	
n water near	9 0.10	.gy 10qui	101110111.								ice viiii y c	, , , , , , , , , , , , , , , , , , ,	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	TFA -13.		73		(42)
Annual averag Reduce the annua not more that 125	ıl average	hot water	usage by	5% if the α	lwelling is	designed t			se target o		.15		(43)
			- 1					_	_				
Jan Hot water usage ir	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	i ilires pei	r day lor ea	ich monun	vu,iii = ia	1	1	(<i>43)</i>					l	
(44)m= 87.06	83.9	80.73	77.56	74.4	71.23	71.23	74.4	77.56	80.73	83.9	87.06		– , .
Energy content of	hot water	used - cal	culated mo	onthly = 4 .	190 x Vd.r	n x nm x E	0Tm / 3600			m(44) ₁₁₂ = ables 1b. 1		949.77	(44)
(45)m= 129.11	112.92	116.52	101.59	97.48	84.12	77.95	89.44	90.51	105.48	115.14	125.04		
(43)111= 123.11	112.32	110.52	101.55	37.40	04.12	11.33	03.44	l		m(45) ₁₁₂ =		1245.3	(45)
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Total = Su	111(43)112 =	l	1243.3	(40)
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage	loss:									1			
Storage volum	e (litres)) includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	eating a	and no ta	nk in dw	elling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage		المعامية	ft-	ممامات	/1.\^/L	·/do./\							(40)
a) If manufact				or is kno	wn (kvvr	n/day):					0		(48)
Temperature fa											0		(49)
Energy lost fro b) If manufact		_	-		or io not		(48) x (49)) =			0		(50)
Hot water stora			-								0		(51)
If community h	_			(-57					<u> </u>		(0.7)
Volume factor	from Ta	ble 2a									0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro	m watei	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (54) in (5	55)									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	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 Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nual) fro	m Table	e 3							0		(58)
Primary circuit				,	•	. ,	, ,						
(modified by		rom Tabl		here is s	i	i		cylinde	r thermo	stat)		l	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss ca	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	1	(61)
	uired for	water h	Leating ca	Lulated	L for eac	h month	(62)ı	—— m =	0 85 x (′45)m +	(46)m +	(57)m +	ı (59)m + (61)m	
(62)m= 109.74	`	99.05	86.35	82.86	71.5	66.25	76.0	_	76.93	89.66	97.87	106.28]	(62)
Solar DHW input	calculated	using App	endix G or	· Appendix	H (negat	ive quantity	y) (ent	er '0'	if no sola	r contribu	tion to wate	r heating)	J	
(add addition												•		
(63)m= 0	0	0	0	0	0	0	0		0	0	0	0]	(63)
Output from v	vater hea	ter									•	!	•	
(64)m= 109.74	95.98	99.05	86.35	82.86	71.5	66.25	76.0	03	76.93	89.66	97.87	106.28]	
				•		•		Outp	out from wa	ater heate	er (annual) ₁	12	1058.51	(64)
Heat gains fro	om water	heating	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (6	1)m	n] + 0.8 x	([(46)m	+ (57)m	+ (59)m	1]	
(65)m= 27.44	24	24.76	21.59	20.71	17.87	16.56	19.0	01	19.23	22.42	24.47	26.57]	(65)
include (57)m in calc	ulation	of (65)m	only if c	ylinder i	s in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal of	jains (see	Table 5	and 5a):										
Metabolic gai	ns (Table	5), Wat	ts											
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec]	
(66)m= 86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.	.3	86.3	86.3	86.3	86.3		(66)
Lighting gains	s (calculat	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso s	ee 7	Table 5				-	
(67)m= 13.41	11.91	9.68	7.33	5.48	4.63	5	6.5	5	8.72	11.08	12.93	13.78]	(67)
Appliances ga	ains (calc	ulated ir	Append	dix L, eq	uation L	.13 or L1	3a), a	also	see Tal	ble 5		-		
(68)m= 150.39	151.95	148.02	139.64	129.08	119.14	112.51	110.	.95	114.88	123.25	133.82	143.75]	(68)
Cooking gain	s (calcula	ted in A	ppendix	L, equat	ion L15	or L15a), als	o se	e Table	5	-	-		
(69)m= 31.63	31.63	31.63	31.63	31.63	31.63	31.63	31.6	63	31.63	31.63	31.63	31.63]	(69)
Pumps and fa	ans gains	(Table	5a)											
(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= -69.04	-69.04	-69.04	-69.04	-69.04	-69.04	-69.04	-69.	04	-69.04	-69.04	-69.04	-69.04		(71)
Water heating	g gains (T	able 5)											_	
(72)m= 36.88	35.71	33.28	29.98	27.84	24.83	22.26	25.	55	26.71	30.13	33.98	35.71		(72)
Total interna	l gains =				(66)m + (67)m	n + (68	8)m +	- (69)m + ((70)m + (7	71)m + (72))m	_	
(73)m= 249.56	248.45	239.87	225.85	211.29	197.49	188.66	191.	.88	199.21	213.34	229.62	242.13		(73)
6. Solar gair	ns:													
Solar gains are		•				•	tions t	to co	nvert to th	e applica		tion.		
Orientation:	Access F Table 6d	actor	Area m²		Flu Ta	ıx ble 6a		т	g_ able 6b	т	FF able 6c		Gains (W)	
0							1 1	-						1
Southeast 0.9x		X			-	36.79	X		0.63	_ ×	0.7	=	51.49	(77)
Southeast 0.9x		X	4.5			62.67	X		0.63	_ ×	0.7	_ =	87.71	(77)
Southeast 0.9x	<u> </u>	X	4.5			35.75	X		0.63		0.7	=	120	[(77)
Southeast 0.9x		X				06.25	X		0.63	×	0.7	=	148.69	<u> </u> (77)
Southeast 0.9x	0.77	X	4.5	58	X 1	19.01	X		0.63	X	0.7	=	166.54	(77)

		_			_		,		_				_
Southeast 0.9x	0.77	X	4.5	58	X	118.15	X	0.63	X	0.7	=	165.34	(77)
Southeast 0.9x	0.77	X	4.5	58	x	113.91	X	0.63	X	0.7	=	159.4	(77)
Southeast _{0.9x}	0.77	X	4.5	58	x	104.39	X	0.63	X	0.7	=	146.08	(77)
Southeast 0.9x	0.77	X	4.5	58	x	92.85	X	0.63	X	0.7	=	129.94	(77)
Southeast 0.9x	0.77	x	4.5	58	x	69.27	X	0.63	X	0.7	=	96.93	(77)
Southeast 0.9x	0.77	X	4.5	58	x	44.07	X	0.63	x	0.7	=	61.67	(77)
Southeast 0.9x	0.77	x	4.5	58	x	31.49	X	0.63	x	0.7	=	44.06	(77)
Southwest _{0.9x}	0.77	x	8.6	65	x	36.79		0.63	X	0.7	=	97.28	(79)
Southwest _{0.9x}	0.77	x	8.6	55	x	62.67		0.63	X	0.7	=	165.7	(79)
Southwest _{0.9x}	0.77	x	8.6	3 5	x	85.75]	0.63	x	0.7	=	226.72	(79)
Southwest _{0.9x}	0.77	x	8.6	65	x	106.25]	0.63	x	0.7	=	280.91	(79)
Southwest _{0.9x}	0.77	x	8.6	65	x	119.01]	0.63	x	0.7	=	314.65	(79)
Southwest _{0.9x}	0.77	x	8.6	65	x	118.15]	0.63	x	0.7	=	312.37	(79)
Southwest _{0.9x}	0.77	×	8.6	65	x	113.91	Ī	0.63	x	0.7		301.16	(79)
Southwest _{0.9x}	0.77	×	8.6	65	x	104.39	Ī	0.63	x	0.7	-	275.99	(79)
Southwest _{0.9x}	0.77	×	8.6	65	х	92.85	Ī	0.63	x	0.7	=	245.49	(79)
Southwest _{0.9x}	0.77	×	8.6	S5	х	69.27	Ī	0.63	x	0.7	=	183.13	(79)
Southwest _{0.9x}	0.77	×	8.6	65	х	44.07	Ī	0.63	x	0.7	=	116.52	(79)
Southwest _{0.9x}	0.77	×	8.6	65	х	31.49	Ī	0.63	x	0.7	<u> </u>	83.25	(79)
Solar gains in (83)m= 148.77 Total gains – i (84)m= 398.33	253.41 34 nternal and	46.72	429.6	481.19	477.7	n , watts	(83)m 422		(82)m 280.0	7 178.19	127.31] 	(83)
` '		- 1											` '
7. Mean inter	· · · · · · · · · · · · · · · · · · ·		`		/	o franc Tal	hla 0	Th4 (9C)					7(05)
Temperature	Ū	٠.			•		bie 9	, 1111 (C)				21	(85)
Utilisation fac		Mar	Apr	May	Jur		Ι	ug Sep	Oct	Nov	Dec		
(86)m= 0.94	-).83	0.73	0.61	0.46	+	0.3		0.78	0.91	0.95		(86)
` '	<u> </u>					!		ļ	0.70	0.01	0.00		()
Mean interna	· · ·	T		· `	i	i i	_		20.27	1 10 00	40.00	1	(87)
(87)m= 19.08	19.47 1	9.92	20.38	20.71	20.9	20.97	20.	96 20.83	20.37	19.63	18.99		(67)
Temperature					i	<u> </u>	1	 	ı		ı	1	
(88)m= 20.03	20.03 2	0.04	20.04	20.04	20.05	20.05	20.	05 20.05	20.04	20.04	20.04		(88)
Utilisation fac	tor for gain	s for r	est of d	welling,	h2,m (see Table	9a)					•	
(89)m= 0.93	0.88).81	0.7	0.56	0.41	0.28	0.3	31 0.5	0.74	0.89	0.94		(89)
Mean interna	l temperatu	re in t	he rest	of dwell	ing T2	(follow ste	eps 3	to 7 in Tabl	e 9c)				
(90)m= 18.29	18.67 1	9.11	19.54	19.83	19.99	20.04	20.	03 19.94	19.54	18.84	18.21		(90)
								1	LA = Liv	∕ing area ÷ (4) =	0.45	(91)
Mean interna	l temperatu	ire (fດ	r the wh	ole dwe	llina) =	: fLA × T1	+ (1	– fLA) × T2					
(92)m= 18.65	· ·	9.47	19.92	20.23	20.4		20.	- '	19.91	19.2	18.56		(92)
Apply adjustr	nent to the	mean	interna	temper	ature f	rom Table	4e,	where appro	priate	:	ı	1	
117,													

(93)m=	18.65	19.03	19.47	19.92	20.23	20.4	20.45	20.45	20.34	19.91	19.2	18.56		(93)
` '			uirement		20.20	20.4	20.40	20.40	20.04	10.01	10.2	10.00		(==)
					ro obtair	and at et	on 11 of	Table Ok	o so tha	t Ti m_/	76)m an	d re-calc	ulato	
				using Ta		ieu at st	эр ттог	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>				<u> </u>	•					
(94)m=	0.92	0.86	0.8	0.7	0.57	0.43	0.31	0.34	0.52	0.74	0.88	0.93		(94)
Usefu	ıl gains,	hmGm .	W = (94)	4)m x (8	4)m		l					<u> </u>		
(95)m=	364.76	433.82	466.66	456.1	395.04	288.79	199.48	207.57	297.76	364.67	357.22	342.73		(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 mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m-	– (96)m	1				
(97)m=	778.99	766.01	702.14	591.71	457.32	308.88	205.27	215.28	333.08	499.43	650.54	774.8		(97)
Space	e heating	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=	308.19	223.23	175.2	97.64	46.34	0	0	0	0	100.26	211.19	321.46		
				I	<u>Į</u>			Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1483.51	(98)
Space	, hootin	a roquir	omont in	kWh/m²	2/voor						,	, I	00.07	□ □(99)
					ува							l	28.97	(99)
8c. Sp	pace co	oling rec	uiremer	nt										
Calcu				August.	l .					_				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1		<u> </u>			1			and exte				r i		(100)
(100)m=	0	0	0	0	0	500.69	394.16	404.31	0	0	0	0		(100)
ĺ		tor for lo		i	i		ı					- 1		(151)
(101)m=		0	0	0	0	0.89	0.93	0.92	0	0	0	0		(101)
				(100)m x	<u> </u>	1	1							
(102)m=	0	0	0	0	0	446.59	365.87	370.39	0	0	0	0		(102)
						1		e Table						
(103)m=		0	0	0	0	854.18	822.61	782.32	0	0	0	0		(103)
						dwelling,	continue	ous (kW	h) = 0.02	24 x [(10	03)m – (102)m] x	k (41)m	
,	04)m to	2ero II (3 × (98	í –	293.47	339.81	306.48	0	0	0			
(104)m=	U	U	0	0	0	293.47	339.61	300.46	0 T-1-1	0	0	0		7(101)
Coolog	I fraction	,								= Sum(104) area ÷ (4	=	939.76	(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				0.20	0.20	0.20		' = Sum(=	0	(106)
Space	cooling	requirer	nent for	month =	: (104)m	× (105)	× (106)r	n	rotar	= <i>Gam</i> (I MT)	_		(100)
(107)m=	Ť	0	0	0	0	73.37	84.95	76.62	0	0	0	0		
(101)		_								= Sum(=	234.94	(107)
0	!!			-\						`	19091	-		4
·		•		kWh/m²/y					` ′	÷ (4) =			4.59	(108)
			, i	alculated	Tonly un	ider spec	cial cond	litions, se		· ·				
Fabrio	Energy	/ Efficier	псу						(99) -	+ (108) =	=		33.55	(109)

