### **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 14:54:43

Project Information:

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

Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 70.86m<sup>2</sup> Plot Reference: Site Reference : Hermitage Lane Plot 20

Address:

Client Details:

Name: Address:

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)

Fuel factor: 1.00 (mains gas (c))

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

Dwelling Carbon Dioxide Emission Rate (DER) 11.62 kg/m<sup>2</sup> OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.1 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 41.0 kWh/m<sup>2</sup>

OK 2 Fabric U-values

**Element Average** 

**Highest** 0.15 (max. 0.70) External wall 0.14 (max. 0.30) OK Floor 0.12 (max. 0.25) 0.12 (max. 0.70) OK

Roof (no roof)

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

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

# **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):	Slight	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	6.1m²	
Windows facing: North West	5.11m²	
Ventilation rate:	6.00	
10 Key features		
Air permeablility	3.0 m³/m²h	
External Walls U-value	0.13 W/m <sup>2</sup> K	
Floors U-value	0.12 W/m <sup>2</sup> K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		
•		

		Llea	Details:						
A consequently and	Zabid Aabaaf	USE		- N			OTDO	004000	
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	•	Strom Softwa					001082 on: 1.0.5.9	
Software Name.	Ottoma i OAI 2012		ty Address				VCISIO	ni. 1.0.3.3	
Address :		·	,						
1. Overall dwelling dime	ensions:								
Ground floor		A	rea(m²)	(4.5)		ight(m)	7(0-)	Volume(m <sup>3</sup>	<u>-</u>
	\	(4 ) <u> </u>		(1a) x	2	2.5	(2a) =	177.14	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)-	+(1n)	70.86	(4)					_
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	177.14	(5)
2. Ventilation rate:	main sec	condary	other		total			m³ per hou	r
N. selven of all leaves a	heating he	ating		, –			40 I		_
Number of chimneys	0 +	0 +	0	] = [	0		40 =	0	(6a)
Number of open flues	0 +	0 +	0	] = [	0		20 =	0	(6b)
Number of intermittent fa				L	0	X '	10 =	0	(7a)
Number of passive vents	3			L	0	X '	10 =	0	(7b)
Number of flueless gas fi	ires				0	X 4	40 =	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimne	vs_flues and fans = (6a)	)+(6b)+(7a)+(7b	)+(7c) =	Г	0		÷ (5) =	0	(8)
	peen carried out or is intended			ontinue fr			- (0) =	0	
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timber fra resent, use the value correspond			•	uction			0	(11)
deducting areas of openi		onding to the gr	eater wall are	a (aner					
If suspended wooden	floor, enter 0.2 (unseale	d) or 0.1 (sea	aled), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
· ·	s and doors draught stri	pped						0	(14)
Window infiltration			0.25 - [0.2					0	(15)
Infiltration rate			(8) + (10)					0	(16)
•	q50, expressed in cubic	•	•	•	etre of e	envelope	area	3	(17)
If based on air permeabil	es if a pressurisation test has $k$				is heina u	sad .		0.15	(18)
Number of sides sheltere		occir done or a	acgree an pe	meability	is being a	Sca	1	2	(19)
Shelter factor			(20) = 1 -	0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporate	ting shelter factor		(21) = (18	x (20) =				0.13	(21)
Infiltration rate modified f	for 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 ∸ 4								
	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		
					<u> </u>			J	

	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m		ı			
0.16 Calculate effe	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
If mechanic		•	ale for t	пе аррп	cable ca	30					Г	0.5	(23a
If exhaust air h	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	wise (23b	) = (23a)		Ī	0.5	(23b
If balanced wit	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (from	n Table 4h	) =			-	79.05	(230
a) If balance	ed mech	anical ve	ntilation	with hea	at recove	ery (MVI	HR) (24a	ı)m = (22	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
(24a)m= 0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25		(24a
b) If balance	ed mech	anical ve	ntilation	without	heat rec	overy (N	ЛV) (24b	)m = (22	2b)m + (	23b)	-		
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b
c) If whole h if (22b)r				•	ve input vo); otherv				5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
d) If natural if (22b)r				•	ve input verwise (2				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
Effective air	change	rate - er	iter (24a	) or (24b	o) or (24	c) or (24	d) in box	(25)		-			
(25)m= 0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25		(25)
3. Heat losse	s and he	eat loss r	paramete	er:									
ELEMENT	Gros		Openin		Net Ar	ea	U-valı	re	AXU		k-value	Α	Χk
	area	(m²)	· m		A ,r	n²	W/m2	K	(W/I	K)	kJ/m²-k	( kJ	/K
Doors					2	Х	1.4	=	2.8				(26)
Windows Type	<del>2</del> 1				6.097	x1,	/[1/( 1.4 )+	0.04] =	8.08				(27)
Windows Type	2				5.107	x1,	/[1/( 1.4 )+	0.04] =	6.77				(27)
Floor					49.41	3 X	0.12	=	5.92956	6			(28)
Walls Type1	35.7	<b>7</b> 2	11.2		24.51	X	0.15	=	3.68				(29)
Walls Type2	11.	7	2		9.7	X	0.14	= [	1.37				(29)
Walls Type3	16.7	<b>'</b> 6	0		16.76	X	0.13	= [	2.22				(29)
Total area of e	elements	, m²			113.6	5							(31)
* for windows and						ated using	formula 1	/[(1/U-valu	re)+0.04] a	as given in	paragraph	3.2	
** include the are. Fabric heat los				is and pari	titions		(26)(30)	+ (32) =			Г	20.05	(33)
Heat capacity		•	0)				(20)(00)	` '	(30) ± (3)	2) + (32a).	(32e) - [	30.85	=
Thermal mass		,	P – Cm -	- TFΔ) ir	n k.l/m²K			** /	tive Value	, , ,	(020) =	4419.71	(34)
For design asses	•	•		•			ecisely the				L able 1f	100	(55)
can be used inste						,	,						
Thermal bridg	es : S (L	x Y) cal	culated i	using Ap	pendix ł	<						13.79	(36)
if details of therma Total fabric he		are not kn	own (36) =	= 0.05 x (3	1)			(33) +	(36) =			44.64	(37)
Ventilation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (	25)m x (5)	)		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 15.63	15.44	15.25	14.32	14.14	13.2	13.2	13.02	13.58	14.14	14.51	14.88		(38)
								(2.2)	(0=)				
Heat transfer	coefficie	nt, VV/K						(39)m	= (37) + (37)	38)m			
Heat transfer (39)m= 60.27	60.08	59.9	58.96	58.78	57.85	57.85	57.66	(39)m 58.22	58.78	59.15	59.52		