SAP Input

Property Details: Plot 28

Address:

Located in: England Region: Thames valley

UPRN:

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

Assessment type: New dwelling design stage

Transaction type:

Tenure type:

Related party disclosure:

Thermal Mass Parameter:

New dwelling

Unknown

No related party

Indicative Value Low

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

PCDF Version: 466

Property description:

Dwelling type: Flat

Detachment:

Year Completed: 2020

Floor Location: Floor area:

Storey height:

Floor 0 51.215 m² 2.5 m

Living area: 22.979 m² (fraction 0.449)

Front of dwelling faces: North West

Opening types:

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

NW Manufacturer Solid

SW Manufacturer Windows double-glazed Yes
SE Manufacturer Windows double-glazed Yes

U-value: Name: Gap: Frame Factor: g-value: Area: No. of Openings: NW 1.4 mm 0 SW 0.7 0.63 1.4 8.651 16mm or more 1

 SW
 16mm or more
 0.7
 0.63
 1.4
 8.651
 1

 SE
 16mm or more
 0.7
 0.63
 1.4
 4.579
 1

Width: Location: Orient: Height: Name: Type-Name: North West NW Corridor Wall n South West SW External Wall 0 0 SE External Wall South East 0 0

Overshading: Average or unknown

Opaque Elements:

Gross area: Openings: Net area: U-value: Ru value: Curtain wall: Kappa: Type: **External Elements** External Wall 41.936 13.23 28.71 0.15 Λ False N/A Corridor Wall 2 0.15 False N/A 5.618 3.62 0.4

Internal Elements
Party Elements

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1196

Length Psi-value

4.795 0.289 E2 Other lintels (including other steel lintels)

SAP Input

	13.2	0.047	E4	Jamb
	34.904	0.069	E7	Party floor between dwellings (in blocks of flats)
[Approved]	2.725	0.06	E18	Party wall between dwellings
	8.175	0.106	E25	Staggered party wall between dwellings
[Approved]	5.45	0.09	E16	Corner (normal)
[Approved]	2.725	-0.09	E17	Corner (inverted internal area greater than external area)
	26.656	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery

Number of wet rooms: Kitchen + 1

Ductwork: Insulation, rigid

Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 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: 0.63 Tilt of collector: 30°

Overshading: None or very little Collector Orientation: South West

Assess Zero Carbon Home: No

		User_[Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa					0001082 on: 1.0.5.9	
		Property	Address	: Plot 28	}				
Address :									
1. Overall dwelling dime	ensions:	Λ να	a(m2)		۸۰، ۵۰	iaht/m	`	Valuma/m³	81
Ground floor		_	ea(m²) 51.22	(1a) x		ight(m) 2.5) (2a) =	Volume(m ³	(3a)
Total floor area TFA – (1	a)+(1b)+(1c)+(1d)+(1e)+(1		51.22	(4)				120.01	(227)
	a)1(1b)1(1c)1(1a)1(1c)1(1		51.22	J)+(3c)+(3c	4) 1 (30) 1	(2n) -		7
Dwelling volume				(3a)+(3b)+(30)+(30	J)+(3e)+	(311) =	128.04	(5)
2. Ventilation rate:	main seconda	irv	other		total			m³ per hou	ır
Number of alligners	heating heating			- 		<u> </u>	(40 =	-	_
Number of chimneys		_ +	0	_	0			0	(6a)
Number of open flues	0 + 0	+	0	_ = [0	×	(20 =	0	(6b)
Number of intermittent fa	ins				2	Х	(10 =	20	(7a)
Number of passive vents	3				0)	(10 =	0	(7b)
Number of flueless gas f	ires				0)	40 =	0	(7c)
							Air ch	angos nor ha	NIIP.
lafiliantina dan tambiana	fl (Co) ((Ch) ((7a) . (7b) .	(70)	_				nanges per ho	_
	ys, flues and fans = (6a)+(6b)+ neen carried out or is intended, proce			continue fi	20	(16)	÷ (5) =	0.16	(8)
Number of storeys in t		ou to (11),	Oli ICI WIGO	oonanao n	0111 (0) 10	(10)		0	(9)
Additional infiltration						[(9	9)-1]x0.1 =	0	(10)
	.25 for steel or timber frame of			•	ruction			0	(11)
if both types of wall are p deducting areas of openi	resent, use the value corresponding	to the grea	iter wall are	a (after					
=	floor, enter 0.2 (unsealed) or	0.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
Percentage of window	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2					0	(15)
Infiltration rate					12) + (13)			0	(16)
	q50, expressed in cubic metrility value, then $(18) = [(17) \div 20]$	•	•	•	etre of e	envelop	e area	5	(17)
•	es if a pressurisation test has been do				is being u	sed		0.41	(18)
Number of sides sheltered			,	,	J			2	(19)
Shelter factor			(20) = 1 -	[0.075 x (19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18	s) x (20) =				0.35	(21)
Infiltration rate modified f			1	•	•	1		1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp						1		1	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind Factor (22a)m = (2	2)m ÷ 4								
(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 infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m	
	0.41
Calculate effective air change rate for the applicable case	
If mechanical ventilation: If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a)	0 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0 (23b)
	0 (23c)
a) If balanced mechanical ventilation with heat recovery (MVHR) $(24a)m = (22b)m + (23b) \times [1 - (24a)m = 0 $	$\frac{(23c) \div 100]}{0} \tag{24a}$
	(24a)
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m= 0 0 0 0 0 0 0 0 0	0 (24b)
	0 (240)
c) If whole house extract ventilation or positive input ventilation from outside if $(22b)m < 0.5 \times (23b)$, then $(24c) = (23b)$; otherwise $(24c) = (22b)m + 0.5 \times (23b)$	
	0 (24c)
d) If natural ventilation or whole house positive input ventilation from loft	
if $(22b)m = 1$, then $(24d)m = (22b)m$ otherwise $(24d)m = 0.5 + [(22b)m^2 \times 0.5]$	
(24d)m= 0.6 0.59 0.59 0.57 0.57 0.55 0.55 0.56 0.57 0.58 0	.58 (24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)	
(25)m= 0.6 0.59 0.59 0.57 0.57 0.55 0.55 0.56 0.57 0.58 0	0.58 (25)
3. Heat losses and heat loss parameter:	
	value A X k
	J/m²·K kJ/K
Doors 2 x 1 = 2	(26)
Windows Type 1 7.06 $x^{1/[1/(1.4) + 0.04]} = 9.36$	(27)
Windows Type 2 $3.74 x^{1/[1/(1.4) + 0.04]} = 4.96$	(27)
Walls Type1 41.94 10.8 31.14 x 0.18 = 5.6	(29)
Walls Type2 5.62 2 3.62 x 0.18 = 0.65	(29)
Total area of elements, m ² 47.55	(31)
* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in para	
** include the areas on both sides of internal walls and partitions	
Fabric heat loss, W/K = S (A x U) $(26)(30) + (32) =$	22.57 (33)
Heat capacity $Cm = S(A \times k)$ ((28)(30) + (32) + (32a)(32	2e) = 486.56 (34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium	250 (35)
For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table can be used instead of a detailed calculation.	1 <i>t</i>
Thermal bridges : S (L x Y) calculated using Appendix K	4.24 (36)
if details of thermal bridging are not known (36) = $0.05 \times (31)$	
Total fabric heat loss (33) + (36) =	26.82 (37)
Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov [Dec
(38)m= 25.22 25.06 24.91 24.17 24.04 23.4 23.4 23.28 23.64 24.04 24.31 2	4.6 (38)
Heat transfer coefficient, W/K (39)m = (37) + (38)m	
(39)m= 52.04 51.88 51.72 50.99 50.85 50.22 50.22 50.1 50.46 50.85 51.13 51	1.42
Average = $Sum(39)_{112}/1$	50.99 (39)

eat loss p						I	ı		- ` 	= (39)m ÷				
0)m= 1.0)2	1.01	1.01	1	0.99	0.98	0.98	0.98	0.99	0.99	1	1		— ,,
umber of	davs	in mor	nth (Tahl	e 1a)					,	Average =	Sum(40) ₁ .	12 /12=	1	(4
Ja	Ť	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
)m= 3	_	28	31	30	31	30	31	31	30	31	30	31		(4
′ <u> </u>		!					<u> </u>		<u> </u>					·
. Water h	neatin	a ener	av reaui	rement:								kWh/yea	ar.	
. Water i	loatii	ig crior	gy roqui	TOTTIOTIC.									۸۱.	
sumed o				[4 0)(0	/ n nnna) 40 v /TI	-A 42.0°	\2\1 · 0 (1012 v /	TEA 40		73		(4
if TFA > if TFA £			+ 1.70 X	[ı - exp	(-0.0003	949 X (11	-A -13.9)2)] + 0.(JU 13 X (IFA - 13.	.9)			
nual ave	_			,	•	•	_	` ,				.19		(4
duce the a t more that		_		• .		-	-	o achieve	a water us	se target o	f			
	_													
Ja t water usa		Feb itres per	Mar day for ea	Apr	May	Jun	Jul Table 1c v	Aug	Sep	Oct	Nov	Dec		
		· ·				1	1	, ,	70.00	70.00	70.7	00.74		
)m= 82.	/1	79.7	76.69	73.69	70.68	67.67	67.67	70.68	73.69	76.69	79.7 m(44) ₁₁₂ =	82.71	902.29	(4
ergy conte	nt of ho	ot water i	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x D	Tm / 3600			· /	_	902.29	(
)m= 122	.66	107.28	110.7	96.51	92.6	79.91	74.05	84.97	85.99	100.21	109.39	118.79		
,			-				l				m(45) ₁₁₂ =	<u> </u>	1183.04	(₍
nstantaneo	us wat	er heatin	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46			(-,	L		
)m= 0		0	0	0	0	0	0	0	0	0	0	0		(4
ater stora	age lo	oss:					!		!					
orage vo	lume	(litres)	includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(4
communi	-	-			_			` '		(01.1/				
herwise i ater stora			not wate	er (this in	cludes i	nstantar	neous co	mbi boil	ers) ente	er 'O' in (47)			
If manu	-		clared lo	oss facto	or is kno	wn (kWł	n/dav):					0		(4
mperatu						(, aay / .					0		(4
ergy lost					ar			(48) x (49)) =			0		(!
If manu			_	-		or is not		(10) // (10)	,			0		(
t water s	storaç	ge loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)					0		(!
communi	•	_		on 4.3										
lume fac				2h							-	0		(!
mperatu									> .	>		0		(
ergy lost nter (50)			•	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(!
, ,	,	,	•	or ooob	month			((EC)(FF) (44)			0		(
ater stora	Ť					Ι			55) × (41)		ı			,
)m= 0		0	0	0	0 (50)	0	0	0	0 (50)	0	0	0		(
ylinder con	itains c	ledicated	solar sto	rage, (57)i	n = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	/)m = (56)	m where (H11) is fro	m Appendix	H	
)m= 0		0	0	0	0	0	0	0	0	0	0	0		(!
mary cire	cuit lo	oss (an	nual) fro	m Table	3							0		(5
mary cire		,	•			59)m = ((58) ÷ 36	55 × (41)	m					
modified	d by fa	actor fr	om Tabl	e H5 if t	here is s	solar wat	ter heatii	ng and a	cylinde	r thermo	stat)			

Combi loss c	alculated	for each	month ((61)m –	(60) ·	365 v (41	/m							
(61)m= 0	0	0	0	0 0	00) +	0 0)III 0		0	0	0	0	1	(61)
													J (59)m + (61)m	(- /
(62)m= 104.26	-	94.09	82.03	78.71	67.92		72.	_	73.09	85.18	92.98	100.97	(39)111 + (01)111	(62)
Solar DHW input													I	(/
(add addition										001111100	mon to wat	or ricating)		
(63)m= 0	0	0	0	0	0	0	0		0	0	0	0	1	(63)
Output from v	uater hea	ter				_!	!						ı	
(64)m= 104.26		94.09	82.03	78.71	67.92	62.94	72.:	23	73.09	85.18	92.98	100.97]	
	1	I		ļ				Outp	out from wa	ater heat	_ I er (annual)₁	12	1005.58	(64)
Heat gains from	om water	heating,	kWh/me	onth 0.2	3.0] ` 5	85 × (45)m	า + (6	1)m	n] + 0.8 x	(46)m	ı + (57)m	+ (59)m	1	•
(65)m= 26.06		23.52	20.51	19.68	16.98		18.	_	18.27	21.29	23.24	25.24	اً	(65)
include (57)m in cal	culation o	of (65)m	only if c	vlinde	is in the	dwell	ing	or hot w	ater is t	rom com	munity h	ı neating	
5. Internal of	•		. ,		•									
Metabolic gai	ns (Table	e 5), Wat	ts											
Jan	Feb	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec		
(66)m= 86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.	.3	86.3	86.3	86.3	86.3		(66)
Lighting gains	s (calcula	ted in Ap	pendix	L, equat	ion L9	or L9a), a	ılso s	ee -	Table 5		-		-	
(67)m= 13.44	11.94	9.71	7.35	5.49	4.64	5.01	6.5	51	8.74	11.1	12.96	13.81		(67)
Appliances g	ains (calc	ulated ir	Append	dix L, eq	uation	L13 or L1	3a), a	also	see Tal	ble 5	•		•	
(68)m= 150.39	151.95	148.02	139.64	129.08	119.1	112.51	110	.95	114.88	123.25	133.82	143.75		(68)
Cooking gain	s (calcula	ted in A	ppendix	L, equat	ion L1	5 or L15a), als	o se	e Table	5	-		•	
(69)m= 31.63	31.63	31.63	31.63	31.63	31.63	31.63	31.	63	31.63	31.63	31.63	31.63		(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= -69.04	-69.04	-69.04	-69.04	-69.04	-69.04	-69.04	-69.	.04	-69.04	-69.04	-69.04	-69.04		(71)
Water heating	g gains (T	able 5)									-		•	
(72)m= 35.03	33.92	31.62	28.48	26.45	23.58	21.15	24.:	27	25.38	28.62	32.28	33.93]	(72)
Total interna	ıl gains =				(6	66)m + (67)n	n + (68	3)m +	+ (69)m + ((70)m + (71)m + (72))m	•	
(73)m= 247.75	246.7	238.23	224.37	209.91	196.2	187.56	190	.62	197.89	211.87	227.95	240.38		(73)
6. Solar gair	ns:	•										•		
Solar gains are	calculated	using sola	r flux from	Table 6a	and ass	ociated equa	ations	to co	nvert to th	e applica	ble orienta	tion.		
Orientation:			Area			lux		_	g_ 	_	FF		Gains	
	Table 6d		m²		'	able 6a	_		able 6b		Table 6c		(W)	_
Southeast 0.9x		X	3.7	74	X	36.79	X		0.63	X	0.7	=	42.06	(77)
Southeast 0.9x		X	3.7	74	X	62.67	X		0.63	x	0.7	=	71.64	(77)
Southeast 0.9x	<u> </u>	X	3.7	74	x	85.75	x		0.63	x [0.7	=	98.01	(77)
Southeast 0.9x	0.77	Х	3.7	74	x	106.25	x		0.63	x [0.7	=	121.44	(77)
Southeast 0.9x	0.77	X	3.7	74	x	119.01	x		0.63	x	0.7	=	136.03	(77)

							_		_				_
Southeast 0.9x	0.77	X	3.7	' 4	X	118.15	X	0.63	X	0.7	=	135.04	(77)
Southeast 0.9x	0.77	X	3.7	' 4	x	113.91	X	0.63	X	0.7	=	130.2	(77)
Southeast 0.9x	0.77	X	3.7	74	x	104.39	X	0.63	X	0.7	=	119.32	(77)
Southeast 0.9x	0.77	X	3.7	74	x	92.85	X	0.63	X	0.7	=	106.13	(77)
Southeast 0.9x	0.77	X	3.7	7 4	x	69.27	X	0.63	x	0.7	=	79.17	(77)
Southeast 0.9x	0.77	X	3.7	7 4	x	44.07	x	0.63	X	0.7	=	50.37	(77)
Southeast 0.9x	0.77	x	3.7	74	x	31.49	x	0.63	X	0.7	=	35.99	(77)
Southwest _{0.9x}	0.77	x	7.0)6	x	36.79		0.63	X	0.7	=	79.39	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x	62.67		0.63	X	0.7	=	135.23	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x	85.75		0.63	x	0.7	=	185.02	(79)
Southwest _{0.9x}	0.77	×	7.0)6	x	106.25		0.63	x	0.7	=	229.25	(79)
Southwest _{0.9x}	0.77	×	7.0)6	x	119.01		0.63	x	0.7	=	256.78	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x [118.15	Ī	0.63	x	0.7	=	254.92	(79)
Southwest _{0.9x}	0.77	×	7.0)6	x \lceil	113.91	Ī	0.63	x	0.7		245.77	(79)
Southwest _{0.9x}	0.77	×	7.0)6	x \lceil	104.39	Ī	0.63	x	0.7		225.24	(79)
Southwest _{0.9x}	0.77	×	7.0)6	x \lceil	92.85	Ī	0.63	x	0.7	<u> </u>	200.34	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x T	69.27	Ī	0.63	x	0.7	=	149.45	(79)
Southwest _{0.9x}	0.77	×	7.0)6	x	44.07	Ī	0.63	x	0.7	=	95.09	(79)
Southwest _{0.9x}	0.77	×	7.0)6	x \lceil	31.49	Ī	0.63	x	0.7	<u> </u>	67.94	(79)
Solar gains in (83) m= 121.44 Total gains – in (84) m= 369.19	206.86 28	33.04	350.7	392.81	389 + (83	9.97 375.97 3)m , watts 5.22 563.53	(83)m 344 535		228.63 440.49	-	103.93]	(83)
7. Mean inter	nal tempera	aturo /					-]	(84)
Temperature		ature ((heating	season	1)								(84)
	during hea		`		<i></i>	rea from Ta	ble 9	, Th1 (°C)				21	(84)
Utilisation fac	Ū	ting pe	eriods ir	n the livi	ng a		ble 9	, Th1 (°C)				21	_
·	tor for gain	ting pe	eriods ir	n the livi	ng a		_	, Th1 (°C)	Oct	Nov	Dec	21	_
Utilisation fac	tor for gain	ting pe	eriods ir iving are	n the livi ea, h1,m	ng a (se	e Table 9a)	_	ug Sep	Oct 0.92	Nov 0.99	Dec 1	21	_
Utilisation fac	Feb 0.98 0	ting po s for li Mar	eriods ir iving are Apr 0.88	n the livi ea, h1,m May	ng a (sed J	e Table 9a) un Jul 54 0.39	A 0.4	ug Sep 13 0.66	_	+		21	(85)
Utilisation fac	Feb 0.98 Control of the control of	ting po s for li Mar	eriods ir iving are Apr 0.88	n the livi ea, h1,m May	ng a (see	e Table 9a) un Jul 54 0.39	A 0.4	ug Sep 13 0.66 Table 9c)	_	0.99		21	(85)
Utilisation factors Jan (86)m= 1 Mean internal (87)m= 20.06	Feb 0.98 0 1 temperatu 20.27 2	s for li Mar 0.96 ure in l	eriods ir iving are Apr 0.88 iving are	n the livi ea, h1,m May 0.73 ea T1 (fo	ng a (see	e Table 9a) un Jul 54 0.39 v steps 3 to 99 21	7 in T	ug Sep 13 0.66 Table 9c) 1 20.97	0.92	0.99	1	21	(85)
Utilisation factors Jan (86)m= 1 Mean interna	retor for gains Feb 0.98 Control I temperatu 20.27 2 during hea	s for li Mar 0.96 ure in l	eriods ir iving are Apr 0.88 iving are	n the livi ea, h1,m May 0.73 ea T1 (fo	ng a (see	e Table 9a) un Jul 54 0.39 steps 3 to 99 21	7 in T	ug Sep 3 0.66 able 9c) 1 20.97 9, Th2 (°C)	0.92	0.99	1	21	(85)
Utilisation factors Jan (86)m= 1 Mean interna (87)m= 20.06 Temperature (88)m= 20.07	retor for gains Feb 0.98 Construction 1 temperatu 20.27 2 during hea 20.07 2	s for li Mar 0.96 ure in l 0.53 ting pe	eriods ir iving are 0.88 iving are 20.79 eriods ir 20.09	n the livi ea, h1,m May 0.73 ea T1 (for 20.94 n rest of 20.09	ng a (see	e Table 9a) un Jul 54 0.39 v steps 3 to 99 21 elling from Ta 0.1 20.1	A 0.47 in T 2 able 9	ug Sep 3 0.66 able 9c) 1 20.97 9, Th2 (°C)	20.76	0.99	20.02	21	(85) (86) (87)
Utilisation factors (86)m= 1 Mean interna (87)m= 20.06 Temperature (88)m= 20.07 Utilisation factors	retor for gain. Feb 0.98 I temperatu 20.27 2 during hear 20.07 2 etor for gain.	s for li Mar 0.96 ure in l 0.53 ting pe 0.08 s for r	eriods ir iving are 0.88 iving are 20.79 eriods ir 20.09	n the livies, h1,m May 0.73 ea T1 (for 20.94 n rest of 20.09 welling,	ng a (see 0.8 0.8 collow 20 dwe 20 h2,n	e Table 9a) un Jul 54 0.39 v steps 3 to .99 21 elling from Ta .0.1 20.1 n (see Table	A 0.47 in T 2 able 9 20 e 9a)	ug Sep 13 0.66 Table 9c) 1 20.97 9, Th2 (°C) 1 20.1	0.92 20.76 20.09	20.35	20.02	21	(85) (86) (87)
Utilisation factors (86)m= 1 Mean interna (87)m= 20.06 Temperature (88)m= 20.07 Utilisation factors (89)m= 0.99	tor for gains Feb 0.98 0 I temperatu 20.27 2 during hea 20.07 2 ctor for gains 0.98 0	s for li Mar 0.96 ure in l 0.53 ting pe 0.08 s for r 0.94	eriods ir iving are 0.88 iving are 20.79 eriods ir 20.09 est of do	n the livies, h1,m May 0.73 ea T1 (for 20.94 n rest of 20.09 welling, 0.68	ng a (see J 0.9 collow 20 dwe 20 h2,n	e Table 9a) un Jul 54 0.39 v steps 3 to .99 21 elling from Ta 0.1 20.1 n (see Table 47 0.31	A 0.4 7 in T 2 able 9 20 9a) 0.3	ug Sep 13 0.66 Table 9c) 1 20.97 9, Th2 (°C) 1 20.1	0.92 20.76 20.09	0.99	20.02	21	(85) (86) (87) (88)
Utilisation factors Jan	tor for gain: Feb 0.98 Cl temperatu 20.27 2 during hea 20.07 2 ctor for gain: 0.98 Cl temperatu	s for li Mar 0.96 Ire in l 0.53 ting pe 0.08 s for r 0.94 Ire in t	eriods ir iving are Apr 0.88 iving are 20.79 eriods ir 20.09 est of do 0.85 the rest	n the livies, h1,m May 0.73 ea T1 (for 20.94 n rest of 20.09 welling, 0.68 of dwell	ng a (see J) 0.3	e Table 9a) un Jul 54 0.39 v steps 3 to 99 21 elling from Ta 0.1 20.1 n (see Table 47 0.31	A 0.2 7 in T 2 able 9 20 9a) 0.3 eps 3	ug Sep 13 0.66 Table 9c) 1 20.97 9, Th2 (°C) 1 20.1 15 0.59 16 7 in Table	0.92 20.76 20.09 0.89 e 9c)	0.99 20.35 20.08	20.02	21	(85) (86) (87) (88) (89)
Utilisation factors (86)m= 1 Mean interna (87)m= 20.06 Temperature (88)m= 20.07 Utilisation factors (89)m= 0.99	tor for gain: Feb 0.98 Cl temperatu 20.27 2 during hea 20.07 2 ctor for gain: 0.98 Cl temperatu	s for li Mar 0.96 ure in l 0.53 ting pe 0.08 s for r 0.94	eriods ir iving are 0.88 iving are 20.79 eriods ir 20.09 est of do	n the livies, h1,m May 0.73 ea T1 (for 20.94 n rest of 20.09 welling, 0.68	ng a (see J 0.9 collow 20 dwe 20 h2,n	e Table 9a) un Jul 54 0.39 v steps 3 to 99 21 elling from Ta 0.1 20.1 n (see Table 47 0.31	A 0.4 7 in T 2 able 9 20 9a) 0.3	ug Sep 3 0.66 Table 9c) 1 20.97 9, Th2 (°C) 1 20.1 55 0.59 to 7 in Table 1 20.08	0.92 20.76 20.09 0.89 e 9c)	0.99 20.35 20.08 0.98	20.02 20.08 1 19.19		(85) (86) (87) (88) (89) (90)
Utilisation factors (86)m= 1 Mean internal (87)m= 20.06 Temperature (88)m= 20.07 Utilisation factors (89)m= 0.99 Mean internal (90)m= 19.22	tor for gain: Feb 0.98 0 I temperatu 20.27 2 during hea 20.07 2 ctor for gain: 0.98 0 I temperatu 19.43 1	s for li Mar 0.96 ure in l 0.53 ting po 0.08 s for r 0.94 ure in t 9.68	eriods ir iving are 0.88 iving are 20.79 eriods ir 20.09 est of do 0.85 the rest 19.93	n the livies, h1,m May 0.73 ea T1 (for 20.94 n rest of 20.09 welling, 0.68 of dwell 20.05	ng a (see J) 0.9 0.9	e Table 9a) un Jul 54 0.39 v steps 3 to .99 21 elling from Ta .0.1 20.1 n (see Table 47 0.31 T2 (follow ste .0.1 20.1	A 0.4 7 in 1 2 able 9 0.3 eps 3	ug Sep 13 0.66 Table 9c) 1 20.97 9, Th2 (°C) 1 20.1 15 0.59 16 7 in Table 1 20.08	0.92 20.76 20.09 0.89 e 9c)	0.99 20.35 20.08	20.02 20.08 1 19.19	0.45	(85) (86) (87) (88) (89)
Utilisation factors Jan	tor for gain: Feb 0.98 0.98 0 temperatu 20.27 2 during hear 20.07 2 tor for gain: 0.98 0 temperatu 19.43 1 temperatu 1 temperatu	s for li Mar 0.96 Ire in I 0.53 ting po 0.08 s for r 0.94 Ire in t 9.68	eriods ir iving are Apr 0.88 iving are 20.79 eriods ir 20.09 est of dr 0.85 the rest 19.93	n the livies, h1,m May 0.73 ea T1 (for 20.94 n rest of 20.09 welling, 0.68 of dwell 20.05	ng a (see J) 0.0	e Table 9a) un Jul 54 0.39 v steps 3 to .99 21 elling from Ta .0.1 20.1 n (see Table 47 0.31 T2 (follow ste .0.1 20.1) = fLA × T1	A 0.2 7 in T 2 able 9 20 9a) 0.3 eps 3	ug Sep 13 0.66 Table 9c) 1 20.97 19, Th2 (°C) 1 20.1 10 0.59 10 7 in Table 1 20.08	0.92 20.76 20.09 0.89 le 9c) 19.91 fLA = Liv	0.99 20.35 20.08 0.98 19.52 ring area ÷ (-	1 20.02 20.08 1 19.19 4) =		(85) (86) (87) (88) (89) (90) (91)
Utilisation factors (86)m= 1 Mean internal (87)m= 20.06 Temperature (88)m= 20.07 Utilisation factors (89)m= 0.99 Mean internal (90)m= 19.22	tor for gain: Feb	s for li Mar 0.96 Ire in l 0.53 ting pe 0.08 s for r 0.94 Ire in t 9.68	eriods ir iving are 0.88 iving are 20.79 eriods ir 20.09 est of do 0.85 the rest 19.93 r the who 20.31	n the livies, h1,m May 0.73 ea T1 (for 20.94 n rest of 20.09 welling, 0.68 of dwell 20.05 ole dwere 20.45	ng a (see J) 0.9 0.9	e Table 9a) un Jul 54 0.39 v steps 3 to .99 21 elling from Ta .0.1 20.1 n (see Table 47 0.31 T2 (follow ste .0.1 20.1) = fLA × T1 .0.5 20.5	A 0.4 7 in T 2 able 9 20 9a) 0.3 eps 3 20 + (1 20	ug Sep 3 0.66 Table 9c) 1 20.97 9, Th2 (°C) 1 20.1 55 0.59 to 7 in Table 1 20.08	0.92 20.76 20.09 0.89 e 9c) 19.91 fLA = Liv	0.99 20.35 20.08 0.98 19.52 ring area ÷ (20.02 20.08 1 19.19		(85) (86) (87) (88) (89) (90)