Heat lo	ss para	meter (H	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m=	0.85	0.85	0.85	0.83	0.83	0.82	0.82	0.81	0.82	0.83	0.83	0.84		
'										Average =	Sum(40) <sub>1</sub>	12 /12=	0.83	(40)
Numbe	er of day		nth (Tab	le 1a)			·		ı					
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ing enei	rgy requi	rement:								kWh/ye	ar:	
if TF.	ed occu A > 13.9 A £ 13.9	N = 1	N + 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (¯	TFA -13		27		(42)
Reduce	the annua	l average	ater usag hot water person per	usage by	5% if the a	lwelling is	designed t			se target c		.67		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea		,			,	·'	!				
(44)m=	101.93	98.23	94.52	90.81	87.11	83.4	83.4	87.11	90.81	94.52	98.23	101.93		
										Total = Su	m(44) <sub>112</sub> =	=	1112.02	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x D	Tm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		<u></u>
(45)m=	151.17	132.21	136.43	118.94	114.13	98.48	91.26	104.72	105.97	123.5	134.81	146.4		
If instant	tanaaya w	atar baati	na ot noint	of upo (no	, hat water	, ataragal	antar O in	havaa (16		Total = Su	m(45) <sub>112</sub> =	-	1458.03	(45)
ı			ng at point I	,		,.	·	` ′	, , , <del>-</del>	1	ı	1		(10)
(46)m= Water	22.67 storage	19.83	20.46	17.84	17.12	14.77	13.69	15.71	15.9	18.53	20.22	21.96		(46)
	_		includin	ia anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
_		, ,	nd no ta				_							• •
	•	_	hot wate		_			` '	ers) ente	er '0' in (	(47)			
	storage													
a) If m	anufact	urer's de	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Tempe	erature fa	actor fro	m Table	2b								0		(49)
٠.			storage					(48) x (49)	) =		1	10		(50)
•			eclared of factor fr	-								02		(51)
		-	ee secti		C 2 (KVV)	ii/iiti C/GC	·y /				0.	02		(31)
	e factor	_									1.	03		(52)
Tempe	rature fa	actor fro	m Table	2b							0	.6		(53)
Energy	lost fro	m water	storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter	(50) or (	54) in (5	55)								1.	03		(55)
Water	storage	loss cal	culated f	or each	month			((56)m = (	(55) × (41)	m				
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinde	er contains	dedicate	d solar sto	rage, (57)ı	n = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	хН	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Priman	v circuit	loss (ar	nual) fro	m Tahla	. 3		•		•	•		0		(58)
	•	`	culated f			59)m = (	(58) ÷ 36	55 × (41)	ım					` '
•	•		rom Tab		•	•	. ,	, ,		r thermo	stat)			
	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)

Combilees	ام مغمار بمام	fo., o.o.b		(C4)	(00) . 0	CF (44)	١						
Combi loss of (61)m= 0	alculated	or each	montn (	61)m =	(60) ÷ 30	05 × (41)	)m   0	0	0	0	0	1	(61)
		<u> </u>					<u> </u>	Ļ	<u> </u>	ļ.		(F0)m + (61)m	(01)
(62)m= 206.4	<del></del>	191.71	172.44	169.41	151.98	146.54	160	159.47	178.78	188.31	201.67	(59)m + (61)m	(62)
Solar DHW inpu						<u> </u>		1		<u> </u>		l	(02)
(add addition									ii contribu	ion to wate	or ricating)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from	uwater hea	ter					<u>I</u>					ı	
(64)m= 206.4		191.71	172.44	169.41	151.98	146.54	160	159.47	178.78	188.31	201.67		
		<u> </u>				<u>!</u>	Ou	put from w	ater heate	r (annual)₁	12	2108.87	(64)
Heat gains fi	om water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)ı	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	 . ]	-
(65)m= 94.48	1	89.58	82.34	82.17	75.54	74.57	79.04	78.03	85.29	87.62	92.9	ĺ	(65)
include (5	7)m in cald	culation o	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is f	rom com	munity h	ı neating	
5. Internal	<u> </u>			•	•						,		
Metabolic ga													
Jan	T ,	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m= 113.3	4 113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34		(66)
Lighting gair	s (calcula	ted in Ap	pendix	L, equati	on L9 o	r L9a), a	lso see	Table 5	•	•	•	•	
(67)m= 18.58	16.5	13.42	10.16	7.59	6.41	6.93	9.01	12.09	15.35	17.91	19.1	]	(67)
Appliances of	jains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5				
(68)m= 199.2	9 201.35	196.14	185.05	171.05	157.88	149.09	147.02	152.23	163.33	177.33	190.49		(68)
Cooking gair	ns (calcula	ted in Ap	pendix	L, equat	ion L15	or L15a	), also s	ee Table	5				
(69)m= 34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33		(69)
Pumps and f	ans gains	(Table 5	ia)										
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses e.g.	evaporatio	n (negat	ive valu	es) (Tab	le 5)							-	
(71)m= -90.6	7 -90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67		(71)
Water heatin	g gains (T	able 5)											
(72)m= 127	124.85	120.41	114.37	110.44	104.92	100.22	106.24	108.38	114.63	121.69	124.86		(72)
Total intern	al gains =	1			(66)	)m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	'1)m + (72)	)m		
(73)m= 401.8	6 399.71	386.97	366.58	346.08	326.21	313.24	319.27	329.7	350.31	373.94	391.45		(73)
6. Solar gai	ns:												
Solar gains are		•				•	itions to c	onvert to th	ne applical		tion.		
Orientation:	Access F Table 6d		Area m²		Flu Tal	ıx ble 6a	-	g_ Fable 6b	т	FF able 6c		Gains (W)	
0									_			` '	1
Southeast 0.9		X	6.	==		36.79	X	0.63		0.7	=	68.56	(77)
Southeast 0.9		X	6.			62.67	X	0.63		0.7	_ =	116.78	](77) ]
Southeast 0.9	<u> </u>	X	6.			35.75	X	0.63	×	0.7	=	159.78	](77) ](77)
Southeast 0.9		X	6.	==		06.25	X	0.63		0.7	=	197.98	[(77)
Southeast 0.9	0.77	X	6.	1	X 1	19.01	X	0.63	X	0.7	=	221.76	(77)