(93)m=	19.59	19.81	20.06	20.31	20.45	20.5	20.5	20.5	20.48	20.3	19.9	19.56		(93)
` '			uirement		20.10	20.0	20.0	20.0	20.10	20.0	10.0	10.00		(12)
					re ohtair	ed at st	en 11 of	Tahle 9k	n so tha	t Ti m=(76)m an	d re-calc	rulate	
			or gains			ica at st	SP 11 01	Table 5	J, 30 tha	(11,111–(<i>1</i> 0)111 a11	a re care	diato	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	i:									l	
(94)m=	0.99	0.98	0.94	0.85	0.7	0.5	0.35	0.38	0.62	0.89	0.98	0.99		(94)
Usefu	l gains,	hmGm	, W = (94	4)m x (8	4)m								l	
(95)m=	366.4	443.66	491.52	491.5	420.89	293.17	195.68	205.05	312.55	393.52	366.46	342.46		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8					!		l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for me	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]	•		l	
(97)m=	795.84	773.25	701.31	582.02	444.97	296.15	195.99	205.57	322.05	493.04	654.32	789.83		(97)
Space	e heatin	g require	ement fo	r each n	nonth, k\	/Vh/mon	th = 0.02	24 x [(97))m – (95)m] x (4	1)m		l	
(98)m=	319.5	221.49	156.08	65.18	17.92	0	0	0	0	74.04	207.26	332.84		
'			•	•	•	•	•	Tota	l per year	(kWh/year	r) = Sum(9	8) _{15,912} =	1394.3	(98)
Space	e heatin	g require	ement in	kWh/m²	²/vear								27.22	(99)
•		• •			.,									
			luiremer		Can Tal	ala 40h								
Calcu	Jan	Feb	July and Mar	August. Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat				<u> </u>								able 10)		
(100)m=		0	0	0	0	472.02	371.59	380.74	0	0	0	0		(100)
		tor for lo	L				01 1.00	000						(/
(101)m=		0	0	0	0	0.97	0.99	0.98	0	0	0	0		(101)
		ıml m (V	/atts) = ((100)m x	(101)m									, ,
(102)m=		0	0	0	0	459.11	367.53	375.01	0	0	0	0		(102)
						<u> </u>	egion, se							, ,
(103)m=		0	0	0	0	750.41	722.65	690.47	0	0	0	0		(103)
		a reauire	ement fo	r month.	whole o	l	continu	us (kW	(h) = 0.0	L 24 x [(1(1. 23) <i>m – (</i>	102)m] :	l x (41)m	
			104)m <			g,	0077411761		,	[((. ()	
(104)m=	0	0	0	0	0	209.74	264.21	234.71	0	0	0	0		
'									Total	= Sum(104)	=	708.65	(104)
Cooled	I fraction	า							f C =	cooled	area ÷ (4	4) =	1	(105)
		<u> </u>	able 10b	i 										
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
_									Total	l = Sum((104)	=	0	(106)
			r		`	`	× (106)r		_	_	_		 	
(107)m=	0	0	0	0	0	52.43	66.05	58.68	0	0	0	0		٦.
										= Sum(107)	=	177.16	(107)
Space	cooling	requirer	ment in k	kWh/m²/y	year				(107)	÷ (4) =			3.46	(108)
8f. Fab	ric Ene	rgy Effic	iency (ca	alculated	l only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabrio	Energy	y Efficie	псу						(99) -	+ (108) =	=		30.68	(109)
Targe	et Fabri	c Energ	y Efficie	ency (TF	EE)								35.29	(109)
•				- '	•								<u> </u>	_

		l Iser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	— <u>03</u> CF L	Strom Softwa					001082 on: 1.0.5.9	
A dalage -	F	Property	Address	Plot 28					
Address: 1. Overall dwelling dime	ensions:								
		Are	a(m²)		Av. He	ight(m)		Volume(m ³	3)
Ground floor			51.22	(1a) x	2	2.5	(2a) =	128.04	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	51.22	(4)					
Dwelling volume		· ·		(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	128.04	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys	0 + 0	+	0	=	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	- + -	0	Ī - Ē	0	x 2	20 =	0	(6b)
Number of intermittent fa	ns				0	x ′	10 =	0	(7a)
Number of passive vents				Ē	0	x ′	10 =	0	(7b)
Number of flueless gas fi	res			F	0	X 4	40 =	0	(7c)
				L					
				_			Air ch	anges per ho	our —
•	ys, flues and fans = (6a)+(6b)+(ontinus fr	0		÷ (5) =	0	(8)
Number of storeys in the	een carried out or is intended, proced ne dwelling (ns)	ea 10 (17),	otrierwise	onunue ir	om (9) to ((16)		0	(9)
Additional infiltration	3 \					[(9)-	-1]x0.1 =	0	(10)
	.25 for steel or timber frame o			•	uction			0	(11)
if both types of wall are pudeducting areas of openia	resent, use the value corresponding t pas): if equal user 0.35	o the grea	ter wall are	a (after					
,	floor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
<u>-</u>	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	. ,	-	()		0	(15)
Infiltration rate	250 amaza dia adia adia ada		(8) + (10)					0	(16)
•	q50, expressed in cubic metro ity value, then $(18) = [(17) \div 20] +$	•	•	•	etre or e	envelope	area	3	(17)
· ·	es if a pressurisation test has been do				is being u	sed		0.15	(10)
Number of sides sheltere	ed							2	(19)
Shelter factor			(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	•		(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified f	- 1 		1 .					1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp (22)m= 5.1 5	eed from Table 7 4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7	1	
(22)m= 5.1 5	7.0 4.7 4.3 3.6	J 3.0	3.1	4	1 4.3	I 4.5	4.1		
Wind Factor $(22a)m = (22a)m $	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		

0.16	0.16	e (allowi _{0.16}	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15	1	
Calculate effec			l -	-		l -	0.12	0.13	0.14	0.14	0.15]	
If mechanica	ıl ventila	tion:										0.5	(2
If exhaust air he	eat pump i	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	wise (23b) = (23a)			0.5	(2
If balanced with	heat reco	very: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				79.05	(2
a) If balance	d mech		entilation	with he	at recove	ery (MVI	- 	m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	
4a)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]	(2
b) If balance	d mech	anical ve	entilation	without	heat red	covery (I	ИV) (24b)m = (22	2b)m + (2	23b)	ī	,	
4b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(2
c) If whole h				•	•				_				
if (22b)n		<u> </u>	<u> </u>	<u> </u>	ŕ –		ŕ	<u> </u>	· ` ·			1	
lc)m= 0	0	0		0	0	0	0	0	0	0	0	J	(
d) If natural if (22b)n					•				0.5]				
-d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
Effective air	change	rate - er	nter (24a	or (24k	o) or (24	c) or (24	d) in box	(25)				-	
5)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		(
. Heat losse	s and he	at loss r	naramete	⊃r.									
LEMENT	Gros	•	Openin		Net Ar	ea	U-valı	ıe	AXU		k-value	e	ΑΧk
	area	(m^2)	m		A ,r		W/m2		(W/I	K)	kJ/m²-		kJ/K
oors					2	X	1.4	=	2.8				(
indows Type	1				8.651	х1	/[1/(1.4)+	0.04] =	11.47				(
indows Type	2				4.579	x1	/[1/(1.4)+	0.04] =	6.07				(
alls Type1	41.9	4	13.23	3	28.71	X	0.15	= [4.31				(
alls Type2	5.62	2	2		3.62	X	0.14	_ = [0.51			$\neg \vdash$	(
tal area of e	lements	, m²			47.55	5							(
or windows and						ated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragrapl	າ 3.2	
nclude the area				ls and par	titions		(26)(30)	± (32) =					
bric heat los		•	U)				(20)(30)	` '	(20) . (20	2) . (226)	(225)	25.16	(
eat capacity		•	. Cm	T[. l. 1/m21/			***	.(30) + (32	, , ,	(32e) =	452.54	(
iermal mass r design assess	•	`		,			raciaaly the		tive Value		abla 1f	100	(
n be used instea				oon su uct	ion ale 1101	. AHOWII PI	COISTIY III	uicative	values Ul	rivii III I C	adio II		
ermal bridge	s : S (L	x Y) cal	culated (using Ap	pendix l	<						5.69	(
letails of therma		are not kn	own (36) =	= 0.05 x (3	1)								
tal fabric he									(36) =			30.85	(
entilation hea						1			= 0.33 × (25)m x (5)		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
3)m= 11.29	11.16	11.03	10.35	10.22	9.54	9.54	9.41	9.81	10.22	10.49	10.76	J	(:
eat transfer o	oefficier	nt, W/K	·					(39)m	= (37) + (3	38)m		,	
ايمما	42.01	41.87	41.2	41.06	40.39	40.39	40.26	40.66	41.06	41.33	41.6		
9)m= 42.14	42.01	41.07	41.2	41.00	40.00	+0.00	10.20	+0.00	41.00	41.00	1.0		