-		_					_						_
Southeast <sub>0.9x</sub>	0.77	X	6.	1	<b>x</b>	118.15	X	0.63	X	0.7	=	220.15	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.	1	X	113.91	X	0.63	X	0.7	=	212.25	(77)
Southeast 0.9x	0.77	X	6.	1	X	104.39	X	0.63	X	0.7	=	194.51	(77)
Southeast 0.9x	0.77	x	6.	1	x	92.85	X	0.63	X	0.7	=	173.01	(77)
Southeast <sub>0.9x</sub>	0.77	x	6.	1	x	69.27	X	0.63	x	0.7	=	129.07	(77)
Southeast <sub>0.9x</sub>	0.77	x	6.	1	x	44.07	X	0.63	х	0.7	=	82.12	(77)
Southeast 0.9x	0.77	x	6.	1	x	31.49	X	0.63	х	0.7	=	58.67	(77)
Northwest <sub>0.9x</sub>	0.77	×	5.1	1	x	11.28	x	0.63	x	0.7	_ =	17.61	(81)
Northwest <sub>0.9x</sub>	0.77	x	5.1	1	x	22.97	x	0.63	x	0.7	=	35.85	(81)
Northwest 0.9x	0.77	×	5.1	1	x	41.38	x	0.63	x	0.7	=	64.58	(81)
Northwest 0.9x	0.77	×	5.1	1	x	67.96	X	0.63	x	0.7	=	106.06	(81)
Northwest 0.9x	0.77	×	5.1	1	x	91.35	jx	0.63	x	0.7		142.57	(81)
Northwest <sub>0.9x</sub>	0.77	= x	5.1	1	x	97.38	j x	0.63	×	0.7	<del>-</del>	151.99	(81)
Northwest 0.9x	0.77	×	5.1	1	x	91.1	X	0.63	×	0.7	<del>=</del> =	142.19	(81)
Northwest <sub>0.9x</sub>	0.77	×	5.1	1	x	72.63	X	0.63	×	0.7	<del>-</del>	113.35	(81)
Northwest <sub>0.9x</sub>	0.77	= x	5.1	1	x	50.42	X	0.63	×	0.7	=	78.69	(81)
Northwest <sub>0.9x</sub>	0.77	×	5.1	1	x	28.07	X	0.63	×	0.7	=	43.81	(81)
Northwest 0.9x	0.77	×	5.1	1	x	14.2	X	0.63	×	0.7	=	22.16	(81)
Northwest <sub>0.9x</sub>	0.77	= x	5.1	1	x	9.21	X	0.63	×	0.7	=	14.38	(81)
_		_		· ·			_						
Solar gains in	watts calcu	ılated	for eacl	h month	ı		(83)m	n = Sum(74)m	(82)m				
(83)m= 86.17		24.37	304.04	364.32	372.15	354.44	307	<del></del>	172.8		73.05	]	(83)
Total gains – i	nternal and	solar	(84)m =	= (73)m	+ (83)r	n , watts	1	I	!			J	
(84)m= 488.03	552.34 61	11.34	670.62	710.41	698.36	667.68	627	.13 581.41	523.18	8 478.21	464.51	]	(84)
7. Mean inter	nal tempera	ature (	heating	season	1)					•	•		
Temperature	· · · · · · · · · · · · · · · · · · ·				<i>′</i>	a from Ta	ble 9.	. Th1 (°C)				21	(85)
Utilisation fac	•	•			_			, , ,					`
Jan	<del></del>	Mar	Apr	May	Jun	<del>– –</del>	Α	ug Sep	Oct	Nov	Dec	]	
(86)m= 0.95	<del>                                     </del>	).87	0.79	0.66	0.5	0.37	0.4	<del></del>	0.82	0.92	0.95		(86)
Mean interna	l temperatu	ra in l	iving ar	 22 T1 /f/	ollow e	tone 3 to	Tin T	ahle 9c)	<u>!</u>		!	J	
(87)m= 19.47	<del> </del>	0.06	20.47	20.77	20.93	-i	20.		20.48	19.92	19.42	]	(87)
` ′	ļ							I		1		J	, ,
Temperature			eriods ir 20.23	20.23	20.24	<del>-</del>	1	<del></del>	1 20 22	20.22	20.22	1	(88)
(88)m= 20.21	ļ	0.21			!		20.	24 20.23	20.23	20.22	20.22		(00)
Utilisation fac							T					1	<b></b> \
(89)m= 0.94	0.91 0	0.86	0.76	0.62	0.45	0.31	0.3	0.56	0.79	0.91	0.95		(89)
Mean interna	l temperatu	re in t	he rest	of dwell	ing T2	(follow ste	eps 3	to 7 in Tab	le 9c)		_	_	
(90)m= 18.15	18.49 18	8.99	19.57	19.97	20.18	20.23	20.	22 20.1	19.6	18.8	18.09		(90)
									fLA = Liv	/ing area ÷ (	4) =	0.41	(91)
Maan intorna													
wean interna	I temperatu	re (foi	r the wh	ole dwe	lling) =	$fLA \times T1$	+ (1	$- fLA) \times T2$					
(92)m= 18.69		re (foi 9.43	r the wh 19.95	ole dwe 20.3	lling) = 20.49	1	+ (1	<del></del>	19.97	19.27	18.64	]	(92)
	19 19	9.43	19.95	20.3	20.49	20.54	20.	53 20.42	19.97		18.64	]	(92)

(20)	¬ ,	(93)
(93)m= 18.69 19 19.43 19.95 20.3 20.49 20.54 20.53 20.42 19.97 19.27 18.64 8. Space heating requirement		(93)
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-ca	lculate	
the utilisation factor for gains using Table 9a	_	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Utilisation factor for gains, hm:	<b>¬</b>	
(94)m= 0.92 0.89 0.84 0.75 0.62 0.46 0.33 0.37 0.57 0.78 0.89 0.93		(94)
Useful gains, hmGm , W = (94)m x (84)m	٦ ,	(OE)
(95)m= 450.29 493.18 515.13 504.37 441.98 323.19 223.31 232.01 332.29 409.54 425.8 432.4		(95)
Monthly average external temperature from Table 8  (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2	7 (	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]		(00)
(97)m= 867.52 846.92 774.74 651.36 505.64 340.73 227.82 238.32 367.81 550.5 719.56 859.8	7	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m		
(98)m= 310.41 237.71 193.14 105.83 47.36 0 0 0 104.87 211.51 317.98		
Total per year (kWh/year) = Sum(98) <sub>15,912</sub>	= 1528.82	(98)
Space heating requirement in kWh/m²/year	21.58	(99)
9b. Energy requirements – Community heating scheme		
This part is used for space heating, space cooling or water heating provided by a community scheme.		
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system $1 - (301) =$	1 (	(302)
The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources,	the latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C. Fraction of heat from Community boilers	1 (	(303a)
Fraction of total space heat from Community boilers (302) x (303a) =		(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		(305)
Distribution loss factor (Table 12c) for community heating system		(306)
Space heating	kWh/year	,
Annual space heating requirement	1528.82	
Space heat from Community boilers (98) x (304a) x (305) x (306) =	1605.27	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) =	0	(309)
Water heating		
Annual water heating requirement	2108.87	
If DHW from community scheme:		(240-)
Water heat from Community boilers (64) x (303a) x (305) x (306) =		(310a)
Electricity used for heat distribution 0.01 × [(307a)(307e) + (310a)(310e)] =		(313)
Cooling System Energy Efficiency Ratio		(314)
Space cooling (if there is a fixed cooling system, if not enter 0) = $(107) \div (314) =$	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside	245.83	(330a)
and the second s	2.5.55	. ,

					_
warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(33	80a) + (330b) + (330g) =		245.83	(331)
Energy for lighting (calculated in Appendix I	-)		Γ	328.11	(332)
Electricity generated by PVs (Appendix M)	(negative quantity)		F	-716.31	(333)
Electricity generated by wind turbine (Appel	ndix M) (negative quantity)			0	(334)
12b. CO2 Emissions – Community heating	scheme				
	Energy kWh/ye			missions g CO2/year	
CO2 from other sources of space and water Efficiency of heat source 1 (%)	r heating (not CHP)  If there is CHP using two fuels repe	eat (363) to (366) for the sec	ond fuel	94	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷	(367b) x 0.22	=	877.69	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	19.82	(372)
Total CO2 associated with community system	ems (363)(366) +	(368)(372)	=	897.51	(373)
CO2 associated with space heating (second	dary) (309) x	0	=	0	(374)
CO2 associated with water from immersion	heater or instantaneous heater	(312) x 0.22	=	0	(375)
Total CO2 associated with space and water	heating (373) + (374) +	(375) =		897.51	(376)
CO2 associated with electricity for pumps a	nd fans within dwelling (331)) x	0.52	=	127.58	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	170.29	(379)
Energy saving/generation technologies (333 Item 1	3) to (334) as applicable	0.52 ×	0.01 =	-371.77	(380)
Total CO2, kg/year	n of (376)(382) =	<del></del>	Γ	823.62	(383)
Dwelling CO2 Emission Rate (38	3) ÷ (4) =			11.62	(384)