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.82	0.82	0.82	0.8	0.8	0.79	0.79	0.79	0.79	0.8	0.81	0.81		
									Average =	Sum(40) ₁ .	12 /12=	0.8	(40)
Number of day	<u> </u>	1 ·	· ·						l _				
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	irement:								kWh/ye	ear:	
Assumed occu if TFA > 13. if TFA £ 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13.		73		(42)
Annual average Reduce the annual not more that 125	ge hot wa al average	hot water	usage by	5% if the c	lwelling is	designed i			se target o		.15		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i								l geb	1 000	INOV	Dec		
(44)m= 87.06	83.9	80.73	77.56	74.4	71.23	71.23	74.4	77.56	80.73	83.9	87.06		
(11)	1 00.0	1 000	77.00		7 1.20	1 1.20				m(44) ₁₁₂ =	l l	949.77	(44)
Energy content of	f hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600			. ,			` ′
(45)m= 129.11	112.92	116.52	101.59	97.48	84.12	77.95	89.44	90.51	105.48	115.14	125.04		
	•								Total = Su	m(45) ₁₁₂ =	-	1245.3	(45)
If instantaneous v	vater heati	ing at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)					
(46)m= 19.37	16.94	17.48	15.24	14.62	12.62	11.69	13.42	13.58	15.82	17.27	18.76		(46)
Water storage		\ ' I - I' -			/\/\ IDO	-1	20.2						
Storage volum	,					•		ame ves	sei		0		(47)
If community hotherwise if no	•			_			, ,	are) ant	ar '∩' in <i>(</i>	47)			
Water storage		not wate	i (uno n	iciuues i	iistaiitai	ieous cc	ATIOI DOII	ers) erik	51 0 111 (71)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro	om watei	r storage	, kWh/ye	ear			(48) x (49)) =		1	10		(50)
b) If manufact			-										
Hot water stor	-			e 2 (kW	h/litre/da	ay)				0.	02		(51)
If community he Volume factor	•		on 4.3								1		(50)
Temperature f			2h							-	.6		(52) (53)
Energy lost fro				oor			(47) v (51)) x (52) x (52) _				, ,
Enter (50) or		_	, KVVII/y	zai			(47) X (31))	JJ) =		03 03		(54) (55)
Water storage	` , ` `	,	for each	month			((56)m = ((55) × (41)	m	<u> </u>	03		(00)
		1			00.00		. , ,	. , , ,	ı		00.04		(EC)
(56)m= 32.01 If cylinder contain	28.92	32.01	30.98	32.01 m = (56)m	30.98 x [(50) = (32.01	32.01	30.98 7)m = (56)	32.01	30.98 H11) is fro	32.01 m Append	iy H	(56)
				· · ·									/F-3\
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit				,	•	` '	, ,						
(modified by		1	ı —	ı —	ı —			<u> </u>		<u> </u>			(=a)
(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)	T 0))	0	0	0	0	1	(61)
	<u>l</u>	<u> </u>		alculated	l for ea	ch month							J · (59)m + (61)m	` ,
(62)m= 184.3		171.8	155.08	152.75	137.61		144	_	144.01	160.76	168.64	180.31]	(62)
Solar DHW inpu		using App	endix G o	Appendix	H (nega	tive quantit) (ent	er '0'	if no sola	r contribu	tion to wate	r heating)	1	
(add addition												0,		
(63)m= 0	0	0	0	0	0	0	0)	0	0	0	0]	(63)
Output from	water hea	ter	•			•						•	•	
(64)m= 184.3	9 162.85	171.8	155.08	152.75	137.61	133.22	144	.72	144.01	160.76	168.64	180.31]	
	'					•		Outp	out from wa	ater heate	er (annual)	12	1896.14	(64)
Heat gains f	rom water	heating	, kWh/m	onth 0.2	5 ´[0.8	5 × (45)m	ı + (6	1)m	1] + 0.8 x	د [(46)m	+ (57)m	+ (59)m	n]	
(65)m= 87.15	77.49	82.97	76.57	76.63	70.76	70.14	73.	96	72.89	79.29	81.08	85.8]	(65)
include (5	7)m in cald	culation	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a):										
Metabolic ga	ins (Table	e 5), Wat	ts											
Jar	Feb	Mar	Apr	May	Jun	Jul	Α	ug	Sep	Oct	Nov	Dec]	
(66)m= 103.5	5 103.55	103.55	103.55	103.55	103.55	103.55	103	.55	103.55	103.55	103.55	103.55		(66)
Lighting gair	ns (calcula	ted in Ap	opendix	L, equat	ion L9	or L9a), a	lso s	ee -	Table 5				_	
(67)m= 33.52	2 29.77	24.21	18.33	13.7	11.57	12.5	16.	25	21.81	27.69	32.32	34.45]	(67)
Appliances (gains (calc	ulated ir	n Append	dix L, eq	uation	L13 or L1	3a),	also	see Ta	ble 5		_	-	
(68)m= 224.4	6 226.79	220.92	208.43	192.65	177.83	167.92	165	.59	171.46	183.96	199.73	214.56]	(68)
Cooking gair	ns (calcula	ited in A	ppendix	L, equat	ion L1	or L15a), als	o se	e Table	5	-	-		
(69)m= 47.08	3 47.08	47.08	47.08	47.08	47.08	47.08	47.	80	47.08	47.08	47.08	47.08]	(69)
Pumps and	ans gains	(Table	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= -69.0	4 -69.04	-69.04	-69.04	-69.04	-69.04	-69.04	-69	.04	-69.04	-69.04	-69.04	-69.04]	(71)
Water heating	ng gains (T	able 5)											_	
(72)m= 117.1	4 115.31	111.51	106.35	103	98.28	94.27	99.	41	101.24	106.58	112.61	115.32]	(72)
Total intern	al gains =	:			(6	6)m + (67)n	า + (68	3)m +	- (69)m + ((70)m + (7	71)m + (72))m 	_	
(73)m= 456.7	2 453.47	438.24	414.71	390.95	369.28	356.29	362	.85	376.11	399.83	426.26	445.92		(73)
6. Solar gai														
Solar gains ar		•				•	ations	to co		e applical		tion.		
Orientation:	Access F Table 6d		Area m²			ux able 6a		т	g_ able 6b	т	FF able 6c		Gains (W)	
Couthooot o					_		1						. ,	1,
Southeast 0.9		X			X	36.79] X		0.63	×	0.7	=	51.49	(77)
Southeast 0.93	<u> </u>	X			x	62.67] X]		0.63	_ ×	0.7	_ =	87.71](77)] ₍₇₇₎
	<u> </u>	X			x	85.75] X]		0.63	×	0.7	_ =	120](77)] ₍₇₇₎
Southeast o.o.		X	4.5		X	106.25] X]	<u> </u>	0.63	×	0.7	=	148.69](77)] ₍₇₇₎
Southeast 0.9	0.77	X	4.5	8	х	119.01	X		0.63	X	0.7	=	166.54	(77)

							7		_				_
Southeast 0.9x	0.77	X	4.5	58	x	118.15	X	0.63	X	0.7	=	165.34	(77)
Southeast _{0.9x}	0.77	X	4.5	i8	x	113.91	X	0.63	X	0.7	=	159.4	(77)
Southeast _{0.9x}	0.77	X	4.5	i8	x	104.39	X	0.63	X	0.7	=	146.08	(77)
Southeast _{0.9x}	0.77	x	4.5	i8	x	92.85	X	0.63	X	0.7	=	129.94	(77)
Southeast 0.9x	0.77	x	4.5	i8	x	69.27	X	0.63	X	0.7	=	96.93	(77)
Southeast _{0.9x}	0.77	x	4.5	i8	x	44.07	X	0.63	x	0.7	=	61.67	(77)
Southeast 0.9x	0.77	x	4.5	i8	x	31.49	X	0.63	x	0.7	=	44.06	(77)
Southwest _{0.9x}	0.77	x	8.6	35	x	36.79]	0.63	x	0.7	=	97.28	(79)
Southwest _{0.9x}	0.77	x	8.6	35	x	62.67		0.63	х	0.7	=	165.7	(79)
Southwest _{0.9x}	0.77	x	8.6	35	x	85.75		0.63	х	0.7	=	226.72	(79)
Southwest _{0.9x}	0.77	×	8.6	35	x	106.25	Ī	0.63	x	0.7	=	280.91	(79)
Southwest _{0.9x}	0.77	×	8.6	35	x	119.01]	0.63	x	0.7	=	314.65	(79)
Southwest _{0.9x}	0.77	×	8.6	35	x	118.15	Ī	0.63	x	0.7	=	312.37	(79)
Southwest _{0.9x}	0.77	×	8.6	35	x	113.91	Ī	0.63	x	0.7		301.16	(79)
Southwest _{0.9x}	0.77	×	8.6	35	x	104.39	Ī	0.63	x	0.7		275.99	(79)
Southwest _{0.9x}	0.77	×	8.6	35	x	92.85	Ī	0.63	x	0.7	=	245.49	(79)
Southwest _{0.9x}	0.77	×	8.6	35	x	69.27	Ī	0.63	x	0.7		183.13	(79)
Southwest _{0.9x}	0.77	×	8.6	35	x	44.07	Ī	0.63	x	0.7		116.52	(79)
Southwest _{0.9x}	0.77	×	8.6	35	x	31.49	Ī	0.63	x	0.7	=	83.25	(79)
Solar gains in (83)m= 148.77 Total gains – i (84)m= 605.48	253.41 34 nternal and	6.72	429.6	481.19	477.	m , watts	(83)m 422		280.0°	_	127.31]	(83)
` '	1 ((l ('	<u> </u>					l .		1		(84)
7. Mean inter		iture ((heating										(84)
•	dumna near	inan	`		<i>'</i>	o from Tol	blo O						_
Utilisation fac	ŭ	٠.	eriods ir	n the livi	ng are	ea from Tal	ble 9					21	(84)
lan	ctor for gains	s for li	eriods ir iving are	n the livi	ng are	Table 9a)		, Th1 (°C)	Oct	Nov	Doc	21	_
Jan 0.82	ctor for gains	s for li Mar	eriods ir iving are Apr	n the livi ea, h1,m May	ng are (see Ju	Table 9a) n Jul	Α	, Th1 (°C)	Oct	+	Dec	21	(85)
(86)m= 0.82	Feb N	s for li Mar	eriods ir iving are Apr 0.54	n the living the hand	ng are (see Ju	Table 9a) n Jul 0.22	A 0.2	, Th1 (°C) ug Sep	Oct	Nov 0.75	Dec 0.84	21	_
(86)m= 0.82 Mean interna	retor for gains Feb 1 0.75 0	s for li Mar .66	eriods ir iving are Apr 0.54 iving are	n the living the hand	ng are (see Ju 0.3	Table 9a) n Jul 0.22 steps 3 to 7	0.2 7 in T	Table 9c)	0.57	0.75	0.84	21	(85)
(86)m= 0.82	retor for gains Feb 1 0.75 0	s for li Mar	eriods ir iving are Apr 0.54	n the living the hand	ng are (see Ju	Table 9a) n Jul 0.22 steps 3 to 7	A 0.2	Table 9c)	_	0.75	 	21	(85)
Mean interna (87)m= 20.18 Temperature	retor for gains Feb 1 0.75 0 1 temperatur 20.42 20 during heat	s for li Mar .66 re in l 0.65	eriods ir iving are Apr 0.54 iving are 20.84 eriods ir	n the living the hand	ng are (see Ju 0.3 ollow 20.9	Table 9a) n	A 0.27 in T 2 able 9	Sep 23 0.36 Table 9c) 1 20.97 9, Th2 (°C)	20.84	0.75	20.13	21	(85) (86) (87)
(86)m= 0.82 Mean interna (87)m= 20.18	retor for gains Feb 1 0.75 0 1 temperatur 20.42 20 during heat	Mar .666 re in I	eriods ir iving are Apr 0.54 iving are 20.84	n the living the hand	ng are (see Ju 0.3 ollow	Table 9a) n	7 in T	Sep 23 0.36 Table 9c) 1 20.97 9, Th2 (°C)	0.57	0.75	0.84	21	(85)
Mean interna (87)m= 20.18 Temperature	retor for gains Feb 1 0.75 0 Il temperatur 20.42 20 during heat 20.24 20	s for li	eriods ir iving are 0.54 iving are 20.84 eriods ir 20.25	m the living the sea, h1,mm May 0.42 ea T1 (for 20.94 m rest of 20.25	ng are (see Ju 0.3 collow 20.9 dwell 20.2	Table 9a) n Jul 0.22 steps 3 to 7 9 21 ing from Ta 6 20.26	A 0.27 in T 2 able 9 20.	Sep 23 0.36 Table 9c) 1 20.97 9, Th2 (°C)	20.84	0.75	20.13	21	(85) (86) (87)
(86)m= 0.82 Mean internal (87)m= 20.18 Temperature (88)m= 20.23	tor for gains Feb 1 0.75 0 I temperatur 20.42 20 during heat 20.24 20 ctor for gains	s for li	eriods ir iving are 0.54 iving are 20.84 eriods ir 20.25	m the living the sea, h1,mm May 0.42 ea T1 (for 20.94 m rest of 20.25	ng are (see Ju 0.3 collow 20.9 dwell 20.2	Table 9a) n	A 0.27 in T 2 able 9 20.	Sep 23 0.36 Table 9c) 1 20.97 9, Th2 (°C) 27 20.26	20.84	0.75	20.13	21	(85) (86) (87)
(86)m= 0.82 Mean internal (87)m= 20.18 Temperature (88)m= 20.23 Utilisation factors	tor for gains Feb 0.75 0 I temperatur 20.42 20 during heat 20.24 20 ctor for gains 0.73 0	s for li Mar .66 re in l 0.65 ting pe 0.24 s for re	eriods ir iving are 0.54 iving are 20.84 eriods ir 20.25 est of d	mathe living the livin	ng are (see Ju 0.3 cllow 20.9 dwell 20.2 h2,m 0.21	Table 9a) n Jul 0.22 steps 3 to 79 21 ing from Ta 6 20.26 (see Table 7 0.18	A 0.27 in T 2 able 9 20. 9 9 a) 0.	Sep 23 0.36 Table 9c) 1 20.97 9, Th2 (°C) 27 20.26	0.57 20.84 20.25	0.75 20.51 20.25	20.13	21	(85) (86) (87) (88)
(86)m= 0.82 Mean internal (87)m= 20.18 Temperature (88)m= 20.23 Utilisation factor (89)m= 0.8	tor for gains Feb 1 0.75 0 Il temperatur 20.42 20 during heat 20.24 20 ctor for gains 0.73 0	s for li Mar .66 re in l 0.65 ting pe 0.24 s for re	eriods ir iving are 0.54 iving are 20.84 eriods ir 20.25 est of d	mathe living the livin	ng are (see Ju 0.3 cllow 20.9 dwell 20.2 h2,m 0.21	Table 9a) n	A 0.27 in T 2 able 9 20. 9 9 a) 0.	Sep 23 0.36 Fable 9c) 1 20.97 9, Th2 (°C) 27 20.26 2 0.33 to 7 in Table	0.57 20.84 20.25	0.75 20.51 20.25 0.72	20.13	21	(85) (86) (87) (88)
Mean interna (87)m= 20.18 Temperature (88)m= 20.23 Utilisation fac (89)m= 0.8 Mean interna	tor for gains Feb 1 0.75 0 Il temperatur 20.42 20 during heat 20.24 20 ctor for gains 0.73 0	s for li Mar .66 re in l 0.65 ting pe 0.24 s for re .64	eriods ir iving are 0.54 iving are 20.84 eriods ir 20.25 est of denoted the rest	m the living the sea of the living the sea of the sea o	ng are (see Ju 0.3 collow 20.9 dwell 20.2 h2,m 0.21	Table 9a) n	A 0.2 7 in T 2 able 9 20. 9 9a) 0.	Sep 23 0.36 Table 9c) 1 20.97 9, Th2 (°C) 27 20.26 2 0.33 to 7 in Table 26 20.23	0.57 20.84 20.25 0.54 e 9c) 20.07	0.75 20.51 20.25 0.72	0.84 20.13 20.24 0.82	21	(85) (86) (87) (88) (89)
Mean internation (87)m= 20.18 Temperature (88)m= 20.23 Utilisation fact (89)m= 0.8 Mean internation (90)m= 19.16	tor for gains Feb 1 0.75 0 1 temperatur 20.42 20 during heat 20.24 20 ctor for gains 0.73 0 1 temperatur 19.49 1	s for li Mar .66 re in l 0.65 ting po 0.24 s for r .64 re in t	eriods ir iving are 0.54 iving are 20.84 eriods ir 20.25 est of do 0.52 the rest 20.06	n the living the livin	dwell 20.2 h2,m 0.21 20.2	Table 9a) n Jul 0.22 steps 3 to 7 9 21 ing from Ta 6 20.26 (see Table 7 0.18 2 (follow ste 5 20.26	A 0.2 7 in T 2 able 9 20. 9a) 0. eps 3	Sep 23 0.36 Table 9c) 1 20.97 27 20.26 2 0.33 to 7 in Table 26 20.23	0.57 20.84 20.25 0.54 e 9c) 20.07	0.75 20.51 20.25 0.72	0.84 20.13 20.24 0.82		(85) (86) (87) (88) (89)
Mean interna (87)m= 20.18 Temperature (88)m= 20.23 Utilisation fac (89)m= 0.8 Mean interna	tor for gains Feb	s for li Mar .66 re in l 0.65 ting po 0.24 s for r .64 re in t	eriods ir iving are 0.54 iving are 20.84 eriods ir 20.25 est of do 0.52 the rest 20.06	n the living the livin	dwell 20.2 h2,m 0.21 20.2	Table 9a) n Jul 0.22 steps 3 to 79 21 ing from Ta 6 20.26 (see Table 7 0.18 2 (follow steps 20.26) = fLA × T1	A 0.2 7 in T 2 able 9 20. 9a) 0. eps 3	Sep 23 0.36 Table 9c) 1 20.97 27, Th2 (°C) 27 20.26 2 0.33 to 7 in Table 26 20.23	0.57 20.84 20.25 0.54 e 9c) 20.07	0.75 20.51 20.25 0.72 19.64 ving area ÷ (0.84 20.13 20.24 0.82		(85) (86) (87) (88) (89)
Mean internal (87)m= 20.18 Temperature (88)m= 20.23 Utilisation fact (89)m= 0.8 Mean internal (90)m= 19.16	tor for gains Feb	s for li Mar .66 re in l 0.65 ting po 0.24 s for re .64 re in t 9.8	eriods ir iving are 0.54 iving are 20.84 eriods ir 20.25 est of do 0.52 che rest 20.06 r the wh	n the living the livin	See Ju 0.3	Table 9a) n Jul 0.22 steps 3 to 7 9 21 ing from Ta 6 20.26 (see Table 7 0.18 2 (follow steps 5 20.26 = fLA × T1 8 20.59	A 0.2 7 in T 2 able 9 20. 9a) 0. eps 3 20. + (1 20.	Sep 23 0.36 Table 9c) 1 20.97 27 20.26 2 0.33 20 7 in Table 26 20.23 3 f - fLA) × T2 59 20.57	0.57 20.84 20.25 0.54 e 9c) 20.07 fLA = Liv	0.75 20.51 20.25 0.72 19.64 ving area ÷ (0.84 20.13 20.24 0.82 19.1 4) =		(85) (86) (87) (88) (89) (90) (91)

												•	
(93)m= 19.62	19.91	20.18	20.41	20.53	20.58	20.59	20.59	20.57	20.42	20.03	19.56		(93)
8. Space hea													
Set Ti to the i 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			iviay	Our	Oui	/ rug	ОСР	001	1101	D00		
(94)m= 0.79	0.72	0.63	0.52	0.4	0.28	0.2	0.21	0.34	0.55	0.72	0.81		(94)
Useful gains,	hmGm	, W = (9	4)m x (8	4)m						ı			
(95)m= 477.53	508.67	497.96	440.51	350.66	238.98	160.63	167.96	257.67	370.68	433.95	462.17		(95)
Monthly avera	age exte	rnal tem	perature	from T	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		1			i					i	i	ı	
(97)m= 645.65	630.39	572.84	474.29	362.52	241.58	161.2	168.73	262.89	403.21	534.45	639.23		(97)
Space heatin		1	1	1	I					r -	404.74	1	
(98)m= 125.08	81.8	55.71	24.32	8.83	0	0	0 	0	24.21	72.36	131.74	504.05	7(00)
							Tota	l per year	(kwh/yeai	') = Sum(9	8)15,912 =	524.05	(98)
Space heatin	g requir	ement in	kWh/m²	² /year								10.23	(99)
9b. Energy red	quiremer	nts – Co	mmunity	heating	scheme								
This part is use										unity sch	neme.		7(204)
Fraction of spa			•		-	_	(Table T	1) U II N	one			0	(301)
Fraction of spa	ace heat	from co	mmunity	system	1 – (30	1) =						1	(302)
The community so									up to four	other heat	sources; t	he latter	
includes boilers, here		-			rom powei	r stations.	See Appei	naix C.				1	(303a)
Fraction of total			-		nilare				(3	02) x (303	a) –		(304a)
Factor for cont	·			•		r commi	ınitv hea	itina svst		02) X (303	u) =	1	(305)
				,	` ''		•	unig oyo	.0111				╡```
Distribution los		(Table	120) 101 (ommun	ity neatii	ig syste	Ш					1.05	(306)
Space heating	_	roquiron	o o n t									kWh/yea	r ¬
Annual space	•	•										524.05	╣
Space heat fro		•								5) x (306) :	=	550.25	(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 syst	tem	(98) x (30	01) x 100 -	= (308) =		0	(309)
Water heating	1												
Annual water h		equirem	ent									1896.14	
If DHW from c											,		_ _
Water heat fro		•								5) x (306) :		1990.95	(310a)
Electricity used							0.01	× [(307a).	(307e) +	· (310a)([310e)] =	25.41	(313)
Cooling Syster	_	•	•									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							مانادة عاد				ĺ	477.00	(220-)
mechanical ve	าแเลแดก	- paiano	eu, extr	act of po	silive in	out Irom	outside					177.68	(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) =	177.68	(331)
Energy for lighting (calculated in Appe	ndix L)		236.78	(332)
Electricity generated by PVs (Appendi	x M) (negative quantity)		-518.71	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)
10b. Fuel costs – Community heating	scheme			
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating from CHP	(307a) x	4.24 x 0.01 =	23.33	(340a)
Water heating from CHP	(310a) x	4.24 x 0.01 =	84.42	(342a)
		Fuel Price		_
Pumps and fans	(331)	13.19 × 0.01 =	25.44	(349)
Energy for lighting	(332)	13.19 x 0.01 =	31.23	(350)
Additional standing charges (Table 12)		120	(351)
Energy saving/generation technologies Total energy cost	s = (340a)(342e) + (345)(354) =		282.41	(355)
11b. SAP rating - Community heating	j scheme			
Energy cost deflator (Table 12)			0.42	(356)
Energy cost factor (ECF)	$[(355) \times (356)] \div [(4) + 45.0] =$		1.23	(357)
SAP rating (section12)			82.8	(358)
12b. CO2 Emissions – Community hea				
		ergy Emission factor h/year kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and Efficiency of heat source 1 (%)	water heating (not CHP)	repeat (363) to (366) for the second fu		(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 1	100 ÷ (367b) x 0.22	= 583.94	(367)
Electrical energy for heat distribution	[(313) x	0.52	= 13.19	(372)
Total CO2 associated with community	systems (363)(36	66) + (368)(372)	= 597.12	(373)
CO2 associated with space heating (s	econdary) (309) x	0	= 0	(374)
CO2 associated with water from imme	rsion heater or instantaneous hea	ater (312) x 0.22	= 0	(375)
Total CO2 associated with space and	water heating (373) + (37	74) + (375) =	597.12	(376)
CO2 associated with electricity for pur	nps and fans within dwelling (331))) x 0.52	= 92.22	(378)
CO2 associated with electricity for ligh			= 122.89	(379)
COZ associated with electricity for light	ting (332))) x	0.52	122.89	(373)
Energy saving/generation technologie		0.02	122.00	_
		0.52 × 0.01 =	122.00](380)](383)

Dwelling CO2 Emission Rate (383) ÷ (4) =				10.6	(384)
El rating (section 14)				92.44	(385)
13b. Primary Energy – Community heating scheme					
	Energy kWh/year	Primary factor		Energy Vh/year	
Energy from other sources of space and water heating (not C Efficiency of heat source 1 (%)	CHP) sing two fuels repeat (363) to	o (366) for the second	fuel	94	(367a)
Energy associated with heat source 1 [(307	(b)+(310b)] x 100 ÷ (367b) x	1.22	= [3298.15	(367)
Electrical energy for heat distribution	[(313) x		= [78.01	(372)
Total Energy associated with community systems	(363)(366) + (368)(37	"2)	= [3376.17	(373)
if it is negative set (373) to zero (unless specified otherwise	e, see C7 in Appendix (C)	[3376.17	(373)
Energy associated with space heating (secondary)	(309) x	0	=	0	(374)
Energy associated with water from immersion heater or insta	ntaneous heater(312) x	1.22	= [0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =		[3376.17	(376)
Energy associated with space cooling	(315) x	3.07	= [0	(377)
Energy associated with electricity for pumps and fans within	dwelling (331)) x	3.07	= [545.49	(378)
Energy associated with electricity for lighting	(332))) x	3.07	=	726.9	(379)
Energy saving/generation technologies Item 1		3.07 × 0.01	=	-1592.44	(380)
Total Primary Energy, kWh/year sum of (37	6)(382) =			3056.12	(383)

		Llear	Details:						
Access Name:	Zahid Ashraf	Usei		a Mirros	b a v .		CTDO	001082	
Assessor Name: Software Name:	Stroma FSAP 2012	<u> </u>	Stroma Softwa					on: 1.0.5.9	
			y Address:						
Address :									
1. Overall dwelling dime	ensions:		>						
Ground floor		Ar	rea(m²)	(1a) x		ight(m) 2.5	(2a) =	Volume(m ³	(3a)
	a) ((1b) ((1a) ((1d) ((1a)	(1n)				2.5	(24) -	120.04	
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)	+(111)	51.22	(4)) . (2-) . (2-	1) . (2-) .	(2-)		_
Dwelling volume				(3a)+(3b))+(3c)+(3c	d)+(3e)+	.(3h) =	128.04	(5)
2. Ventilation rate:	main see	condary	other		total			m³ per hou	r
Number of chimneys	heating he	eating		1 ₌ [40 =		_
Number of chimneys			0]	0		20 =	0	(6a)
Number of open flues		0 +	0	」 ⁻ └	0			0	(6b)
Number of intermittent fa				Ļ	2		10 =	20	(7a)
Number of passive vents				Ĺ	0		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	ys, flues and fans = $(6a)$)+(6b)+(7a)+(7b)	+(7c) =	Г	20		÷ (5) =	0.16	(8)
If a pressurisation test has b	peen carried out or is intended	l, proceed to (17), otherwise o	ontinue fr			` ′		`` <i>`</i>
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration	OF for atoal antimber fr	omo or 0 25 i				[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber fr resent, use the value correspond			•	uction			0	(11)
deducting areas of opening	ngs); if equal user 0.35								_
•	floor, enter 0.2 (unseale	d) or 0.1 (sea	aled), else	enter 0				0	(12)
If no draught lobby, en								0	(13)
· ·	s and doors draught stri	pped	0.05 (0.0	(4.4)4	001			0	(14)
Window infiltration			0.25 - [0.2			. (45)		0	(15)
Infiltration rate	.50	((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 c	legice all per	meability	is being u	Sca		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								
	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		
								ı	