El rating (section 14)

90.47

### **SAP 2012 Overheating Assessment**

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

### Property Details: Plot 20

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: Yes
Number of storeys: 1

Front of dwelling faces: South West

Overshading: Average or unknown

Overhangs: None

Thermal mass parameter: Indicative Value Low

**Night ventilation:** False

Blinds, curtains, shutters:

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

### Overheating Details

Summer ventilation heat loss coefficient: 350.74 (P1)

Transmission heat loss coefficient: 44.6

Summer heat loss coefficient: 395.38 (P2)

### Overhangs:

Orientation:	Ratio:	Z_overhangs:
Orientation:	Ratio:	Z_overhangs

South East (SE) 0 1 North West (NW) 0 1

### Solar shading:

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

### Solar gains:

Orientation		Area	Flux	<b>g</b> _	FF	Shading	Gains
South East (SE)	0.9 x	6.1	119.92	0.63	0.7	0.9	261.18
North West (NW)	0.9 x	5.11	98.85	0.63	0.7	0.9	180.32
						Total	441.5 <b>(P3/P4)</b>

### Internal gains:

	June	July	August
Internal gains	452.8	436.27	444.39
Total summer gains	921.64	877.77	835.56 <b>(P5)</b>
Summer gain/loss ratio	2.33	2.22	2.11 <b>(P6)</b>
Mean summer external temperature (Thames valley)	16	17.9	17.8
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	19.63	21.42	21.21 <b>(P7)</b>
Likelihood of high internal temperature	Not significant	Slight	Slight

Assessment of likelihood of high internal temperature: Slight

			S						
		User L	Details:						
Assessor Name:	Zahid Ashraf			a Num				0001082	
Software Name:	Stroma FSAP 2012	Property	Address	are Ve			versic	on: 1.0.5.9	
Address :	'	Toperty	Address	. 1 101 20					
1. Overall dwelling dime	nsions:								
		Are	a(m²)		Av. He	ight(m)	-	Volume(m³	)
Ground floor			70.86	(1a) x		2.5	(2a) =	177.14	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	70.86	(4)					
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	177.14	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	r
Number of chimneys	0 + 0	_ + [	0	_ = [	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	<b>-</b> + -	0	Ī = [	0	x 2	20 =	0	(6b)
Number of intermittent fa	ns				3	x -	10 =	30	(7a)
Number of passive vents				Ī	0	x	10 =	0	(7b)
Number of flueless gas fi	res			F	0	x 4	40 =	0	(7c)
				L					
							Air ch	nanges per ho	ur
•	ys, flues and fans = $(6a)+(6b)+($				30		÷ (5) =	0.17	(8)
If a pressurisation test has b  Number of storeys in the	een carried out or is intended, procee	ed to (17),	otherwise	continue fi	rom (9) to	(16)		0	(9)
Additional infiltration	ic dwelling (113)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r mason	ry consti	ruction			0	(11)
• • • • • • • • • • • • • • • • • • • •	resent, use the value corresponding t	o the grea	ter wall are	ea (after					_
deducting areas of openir  If suspended wooden f	igs <i>), ii equal user 0.</i> 33 iloor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	,	`	,.					0	(13)
Percentage of windows	s and doors draught stripped							0	(14)
Window infiltration				2 x (14) ÷ 1				0	(15)
Infiltration rate	.50			+ (11) + (	, , ,	, ,		0	(16)
•	q50, expressed in cubic metro ity value, then $(18) = [(17) \div 20] + (18)$	•	•	•	etre of e	envelope	area	3	(17)
•	s if a pressurisation test has been do				is being u	sed		0.32	(18)
Number of sides sheltere	d							2	(19)
Shelter factor				[0.075 x (	19)] =			0.85	(20)
Infiltration rate incorporat	_		(21) = (18	3) x (20) =				0.27	(21)
Infiltration rate modified for	<del></del>	Jul	Διια	Son	Oct	Nov	Doo	1	
L I		Jui	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp (22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7	1	
, , [ ] ,	1 1 1		1	<u> </u>	L		<u> </u>	J	
Wind Factor (22a)m = (22	<del></del>							1	
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18	]	

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.35	0.34	0.33	0.3	0.29	0.26	0.26	0.25	0.27	0.29	0.31	0.32		
Calculate effect If mechanica		_	ate for t	пе арріі	саріе са	se						0	(23a)
If exhaust air he	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b	) = (23a)			0	(23b)
If balanced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (from	n Table 4h	) =				0	(23c)
a) If balance	ed mech	anical ve	ntilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (22)	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balance	d mech	anical ve	ntilation	without	heat rec	covery (N	ЛV) (24b	)m = (22	2b)m + (	23b)		-	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h if (22b)n				•	-				5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural if (22b)n									0.5]				
(24d)m= 0.56	0.56	0.56	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(24d)
Effective air	change	rate - er	iter (24a	) or (24b	o) or (24	c) or (24	d) in box	(25)				-	
(25)m= 0.56	0.56	0.56	0.54	0.54	0.53	0.53	0.53	0.54	0.54	0.55	0.55		(25)
3. Heat losse	s and he	eat loss p	paramete	er:									
ELEMENT	Gros		Openin		Net Ar		U-val		AXU		k-value		ΑΧk
Danie	area	(m²)	m	l <sup>2</sup>	A ,r	_	W/m2	K r	(W/I	K)	kJ/m²-l	K I	kJ/K
Doors	4				2	×	1.4	= [	2.8	4			(26)
Windows Type					6.097	=	/[1/( 1.4 )+	L	8.08	=			(27)
Windows Type	2				5.107	=	/[1/( 1.4 )+	0.04] = [	6.77	ᆗ ,			(27)
Floor					49.41	=	0.12	=	5.92956			┥	(28)
Walls Type1	35.7	72	11.2		24.51	X	0.15	=	3.68	닠 !		╡	(29)
Walls Type2	11.		2	_	9.7	×	0.14	=	1.37	닠 !		╡	(29)
Walls Type3	16.7		0		16.76	×	0.13	= [	2.22				(29)
Total area of e					113.6		. (	/F/4/11	) 0.041				(31)
* for windows and  ** include the area						atea using	rormula 1	/[(1/U-vaiu	ie)+0.04] a	is given in	paragrapn	1 3.2	
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				30.85	(33)
Heat capacity	Cm = S	(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	4419.71	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For design assess can be used inste				construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridge	es : S (L	x Y) cal	culated ı	using Ap	pendix ł	<						13.79	(36)
if details of therma Total fabric he		are not kn	own (36) =	= 0.05 x (3	1)			(33) +	(36) =			44.64	(37)
Ventilation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × (	25)m x (5)	)		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 32.73	32.59	32.46	31.83	31.72	31.17	31.17	31.07	31.38	31.72	31.95	32.2		(38)
Heat transfer of	coefficie	nt, W/K						(39)m	= (37) + (	38)m		-	
(39)m= 77.37	77.24	77.1	76.48	76.36	75.81	75.81	75.71	76.02	76.36	76.6	76.84		<del></del>
								1	Average =	Sum(39) <sub>1</sub>	12 /12=	76.48	(39)