Adjusted infilt	ration rat	e (allowi	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41]	
Calculate effe		_	rate for t	he appli	cable ca	se	•		•	•	_	-	
If mechanic If exhaust air h			endix N (2	(23a) = (23a	a) × Fmv (e	equation (I	N5)) othe	rwise (23h) = (23a)			0	(23
If balanced wit) = (20a)			0	(23
a) If balance		•	•	ŭ		`		,	2h\m . (22h) v [1 (226)	0 . 1001	(23
24a)m= 0	0	0	0	0	0	0	0	0	0	0	$\frac{1-(230)}{0}$] — 100j]	(24
b) If balance						L						J	(_
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
c) If whole h				<u> </u>								J	•
,	m < 0.5 >			•	•				5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
d) If natural	ventilation = 1, th				•				0.51			•	
24d)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	1	(24
Effective air				<u> </u>		<u> </u>	ļ		<u> </u>			J	
25)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	1	(2
	1	1	1	1	1	1	1	1	1	1	1	J	`
3. Heat losse	es and he	eat loss _l	paramet	er:									
LEMENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/	K)	k-valu kJ/m²·	-	A X k kJ/K
oors					2	х	1	=	2				(20
Vindows Typ	e 1				7.06	x1	/[1/(1.4)+	0.04] =	9.36				(2
Vindows Typ	e 2				3.74	x1,	/[1/(1.4)+	0.04] =	4.96	=			(2
Valls Type1	41.9	94	10.8	3	31.14	x	0.18		5.6	= [п г	(2
Valls Type2	5.6	2	2		3.62	x	0.18	=	0.65	F i		-	(2
otal area of					47.55	_							(3
for windows and		,	effective wi	ndow U-va			g formula 1	/[(1/U-valu	ıe)+0.04] á	as given in	paragrapi	h 3.2	(-
* include the are				ls and par	titions		,,					_	
abric heat lo		,	U)				(26)(30)					22.5	7 (3:
leat capacity								((28)	(30) + (32	2) + (32a).	(32e) =	486.5	(3.
hermal mass	•	`		,					tive Value			250	(3
or design asses an be used inste				construct	ion are no	t known pr	recisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridg				usina An	pendix I	<						4.24	(30
details of therm	`	,		О.	•	•						7.2-	(*
otal fabric he			, ,	·	,			(33) +	(36) =			26.8	2 (3
entilation he	at loss ca	alculated	d monthly	y				(38)m	= 0.33 × ((25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
38)m= 25.22	25.06	24.91	24.17	24.04	23.4	23.4	23.28	23.64	24.04	24.31	24.6	1	(3
		ot \\//k	•	•	•	•	•	(30)m	= (37) + (38)m	•	-	
leat transfer	coemciei	IL. VV/FN						(38)111					
Heat transfer 52.04	51.88	51.72	50.99	50.85	50.22	50.22	50.1	50.46	50.85	51.13	51.42	1	

Heat loss para	meter (l	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.02	1.01	1.01	1	0.99	0.98	0.98	0.98	0.99	0.99	1	1		
` /				<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	L Average =	Sum(40) ₁ .	12 /12=	1	(40)
Number of day	s in mo	nth (Tab	le 1a)							, ,			
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)
				Į.		Į.	Į.						
1 Motor boot	ing one	ravi roavi	romonti								Is\A/b/ye	2011	
4. Water heat	ing ene	rgy requi	rement.								kWh/ye	ear.	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		73		(42)
Annual averag	ıl average	hot water	usage by	5% if the c	lwelling is	designed i			se target o		.19	I	(43)
not more that 125	litres per	person per	day (all w	ater use, i	not and co	ld)						•	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage ir	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m= 82.71	79.7	76.69	73.69	70.68	67.67	67.67	70.68	73.69	76.69	79.7	82.71		
Energy content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	m x nm x E	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		902.29	(44)
(45)m= 122.66	107.28	110.7	96.51	92.6	79.91	74.05	84.97	85.99	100.21	109.39	118.79		
					ı			-	Total = Su	m(45) ₁₁₂ =	=	1183.04	(45)
If instantaneous w	ater heati	ing at point	of use (no	o hot water	storage),	enter 0 in	boxes (46) to (61)			'		_
(46)m= 18.4	16.09	16.6	14.48	13.89	11.99	11.11	12.75	12.9	15.03	16.41	17.82		(46)
Water storage	loss:			!	<u> </u>	!	!						
Storage volum	e (litres)) includin	ig any s	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	eating a	and no ta	nk in dw	velling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	rcludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage					. (1.) (1.)	. / .1						1	
a) If manufact				or is kno	wn (kvvr	n/day):				1.	39	 	(48)
Temperature fa										0.	54		(49)
Energy lost fro		-	-				(48) x (49)) =		0.	75		(50)
b) If manufactHot water stora			-										(51)
If community h	-			16 Z (KVV	ii/iiti c /ua	iy <i>)</i>					0		(51)
Volume factor	•		311 4.0								0		(52)
Temperature fa			2b							—	0		(53)
Energy lost fro				-ar			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (_	, 100011/90	Jui			(11)11(01)	,	55 ,		75		(55)
Water storage		•	or each	month			((56)m = ((55) × (41)	m	<u> </u>			(/
					00.50		·	1	ı		00.00		(50)
(56)m= 23.33 If cylinder contains	21.07 dedicate	23.33 d solar sto	22.58 rage, (57)	23.33 m = (56)m	22.58 x [(50) – (23.33 H11)] ÷ (5	23.33 0), else (5	22.58 7)m = (56)	23.33 m where (22.58 H11) is fro	23.33 m Append	ix H	(56)
(57)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Primary circuit	loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit (modified by	loss cal	culated f	or each	month (•	. ,	, ,		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)
25.20	21.01	20.20	22.01		22.01						20.20	ı	(55)

Combi loss of	salculated	for each	month	(61)m –	(60) · 3	65 v (41	/m						
(61)m= 0	0 0	0	0	0 0	00) + 3	05 x (41	0	0	0	0	0		(61)
						<u> </u>				<u> </u>	<u> </u>	(59)m + (61)m	` /
(62)m= 169.2		157.29	141.6	139.2	125	120.64	131.5		146.8	154.48	165.38		(62)
Solar DHW inpu			endix G o	r Appendix	H (negati	ve quantity	L		r contribut	tion to wate	L er heating)		
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)													
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from	water hea	ter									-		
(64)m= 169.2	5 149.36	157.29	141.6	139.2	125	120.64	131.5	7 131.08	146.8	154.48	165.38		_
							0	utput from w	ater heate	r (annual)	112	1731.66	(64)
Heat gains f	rom water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61	m] + 0.8	x [(46)m	+ (57)m	+ (59)m	1	
(65)m= 78.06	69.34	74.08	68.16	68.07	62.64	61.9	65.53	64.66	70.6	72.44	76.77		(65)
include (5	7)m in cal	culation of	of (65)m	only if c	ylinder i	s in the	dwellin	g or hot w	ater is f	rom com	munity h	eating	
5. Internal	gains (see	e Table 5	and 5a):									
Metabolic ga	ains (Table	e 5), Wat	ts										
Jar		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3	86.3		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m= 13.44	11.94	9.71	7.35	5.49	4.64	5.01	6.51	8.74	11.1	12.96	13.81		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m= 150.3	9 151.95	148.02	139.64	129.08	119.14	112.51	110.9	5 114.88	123.25	133.82	143.75		(68)
Cooking gair	ns (calcula	ted in A	ppendix	L, equat	ion L15	or L15a), also	see Table	5		-	•	
(69)m= 31.63	3 31.63	31.63	31.63	31.63	31.63	31.63	31.63	31.63	31.63	31.63	31.63		(69)
Pumps and	fans gains	(Table 5	ōa)					•				•	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)	-		-	-	-	-		
(71)m= -69.0	4 -69.04	-69.04	-69.04	-69.04	-69.04	-69.04	-69.04	-69.04	-69.04	-69.04	-69.04		(71)
Water heating	ng gains (1	able 5)						-			•	•	
(72)m= 104.9	2 103.18	99.57	94.67	91.49	87	83.19	88.08	89.81	94.89	100.62	103.19		(72)
Total intern	al gains =	:			(66)m + (67)m	n + (68)r	n + (69)m +	(70)m + (7	71)m + (72))m	•	
(73)m= 320.6	4 318.96	309.19	293.55	277.95	262.68	252.6	257.4	3 265.32	281.13	299.28	312.64		(73)
6. Solar gai	ins:	•		•		•		•	•				
Solar gains ar	e calculated	using sola	r flux from	Table 6a	and assoc	iated equa	itions to	convert to the	ne applicat	ole orienta	tion.		
Orientation:			Area		Flu			g_ 	_	FF		Gains	
	Table 6d		m²			ble 6a	_	Table 6b	_ '	able 6c		(W)	_
Southeast 0.9		X	3.7	74	x (36.79	x	0.63	X	0.7	=	42.06	(77)
Southeast 0.9	× 0.77	X	3.7	74	x (62.67	X	0.63	X	0.7	=	71.64	(77)
Southeast 0.9	0.77	X	3.7	74	x [35.75	x	0.63	x	0.7	=	98.01	(77)
Southeast 0.9		X	3.7	74	x 1	06.25	x	0.63	x	0.7	=	121.44	(77)
Southeast 0.9	× 0.77	X	3.7	74	x 1	19.01	x	0.63	Х	0.7	=	136.03	(77)

					_		,		_				_
Southeast 0.9x	0.77	X	3.7	' 4	X	118.15	X	0.63	X	0.7	=	135.04	(77)
Southeast 0.9x	0.77	X	3.7	7 4	X	113.91	X	0.63	X	0.7	=	130.2	(77)
Southeast 0.9x	0.77	X	3.7	74	x	104.39	X	0.63	X	0.7	=	119.32	(77)
Southeast 0.9x	0.77	X	3.7	74	x	92.85	X	0.63	X	0.7	=	106.13	(77)
Southeast 0.9x	0.77	X	3.7	7 4	x	69.27	X	0.63	x	0.7	=	79.17	(77)
Southeast 0.9x	0.77	X	3.7	74	x	44.07	x	0.63	X	0.7	=	50.37	(77)
Southeast 0.9x	0.77	X	3.7	74	x	31.49	x	0.63	x	0.7	=	35.99	(77)
Southwest _{0.9x}	0.77	X	7.0)6	x	36.79		0.63	x	0.7	=	79.39	(79)
Southwest _{0.9x}	0.77	X	7.0)6	x	62.67		0.63	x	0.7	=	135.23	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x	85.75		0.63	x	0.7	=	185.02	(79)
Southwest _{0.9x}	0.77	X	7.0)6	x	106.25]	0.63	x	0.7	=	229.25	(79)
Southwest _{0.9x}	0.77	X	7.0)6	x	119.01]	0.63	x	0.7	=	256.78	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x	118.15]	0.63	x	0.7	=	254.92	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x	113.91	Ī	0.63	×	0.7		245.77	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x	104.39	ĺ	0.63	x	0.7		225.24	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x	92.85	ĺ	0.63	x	0.7	<u> </u>	200.34	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x	69.27	ĺ	0.63	x	0.7	=	149.45	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x	44.07	ĺ	0.63	x	0.7	=	95.09	(79)
Southwest _{0.9x}	0.77	x	7.0)6	x	31.49	ĺ	0.63	×	0.7	<u> </u>	67.94	(79)
Solar gains in (83) m= 121.44 Total gains – in (84) m= 442.08	206.86 2 nternal and	283.04	350.7	392.81	389.9	m , watts	344	n = Sum(74)m . .55 306.47	(82)m 228.6	3 145.46	103.93		(83)
7. Mean internal temperature (heating season)											416.57		(84)
7. Mean inter	nal temper	rature ((heating	season	<u> </u>	4 628.58	601	.98 571.79	509.70	6 444.74	416.57		(84)
7. Mean inter	•		`)				509.7	6 444.74	416.57	21	(84)
	during hea	ating p	eriods ir	n the livi) ng are	a from Tal			509.70	6 444.74	416.57	21	
Temperature	during hea	ating p	eriods ir	n the livi) ng are	a from Tal	ole 9		509.70		416.57 Dec	21	
Temperature Utilisation fac	during heat tor for gain	ating pons	eriods ir	n the livi	ng are	a from Tal Table 9a)	ole 9	, Th1 (°C)				21	
Temperature Utilisation fac	during heat stor for gain Feb 0.97	ating pons for line Mar	eriods ir iving are Apr 0.83	n the living the hand) ng are (see Jur 0.49	a from Tal Table 9a) 1 Jul 0.35	ole 9	, Th1 (°C) ug Sep	Oct	Nov	Dec	21	(85)
Temperature Utilisation fac Jan (86)m= 0.99	during heater for gair Feb 0.97 I temperate	ating pons for line Mar	eriods ir iving are Apr 0.83	n the living the hand) ng are (see Jur 0.49	a from Tal Table 9a) 1 Jul 0.35 steps 3 to 7	ole 9	, Th1 (°C) ug Sep 88 0.59 Table 9c)	Oct	Nov 0.97	Dec	21	(85)
Temperature Utilisation factors Jan (86)m= 0.99 Mean interna (87)m= 20.19	during heater for gair Feb 0.97 I temperate 20.39	ns for li Mar 0.93 ure in l	eriods ir iving are Apr 0.83 iving are 20.85	n the livingea, h1,m May 0.67 ea T1 (for 20.96) ng are (see Jur 0.49 ollow s	a from Tal Table 9a) Jul 0.35 steps 3 to 7	ole 9 A 0.3 7 in T	s, Th1 (°C) ug Sep 88 0.59 Table 9c) 1 20.98	Oct 0.87	Nov 0.97	Dec 0.99	21	(85)
Temperature Utilisation fac Jan (86)m= 0.99 Mean interna	during heater for gair Feb 0.97 I temperate 20.39 cduring heater to the during heater to the	ns for li Mar 0.93 ure in l	eriods ir iving are Apr 0.83 iving are 20.85	n the livingea, h1,m May 0.67 ea T1 (for 20.96) ng are (see Jur 0.49 ollow s	a from Tal Table 9a) 1 Jul 1 0.35 Steps 3 to 7 21 ng from Ta	ole 9 A 0.3 7 in T	s, Th1 (°C) ug Sep 88 0.59 Table 9c) 1 20.98 9, Th2 (°C)	Oct 0.87	Nov 0.97	Dec 0.99	21	(85)
Temperature Utilisation fact Jan (86)m= 0.99 Mean interna (87)m= 20.19 Temperature (88)m= 20.07	during heater for gair Feb 0.97 l temperate 20.39 curing heater 20.07 curing heater temperate 20.07 curing heater 20.07 curing	ns for ling persons for ling man ling persons ling persons ling persons line ling persons line ling persons line ling persons line line line line line line line line	eriods ir iving are Apr 0.83 iving are 20.85 eriods ir 20.09	mathe living the hand may not only the hand) ng are i (see i Jur 0.49 cllow s 20.99 dwelli 20.1	a from Tal Table 9a) 1 Jul 1 0.35 Steps 3 to 7 2 21 Ing from Tal 20.1	ole 9 A 0.3 7 in T 2 able 9	s, Th1 (°C) ug Sep 88 0.59 Table 9c) 1 20.98 9, Th2 (°C)	Oct 0.87	Nov 0.97	Dec 0.99	21	(85) (86) (87)
Temperature Utilisation fact Jan (86)m= 0.99 Mean interna (87)m= 20.19 Temperature (88)m= 20.07 Utilisation fact	during heater for gair Feb 0.97 I temperate 20.39 2 during heater for gair eter for gair	ns for ling per ns for ling per ns for r	eriods ir iving are 0.83 iving are 20.85 eriods ir 20.09	n the living the sea, h1,mmm May 0.67 ea T1 (for 20.96 on rest of 20.09 welling,) ng are (see Jur 0.49 bllow s 20.99 dwelli 20.1	a from Tal Table 9a) 1 Jul 0.35 Steps 3 to 7 21 Ing from Tal 20.1	ole 9 A 0.3 7 in T 2 able 9 20 9a)	s, Th1 (°C) ug Sep 88 0.59 Table 9c) 1 20.98 9, Th2 (°C) .1 20.1	Oct 0.87 20.83	Nov 0.97 20.48	Dec 0.99 20.15	21	(85) (86) (87)
Temperature Utilisation factors Jan (86)m= 0.99 Mean interna (87)m= 20.19 Temperature (88)m= 20.07 Utilisation factors (89)m= 0.98	during heater for gair Feb 0.97 I temperate 20.39 20.07 20.07 20.96	ns for ling per series of the	eriods ir iving are 0.83 iving are 20.85 eriods ir 20.09 est of do	mathe living the hand may not on the living the hand may not on th) ng are (see Jur 0.49 bllow s 20.99 dwelli 20.1 h2,m (a from Tal Table 9a) 1 Jul 0.35 Steps 3 to 7 21 Ing from Tal 20.1 (see Table 0.28	Dole 9 A 0.3 7 in T 2 Able 9 9a) 0.3	s, Th1 (°C) ug Sep 88 0.59 Table 9c) 1 20.98 9, Th2 (°C) .1 20.1	Oct 0.87 20.83 20.09	Nov 0.97	Dec 0.99	21	(85) (86) (87) (88)
Temperature Utilisation fact Jan (86)m= 0.99 Mean interna (87)m= 20.19 Temperature (88)m= 20.07 Utilisation fact (89)m= 0.98 Mean interna	during heater for gair Feb 0.97 I temperate 20.39 during heater 20.07 eter for gair 0.96 I temperate	ns for li Mar 0.93 ure in l 20.62 ating per 20.08 ns for r 0.91 ure in t	eriods ir iving are 0.83 iving are 20.85 eriods ir 20.09 est of do 0.79 the rest	n the living the livin) ng are (see Jur 0.49 collow s 20.99 dwelli 20.1 h2,m (0.42 ing T2	a from Tal Table 9a) 1 Jul 0.35 steps 3 to 7 21 ng from Ta 20.1 (see Table 0.28 (follow ste	A 0.37 in T 2 2 able (20 9a) 0.3 eps 3	s, Th1 (°C) ug Sep 88 0.59 Table 9c) 1 20.98 9, Th2 (°C) 1 20.1 1 0.52 1 to 7 in Table	Oct 0.87 20.83 20.09 0.83 e 9c)	Nov 0.97 20.48 20.08	Dec 0.99 20.15 20.08	21	(85) (86) (87) (88) (89)
Temperature Utilisation factors Jan (86)m= 0.99 Mean interna (87)m= 20.19 Temperature (88)m= 20.07 Utilisation factors (89)m= 0.98	during heater for gair Feb 0.97 I temperate 20.39 during heater 20.07 eter for gair 0.96 I temperate	ns for ling per series of the	eriods ir iving are 0.83 iving are 20.85 eriods ir 20.09 est of do	mathe living the hand may not on the living the hand may not on th) ng are (see Jur 0.49 bllow s 20.99 dwelli 20.1 h2,m (a from Tal Table 9a) 1 Jul 0.35 steps 3 to 7 21 ng from Ta 20.1 (see Table 0.28 (follow ste	Dole 9 A 0.3 7 in T 2 Able 9 9a) 0.3	Sep Sep Sep Sep Sep Sep Sep Sep	Oct 0.87 20.83 20.09 0.83 e 9c) 19.92	Nov 0.97 20.48 0 20.08 0.96	Dec 0.99 20.15 20.08 0.99		(85) (86) (87) (88) (89) (90)
Temperature Utilisation fact Jan (86)m= 0.99 Mean interna (87)m= 20.19 Temperature (88)m= 20.07 Utilisation fact (89)m= 0.98 Mean interna (90)m= 19.01	during heater for gair Feb 0.97 I temperate 20.39 20.07 20.07 20.96 I temperate 19.3	ns for li Mar 0.93 ure in l 20.62 ating pe 20.08 ns for r 0.91 ure in t	eriods ir iving are 0.83 iving are 20.85 eriods ir 20.09 est of do 0.79 the rest 19.92	n the living the livin) ng are (see Jur 0.49 bllow s 20.99 dwelli 20.1 h2,m (0.42 ing T2 20.1	a from Tal Table 9a) 1 Jul 1 0.35 Steps 3 to 7 21 Ing from Ta 20.1 (see Table 0.28 (follow steps)	oble 9 A 0.3 7 in T 2 20 9a) 0.3 eps 3	s, Th1 (°C) ug Sep 88 0.59 Table 9c) 1 20.98 9, Th2 (°C) 1 20.1 81 0.52 1 to 7 in Table 1 20.08	Oct 0.87 20.83 20.09 0.83 e 9c) 19.92	Nov 0.97 20.48 20.08	Dec 0.99 20.15 20.08 0.99	0.45	(85) (86) (87) (88) (89)
Temperature Utilisation factors Jan (86)m= 0.99 Mean interna (87)m= 20.19 Temperature (88)m= 20.07 Utilisation factors (89)m= 0.98 Mean interna (90)m= 19.01 Mean interna	during heater for gair Feb 0.97 I temperate 20.39 2: ctor for gair 0.96 I temperate 19.3 I temperate 19.3	ns for li Mar 0.93 ure in l 20.62 ating por 20.08 ns for r 0.91 ure in t 19.63 ure (for	eriods ir iving are Apr 0.83 iving are 20.85 eriods ir 20.09 est of dr 0.79 the rest 19.92	n the living the part of the living the part of the pa) ng are (see Jur 0.49 Dllow s 20.99 dwelli 20.1 h2,m (0.42 ing T2 20.1	a from Tal Table 9a) 1 Jul 0.35 steps 3 to 7 2 21 ng from Ta 20.1 (see Table 0.28 (follow ste 20.1	9a) 0.3 20 + (1	g Sep 88 0.59 Table 9c) 1 20.98 9, Th2 (°C) 1 20.1 31 0.52 1 to 7 in Table 1 20.08 - fLA) × T2	Oct 0.87 20.83 20.09 0.83 e 9c) 19.92	Nov 0.97 20.48 20.08 0.96 19.43 ving area ÷ (-	Dec 0.99 20.15 20.08 0.99 18.96 4) =		(85) (86) (87) (88) (89) (90) (91)
Temperature Utilisation fact Jan (86)m= 0.99 Mean interna (87)m= 20.19 Temperature (88)m= 20.07 Utilisation fact (89)m= 0.98 Mean interna (90)m= 19.01	during heater for gair Feb 0.97 I temperate 20.39 20.07 20.07 20.96 I temperate 19.3 I temperate 19.79 20.79	ns for li Mar 0.93 ure in l 20.62 ating pe 20.08 ns for r 0.91 ure in t 19.63 ure (for	eriods ir iving are Apr 0.83 iving are 20.85 eriods ir 20.09 est of do 0.79 the rest 19.92 r the wh 20.34	n the living the harmonic the living the harmonic the har) ng are (see Jur 0.49 bllow s 20.99 dwelli 20.1 h2,m (0.42 ing T2 20.1	a from Tal Table 9a) 1 Jul 0.35 Steps 3 to 7 21 Ing from Ta 20.1 (see Table 0.28 (follow steps 20.1) = fLA × T1 20.5	pole 9 A 0.3 7 in T 2 20 9a) 0.3 eps 3 20 + (1 20	Sep Sep Sep Sep Sep Sep Sep Sep	Oct 0.87 20.83 20.09 0.83 e 9c) 19.92 LA = Liv	Nov 0.97 20.48 20.08 0.96 19.43 ving area ÷ (-	Dec 0.99 20.15 20.08 0.99		(85) (86) (87) (88) (89) (90)

ı							1	,					ı	
(93)m=	19.54	19.79	20.07	20.34	20.46	20.5	20.5	20.5	20.49	20.33	19.9	19.5		(93)
			uirement											
			ernal ter or gains			ed at ste	ep 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	culate	
ine ui	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
l Utilisa			ains, hm		iviay	Juli	Jui	L	Seb	Oct	INOV	Dec		
(94)m=	0.98	0.96	0.91	0.8	0.64	0.45	0.31	0.34	0.55	0.84	0.96	0.99		(94)
L	l gains.	hmGm .	, W = (9 ²	1)m x (84	4)m		<u> </u>		l		<u> </u>			
(95)m=	434.3	504.39	539.04	518.16	429.72	294.47	195.83	205.31	316.88	426.63	427.26	410.95		(95)
เ Month	nly avera	age exte	rnal tem	perature	from Ta	able 8		<u> </u>	l		<u> </u>	<u> </u>	l	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat I	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]			l	
(97)m=	792.94	772.33	702.04	583.18	445.5	296.24	196	205.6	322.37	494.77	654.51	786.51		(97)
Space	e heating	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=	266.83	180.05	121.27	46.81	11.74	0	0	0	0	50.69	163.62	279.42		
_			_				-	Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	1120.45	(98)
Space	e heating	g require	ement in	kWh/m²	/year								21.88	(99)
		•				veteme i	ncluding	micro-C	'HDI					
	e heatir		ito — iriui	Mudai II	calling s	ysterns i	ricidaling	i illiolo-c) II <i>)</i>					
•		•	t from s	econdar	y/supple	mentary	system						0	(201)
Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) (202) = 1 - (201) =									1	(202)				
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$									1] (204)				
Tradition of total freating from from the species of the species o										╡				
Efficiency of main space heating system 1										93.5	(206)			
Efficiency of secondary/supplementary heating system, %										0	(208)			
_ [Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space		•	· `		d above)							l	I	
Į	266.83	180.05	121.27	46.81	11.74	0	0	0	0	50.69	163.62	279.42		
(211)m		,	4)] } x 1				1	1			ı		ı	(211)
	285.38	192.57	129.7	50.07	12.55	0	0	0	0	54.22	175	298.84		,
								Tota	ıl (kWh/yea	ar) =Sum(2	211) _{15,1012}	F	1198.34	(211)
•		•	econdar	• •	month									
			00 ÷ (20					Ι .			Ι ,		ı	
(215)m=	0	0	0	0	0	0	0	O Tota	0 II (kWh/yea	0	0	0		7(045)
								1018	ıı (Kvvri/yea	ar) =Surri(2	213) _{15,1012}	F	0	(215)
	heating		to = (oolo	ام امداداد	(میره									
Output	169.25	149.36	ter (calc 157.29	141.6	139.2	125	120.64	131.57	131.08	146.8	154.48	165.38		
Efficier		ater hea		111.0	100.2	120	120.01	101.07	101.00	1 10.0	101.10	100.00	79.8	(216)
(217)m=		85.31	84.13	82.22	80.54	79.8	79.8	79.8	79.8	82.3	84.97	86.2	7 3.0	(217)
L			kWh/mo		50.04	1 . 0.0	L . 0.0	L . 0.0	I . 0.0	JZ.0	1 54.07	1 30.2		()
		0.) ÷ (217)											
(219)m=		175.07	186.96	172.23	172.83	156.64	151.18	164.87	164.26	178.38	181.81	191.85		
•								Tota	I = Sum(2	19a) ₁₁₂ =			2092.84	(219)
	l totals									k'	Wh/year	•	kWh/year	- -
Space heating fuel used, main system 1									1198.34]				
												!		_

					_
Water heating fuel used	2092.84				
Electricity for pumps, fans and electric keep-hot					
central heating pump:			30		(230c)
boiler with a fan-assisted flue		(230e)			
Total electricity for the above, kWh/year	sum of (230		75	(231)	
Electricity for lighting				237.36	(232)
12a. CO2 emissions – Individual heating system	s including micro-CHP				
	Energy kWh/year	Emission fac kg CO2/kWh	ctor	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x	0.216	=	258.84	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	452.05	(264)
Space and water heating	(261) + (262) + (263) + (264) =			710.9	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	123.19	(268)
Total CO2, kg/year	sun	n of (265)(271) =		873.01	(272)

TER =

(273)

17.05