Heat loss para	meter (l	HLP). W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.09	1.09	1.09	1.08	1.08	1.07	1.07	1.07	1.07	1.08	1.08	1.08		
( )									<u> </u>	Sum(40) <sub>1</sub> .		1.08	(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)
						<u> </u>							
A Materia	•										130/1./		
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 ( <sup>-</sup>	ΓFA -13		27		(42)
Annual averag Reduce the annua not more that 125	ıl average	hot water	usage by	5% if the a	lwelling is	designed t			se target c		.67		(43)
								_					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from	able 1c x	(43)		•				
(44)m= 101.93	98.23	94.52	90.81	87.11	83.4	83.4	87.11	90.81	94.52	98.23	101.93		_
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	m x nm x D	)Tm / 3600			ım(44) <sub>112</sub> = ables 1b, 1		1112.02	(44)
(45)m= 151.17	132.21	136.43	118.94	114.13	98.48	91.26	104.72	105.97	123.5	134.81	146.4		
						ı		-	Total = Su	ım(45) <sub>112</sub> =		1458.03	(45)
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46 <sub>)</sub>	) to (61)			•		_
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage	loss:					<u>!</u>			<u>I</u>				
Storage volum	e (litres)	) includin	ig 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	velling, e	nter 110	litres in	(47)						
Otherwise if no		hot wate	er (this in	ıcludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage					(1.) A (1	<i>(</i> 1							
a) If manufact				or is kno	wn (KVVI	n/day):					0		(48)
Temperature fa	actor fro	m Table	2b								0		(49)
Energy lost fro		_	-				(48) x (49)	) =			0		(50)
b) If manufact			-										(= A)
Hot water stora If community h	-			e z (KVVI	n/iitre/aa	ıy)					0		(51)
Volume factor	•		JII 4.3										(52)
Temperature fa			2b							_	0		(53)
Energy lost fro				oor			(47) x (51)	V (52) V (	52) _				
Enter (50) or (		•	, KVVII/yt	zai			(47) X (31)	/ X (32) X (	33) =	-	0		(54) (55)
` ' '		,	or oach	month			((E6)m - (	EE\ (41\)	<b>~</b>		0		(33)
Water storage	1055 Cai	culateu i	or each	HIOHUI			((56)m = (	55) x (41)i	· · · · · · · · · · · · · · · · · · ·				
(56)m= 0  If cylinder contains	0 dedicate	0 d solar sto	0 rage, (57)ı	0 m = (56)m	0 x [(50) – (	0 H11)] ÷ (5	0 0), else (5	0 7)m = (56)	0 m where (	0 (H11) is fro	0 m Append	ix H	(56)
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nnual) fro	m Table	3							0		(58)
Primary circuit	loss cal	culated f	or each	month (	•	. ,	, ,		r thermo	etat)			
(modified by						i			i	<del>-                                    </del>			(EO)
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combis loss calculated for each month (61)m = (60) + 365 x (41)m (61)m    (61)m    0
Total heat required for water heating calculated for each month (62)m = 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m (62)m (62
Column   128.49   112.38   115.97   101.1   97.01   83.71   77.57   89.01   90.08   104.98   114.59   124.44   (62)
Colar DHW linput calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G)
(add additional lines if FGHRS and/or WHRS applies, see Appendix G)  (63)ms  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Cotyput from water heater  (64)me   128.49   112.38   115.97   101.1   97.01   83.71   77.57   89.01   90.08   104.98   114.59   124.44      128.49   112.38   115.97   101.1   97.01   83.71   77.57   89.01   90.08   104.98   114.59   124.44     128.49   112.38   115.97   101.1   97.01   83.71   77.57   89.01   90.08   104.98   114.59   124.44     128.49   112.38   115.97   101.1   97.01   83.71   77.57   89.01   90.08   104.98   114.59   124.44     128.49   112.38   115.97   101.1   97.01   83.71   77.57   89.01   90.08   104.98   114.59   124.44     128.49   128.49   128.49   128.49   128.33   (64)     128.59   128.49   128.49   128.49   128.33   (64)     128.50   128.50   128.50   128.50   128.33   (64)     128.50   128.50   128.50   128.50   128.50   128.33   (64)     128.50   128.
Output from water heater  (64)m=   128.49   112.38   115.97   101.1   97.01   83.71   77.57   89.01   90.08   104.98   114.59   124.44    Heat gains from water heating, kWh/month 0.25 '[0.85 x (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]    (65)m=   32.12   28.09   28.99   25.28   24.25   20.93   19.39   22.25   22.52   26.24   28.65   31.11    (65)miclude (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating  5. Internal gains (Table 5), Watts  Metabolic gains (Table 5), Watts    48
Column   128.49   112.38   115.97   101.1   97.01   83.71   77.57   89.01   90.08   104.98   114.59   124.44
Couput from water heater (annual)
Heat gains from water heating, kWh/month 0.25 ' [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m] (65)m = 32.12   28.09   28.99   25.28   24.25   20.93   19.39   22.25   22.52   26.24   28.65   31.11   (65) include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m = 113.34   113.3
(65)m= 32.12
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating  5. Internal gains (see Table 5 and 5a):  Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
Metabolic gains (Table 5), Watts    Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
Metabolic gains (Table 5), Watts           Jan         Feb         Mar         Apr         May         Jun         Jul         Aug         Sep         Oct         Nov         Dec           (66)m=         113.34
Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec
(66)m=
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5  (67)m= 18.58
(67)m=
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (68)m= 199.29 201.35 196.14 185.05 171.05 157.88 149.09 147.02 152.23 163.33 177.33 190.49  Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 34.33 (69)  Pumps and fans gains (Table 5a) (70)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(68)m= 199.29 201.35 196.14 185.05 171.05 157.88 149.09 147.02 152.23 163.33 177.33 190.49 (68)  Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 34.33 (69)  Pumps and fans gains (Table 5a)  (70)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5  (69)m= 34.33 3
(69)m= 34.33
Pumps and fans gains (Table 5a)  (70)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(70)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(70)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(71)m=
(71)m=
(72)m= 43.18 41.81 38.97 35.1 32.6 29.07 26.07 29.91 31.28 35.27 39.79 41.81  Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m  (73)m= 318.04 316.67 305.53 287.31 268.24 250.36 239.08 242.94 252.6 270.95 292.03 308.4 (73)  6. Solar gains:  Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.
(72)m= 43.18 41.81 38.97 35.1 32.6 29.07 26.07 29.91 31.28 35.27 39.79 41.81  Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m  (73)m= 318.04 316.67 305.53 287.31 268.24 250.36 239.08 242.94 252.6 270.95 292.03 308.4 (73)  6. Solar gains:  Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.
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6. Solar gains: Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.
Orientation: Access Factor Area Flux a FF Gains
<u> </u>
Table 6d m² Table 6a Table 6b Table 6c (W)
Southeast $0.9x$ 0.77 x 6.1 x 36.79 x 0.63 x 0.7 = 68.56 (77)
Southeast 0.9x 0.77 x 6.1 x 62.67 x 0.63 x 0.7 = 116.78 (77)
Southeast 0.9x 0.77 x 6.1 x 85.75 x 0.63 x 0.7 = 159.78 (77)
Southeast 0.9x 0.77 x 6.1 x 106.25 x 0.63 x 0.7 = 197.98 (77)

-		_							_				_
Southeast <sub>0.9x</sub>	0.77	X	6.	1	X	18.15	X	0.63	X	0.7	=	220.15	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.	1	X 1	13.91	×	0.63	X	0.7	=	212.25	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.	1	X 1	04.39	X	0.63	X	0.7	=	194.51	(77)
Southeast 0.9x	0.77	X	6.	1	x	92.85	X	0.63	X	0.7	=	173.01	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.	1	x	69.27	x	0.63	X	0.7	=	129.07	(77)
Southeast <sub>0.9x</sub>	0.77	x	6.	1	X .	44.07	X	0.63	X	0.7	=	82.12	(77)
Southeast 0.9x	0.77	X	6.	1	X	31.49	x	0.63	x	0.7	=	58.67	(77)
Northwest <sub>0.9x</sub>	0.77	×	5.1	1	х	11.28	x	0.63	x	0.7		17.61	(81)
Northwest <sub>0.9x</sub>	0.77	×	5.1	1	x	22.97	x	0.63	x	0.7	_	35.85	(81)
Northwest 0.9x	0.77	×	5.1	1	x	41.38	x	0.63	x	0.7	=	64.58	(81)
Northwest <sub>0.9x</sub>	0.77	×	5.1	1	x	67.96	x	0.63	x	0.7	=	106.06	(81)
Northwest <sub>0.9x</sub>	0.77	×	5.1	1	x	91.35	x	0.63	х	0.7	=	142.57	(81)
Northwest 0.9x	0.77	×	5.1	1	х	97.38	x	0.63	x	0.7	=	151.99	(81)
Northwest 0.9x	0.77	×	5.1	1	х	91.1	x	0.63	x	0.7	=	142.19	(81)
Northwest 0.9x	0.77	×	5.1	1	х	72.63	x	0.63	x	0.7	=	113.35	(81)
Northwest 0.9x	0.77	×	5.1	1	x	50.42	x	0.63	x	0.7		78.69	(81)
Northwest 0.9x	0.77	×	5.1	1	x	28.07	x	0.63	x	0.7		43.81	(81)
Northwest 0.9x	0.77	×	5.1	1	х	14.2	x	0.63	x	0.7	=	22.16	(81)
Northwest 0.9x	0.77	×	5.1	1	х	9.21	x	0.63	x	0.7		14.38	(81)
Solar gains in (83)m= 86.17	152.63 22	24.37	304.04	364.32	372.15	354.44	(83)m 307.	= Sum(74)m . 87 251.71	(82)m 172.87	7 104.28	73.05		(83)
Total gains – i (84)m= 404.21		29.9	591.36	632.56	622.51	593.52	550.	81 504.31	443.82	2 396.31	381.46	]	(84)
					<u> </u>	393.32	330.	01 304.31	443.02	390.31	301.40		(04)
7. Mean inter	•		`		,			TI 4 (0.0)				Γ	7
Temperature	Ū	٠.			Ū		ole 9,	Th1 (°C)				21	(85)
Utilisation fac		$\overline{}$			<del>`                                      </del>	<del> </del>	Ι,			1		1	
Jan	<del>                                     </del>	Mar	Apr	May	Jun	Jul	Au	<u> </u>	Oct	+	Dec		(96)
(86)m= 0.97		).93	0.87	0.77	0.64	0.5	0.5		0.9	0.96	0.97		(86)
Mean interna						i	т —				ı	1	
(87)m= 18.68	18.95	9.38	19.93	20.43	20.77	20.91	20.8	38 20.62	19.98	19.23	18.63		(87)
Temperature	during hea	ting p	eriods ir	rest of	dwelling	from Ta	able 9	, Th2 (°C)				•	
(88)m= 20.01	20.01 2	0.01	20.02	20.02	20.03	20.03	20.0	20.02	20.02	20.02	20.01		(88)
Utilisation fac	tor for gain	s for r	est of d	welling,	h2,m (s	ee Table	9a)						
(89)m= 0.97	0.95	).91	0.85	0.73	0.57	0.41	0.4	6 0.69	0.88	0.95	0.97		(89)
Mean interna	l temperatu	re in t	he rest	of dwelli	ing T2 (f	follow ste	eps 3	to 7 in Tabl	e 9c)	-	-		
(90)m= 17.88	<del> </del>	8.57	19.11	19.57	19.88	19.98	19.9		19.16	18.43	17.83		(90)
		!			•	•		f	LA = Liv	ving area ÷ (	4) =	0.41	(91)
Mean interna		/f.o.	مارین محاکیت	مام طبیت	II:\ .	11 A T4	. /4	_ fl Λ\ ∨ T2					_
	Hemberatu	Le no	r ine wn	OIG UWG	1111nan — 1	IAXII	+ ( ) ·						
(92)m= 18.22	<del></del>	8.91	19.45	19.93	20.25	20.37	20.3	<u> </u>	19.5	18.76	18.16		(92)
	18.48	8.91	19.45	19.93	20.25	20.37	20.3	35 20.11			18.16		(92)

(93)m=	18.22	18.48	18.91	19.45	19.93	20.25	20.37	20.35	20.11	19.5	18.76	18.16		(93)
	ace hea	ting requ	uirement											
Set T	i to the r	nean int	ernal ter	mperatu	re obtair	ned at st	ep 11 of	Table 9b	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
				using Ta			<u>'</u>		<u> </u>	, ,				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	1:		_								
(94)m=	0.95	0.93	0.9	0.83	0.73	0.59	0.45	0.49	0.69	0.86	0.94	0.96		(94)
Usefu	ıl gains,	hmGm	W = (94)	4)m x (8	4)m		_							
(95)m=	385.72	438.11	475.94	492.24	460.87	364.19	264.17	270.3	350.36	383.01	370.75	366.18		(95)
Month	nly 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	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m-	– (96)m	]				
(97)m=	1076.67	1048.95	956.8	807.17	628.27	428.08	285.7	298.95	457.11	679.7	893.25	1072.92		(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 <sup>-</sup>	1)m			
(98)m=	514.07	410.48	357.75	226.75	124.55	0	0	0	0	220.74	376.2	525.82		
								Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	2756.36	(98)
Space	e heatin	a reauire	ement in	kWh/m²	2/vear							i	38.9	(99)
	·	•			. ,							l	33.0	
		Ĭ	luiremer		O T-	. I. 40L								
Caicu	Jan	Feb	Mar	August. Apr	See Ta May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat				<u> </u>				and exte	<u> </u>					
(100)m=		0 Ca	0	0	0	712.65	561.02	575.42	0	o 0	0	0		(100)
, ,		tor for lo			U	712.03	301.02	373.42	0	0	U	U		(100)
(101)m=	0	0	0	0	0	0.78	0.84	0.81	0	0	0	0		(101)
	,			100)m x			0.04	0.01	U	0	U	Ů		(101)
(102)m=		0	0 (alls)	0	0	554.24	469.78	466.89	0	0	0	0		(102)
				<u> </u>	<u> </u>		<u> </u>			0	U	U		(102)
(103)m=	Ò	gains ca 0	0 0		0	811.92	776.39	e Table 727.91	0	0	0	0		(103)
				l	l		l	ous ( kW					v (11)m	(100)
				: 3 × (98		iweiiiig,	COMMINU	JUS ( KVV	11) = 0.0.	24 X [( 10	)3)III — (	102)111])	K (41)III	
(104)m=	0	0	0	0	0	185.53	228.11	194.2	0	0	0	0		
					<u> </u>	<u>!</u>	Į	<u> </u>	Total	= Sum(	 104)	=	607.84	(104)
Cooled	fraction	า								,	area ÷ (4	1) =	1	(105)
Intermi	ttency fa	actor (Ta	able 10b	)								· !		
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
						•	•		Total	= Sum(	104)	=	0	(106)
Space	cooling	requirer	ment for	month =	(104)m	× (105)	× (106)r	n						_
(107)m=	0	0	0	0	0	46.38	57.03	48.55	0	0	0	0		
				•	•	•	•		Total	= Sum(	107)	=	151.96	(107)
Space	cooling	requirer	nent in k	(Wh/m²/y	/ear				(107)	÷ (4) =		i	2.14	(108)
•		•			•	der spe	rial conc	litions, se	` '	. ,				
		/ Efficier		<del>aloul</del> ate0	-omy ur	<del>aci spe</del> (	<del>siai cori</del> c	<del>1110113, 3</del> 0		<i>'</i>	_		44.05	(109)
rabil	Lileig	, Liliciei	юу						(99)	+ (108) =	_	l	41.05	(109)

### **SAP Input**

Address:

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

**UPRN:** 

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

Assessment type: New dwelling design stage

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

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

PCDF Version: 466

Flat Dwelling type:

Detachment:

2020 Year Completed:

Floor Location: Floor area:

Storey height:

1.4

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

29.384 m<sup>2</sup> (fraction 0.415) Living area:

South West Front of dwelling faces:

NW

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

SW Manufacturer Solid

SE Manufacturer Windows double-glazed Yes NW Manufacturer Windows double-glazed Yes

0.7

**U-value:** No. of Openings: Name: Gap: Frame Factor: g-value: Area: SW 0 1.4 mm SF 0.7 0.63 1.4 6.097 1 16mm or more 0.63 5.107

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

Average or unknown Overshading:

16mm or more

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Element	<u>:S</u>						
External Wall	35.717	11.2	24.51	0.15	0	False	N/A
Corridor Wall	11.704	2	9.7	0.15	0.4	False	N/A
Stairwell Wall	16.764	0	16.76	0.15	0.9	False	N/A
Exposed Floor	49.413			0.12			N/A
Internal Element	<u>s</u>						
Party Elements							

User-defined (individual PSI-values) Y-Value = 0.1214 Thermal bridges:

> Length **Psi-value**

5.93 0.291 E2 Other lintels (including other steel lintels)

1

### **SAP Input**

17.7	0.048	E4	Jamb
30.239	0.066	E7	Party floor between dwellings (in blocks of flats)
2.725	0.074	E16	Corner (normal)
5.45	-0.072	E17	Corner (inverted internal area greater than external area)
16.869	0.284	E20	Exposed floor (normal)
6.828	0.14	E21	Exposed floor (inverted)
8.175	0.056	E18	Party wall between dwellings
8.175	0.113	E25	Staggered party wall between dwellings
21.989	0	P3	Intermediate floor between dwellings (in blocks of flats)
14.277	0.16	P7	Exposed floor (normal)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery

Number of wet rooms: Kitchen + 1

Ductwork: Insulation, rigid

Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 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: 0.87 Tilt of collector: 30°

Overshading: None or very little

# **SAP Input**

Collector Orientation: South West

Assess Zero Carbon Home:

Nο

		User_l	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa					0001082 on: 1.0.5.9	
		Property	Address	: Plot 20	)				
Address :									
1. Overall dwelling dime	ensions:	_	4 2						
Ground floor			ea(m²)	l(10) v		ight(m)	_	Volume(m <sup>3</sup>	<u>`</u>
			70.86	(1a) x		2.5	(2a) =	177.14	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(	In)	70.86	(4)					
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	(3n) =	177.14	(5)
2. Ventilation rate:									
	main seconda heating heating		other		total			m³ per hou	ır
Number of chimneys	0 + 0	+	0	=	0	Х	40 =	0	(6a)
Number of open flues	0 + 0	7 +	0	<b> </b> =	0	×	20 =	0	(6b)
Number of intermittent fa	ins				3	×	10 =	30	(7a)
Number of passive vents	<b>;</b>			F	0	x	10 =	0	(7b)
Number of flueless gas fi	ires			L F	0	x	40 =	0	(7c)
				L					(, o)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+$	(7a)+(7b)+	(7c) =	Γ	30		÷ (5) =	0.17	(8)
	peen carried out or is intended, proce	ed to (17),	otherwise (	continue fi	rom (9) to	(16)			
Number of storeys in the Additional infiltration	he dwelling (ns)					T/C	N 41-0 4	0	(9)
	.25 for steel or timber frame of	or 0 35 fc	or masoni	rv consti	ruction	2)]	9)-1]x0.1 =	0	(10)
	resent, use the value corresponding			•	dollon			0	(11)
deducting areas of openii									_
·	floor, enter 0.2 (unsealed) or	J.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	s and doors draught stripped							0	(13)
Window infiltration	s and doors draught stripped		0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (	12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic met	es per h	our per s	quare m	etre of e	envelop	e area	5	(17)
If based on air permeabil	lity value, then $(18) = [(17) \div 20]$	(8), otherv	vise (18) =	(16)				0.42	(18)
	es if a pressurisation test has been d	one or a de	egree air pe	rmeability	is being u	sed			<b>-</b>
Number of sides sheltere Shelter factor	ed .		(20) = 1 -	[0.075 x ( <sup>2</sup>	19)] =			0.85	(19) (20)
Infiltration rate incorporat	ting shelter factor		(21) = (18	`	,,			0.36	(21)
Infiltration rate modified f	•		` , ` ,	, , ,				0.30	(=1)
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
Monthly average wind sp		_ <b>!</b>					_ <b>!</b>	J	
(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 (00c) : (0	2)	•	•	•	•	•		•	
Wind Factor $(22a)m = (22a)m = 1.27$	2)m ÷ 4 1.23 1.1 1.08 0.95	0.95	0.92	<u> </u>	1.08	1.12	1.18	1	
(22a)m= 1.27 1.25	1.20 1.1 1.00 0.95	0.95	1 0.92		1.00	1.12	1.10	J	

0.45	ation rate	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42		
Calculate effe		•				se							
If mechanic												0	(23
If exhaust air h		0		, ,	,	. `	,, .	•	) = (23a)			0	(23
If balanced wit		-	-	_								0	(23
a) If balance	1					<u> </u>	<u> </u>	<u> </u>	<u> </u>	<del></del>	<u>`</u>	÷ 100]	
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
b) If balance						<u> </u>	<u> </u>	<u> </u>	<u> </u>			Ī	(0.
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h	nouse ext n < 0.5 ×			•	•				5 v (22h	.\			
$\frac{11(220)1}{24c)m=0}$	0.5 x	0	0	) = (23L 0	0	0	0 = (220)	0	0	0	0		(24
d) If natural									Ů				(-
,	n = 1, the			•	•				0.5]				
24d)m= 0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(24
Effective air	change	rate - er	iter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)			•	•	
25)m= 0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(2
3. Heat losse	s and ha	ot loce r	aramata	or:									
S. Fleat losse ELEMENT	S and ne	•	Openin		Net Ar	00	U-valı	10	AXU		k-value	Λ Λ	Χk
ELEIVIENI	area		m		A,n		W/m2		(W/F	<b>〈</b> )	kJ/m²-ł		J/K
Doors					2	x	1	=	2				(20
Vindows Type	e 1				6.097	x1/	/[1/( 1.4 )+	0.04] =	8.08				(27
Windows Type	e 2				5.107	x1/	/[1/( 1.4 )+	0.04] =	6.77				(27
loor					49.41	3 x	0.13	□ = [	6.42368	<u> </u>			(28
Walls Type1	35.7	2	11.2		24.51	x	0.18	<b>=</b>	4.41	Ŧ i		1	(29
Nalls Type2	11.7	7	2		9.7	x	0.18	<u> </u>	1.75	<b>=</b>		ī	(29
Walls Type3	16.7	6	0		16.76	x	0.18	<b>=</b>	3.02	<b>=</b>			(29
Γotal area of ε	elements	 , m²			113.6								` (3 <sup>,</sup>
	d roof windo		ffective wi	ndow U-va			formula 1	/[(1/U-valu	e)+0.04] a	s given in	paragraph	3.2	<b>\</b>
tor windows and	as on both	sides of in	ternal wall	s and part	titions								
												32.45	(3:
* include the are	ss, W/K =	= S (A x	U)				(26)(30)	+ (32) =					
* include the are	•	,	U)				(26)(30)		.(30) + (32	2) + (32a).	(32e) =	4419.71	(34
* include the are Fabric heat los Heat capacity	Cm = S(	Axk)	,	- TFA) ir	n kJ/m²K		(26)(30)	((28)	.(30) + (32 tive Value:	, , ,	(32e) =	4419.71 250	=
** include the are Fabric heat los Heat capacity Fhermal mass For design asses	Cm = S(s paramessments who	A x k) ter (TMF ere the de	$P = Cm \div tails of the$	•				((28) Indica	tive Value:	Medium			=
* include the are. Fabric heat los Heat capacity Thermal mass For design assess can be used inste	Cm = S(s parame sments who	A x k ) ter (TMF ere the de tailed calcu	P = Cm ÷ tails of the ulation.	constructi	ion are not	t known pr		((28) Indica	tive Value:	Medium		250	(3
* include the are. Fabric heat lose Heat capacity Thermal mass For design assess tean be used inste	Cm = S( s parame sments who ead of a det es : S (L	A x k ) ter (TMF ere the de tailed calcu x Y) calc	P = Cm ÷ tails of the ulation. culated t	constructius	ion are not pendix k	t known pr		((28) Indica	tive Value:	Medium			(3
* include the area  Fabric heat lose  Heat capacity  Thermal mass  For design assess  Fan be used instea  Thermal bridg  Thetails of therma	Cm = S( s parame sments who ead of a det es : S (L al bridging	A x k ) ter (TMF ere the de tailed calcu x Y) calc	P = Cm ÷ tails of the ulation. culated t	constructius	ion are not pendix k	t known pr		((28) Indica	tive Value:	Medium		250	(3:
* include the area  Fabric heat los  Heat capacity  Thermal mass  For design assess  In be used instea  Thermal bridg  # details of therma  Total fabric he	Cm = S( s parame sments who ead of a det es : S (L al bridging eat loss	A x k ) ter (TMF ere the de tailed calcu x Y) calcu are not kn	P = Cm ÷ tails of the ulation. culated to	constructions constructions constructions constructions constructed as the construction construc	ion are not pendix k	t known pr		((28) Indica e indicative (33) +	tive Value:	Medium TMP in Ta	able 1f	250 13.9	(3)
* include the area for the area for the area for the area for design assessed to the area for th	Cm = S( s parame sments who ead of a det es : S (L al bridging eat loss	A x k ) ter (TMF ere the de tailed calcu x Y) calcu are not kn	P = Cm ÷ tails of the ulation. culated to	constructions co	ion are not pendix k	t known pr		((28) Indica e indicative (33) +	tive Value:  values of  (36) =	Medium TMP in Ta	able 1f	250 13.9	(3)
* include the area  Fabric heat lose  Heat capacity  Thermal mass  For design assess  Fan be used instea  Thermal bridg  F details of thermal  Total fabric hea  Jan	Cm = S( s parame sments who ead of a det es : S (L al bridging eat loss at loss ca	A x k ) ter (TMF ere the de tailed calcu x Y) calc are not kn	P = Cm ÷ tails of the ulation. culated to own (36) =	constructions and constructions are constructed using Ap	on are not pendix h	t known pr	ecisely the	((28) Indica e indicative (33) + (38)m	(36) = = 0.33 × (	Medium  TMP in Ta	able 1f	250 13.9	(34
include the area include the area include the area included in including inc	Cm = S( s parame sments who ead of a det es : S (L al bridging eat loss at loss ca Feb 35.03	A x k ) ter (TMF ere the de tailed calcu x Y) calc are not kn alculated Mar 34.8	P = Cm ÷ tails of the ulation. culated to own (36) = I monthly	constructions are constructed using Ap = 0.05 x (3)	pendix h	t known pri	ecisely the	((28) Indica e indicative (33) + (38)m Sep 32.94	tive Value:  values of  (36) =  = 0.33 × (	25)m x (5) Nov 33.93	able 1f	250 13.9	(36)

Heat loss para	ameter (I	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m= 1.15	1.15	1.15	1.13	1.13	1.11	1.11	1.11	1.12	1.13	1.13	1.14		
		!	<u>.                                    </u>	!	<u>.                                    </u>	!	!		Average =	Sum(40) <sub>1</sub> .	12 /12=	1.13	(40)
Number of day	<u> </u>	1 ·	· ·		· .	l			<u> </u>				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	irement:								kWh/ye	ear:	
Assumed occurring TFA > 13. if TFA £ 13.	9, N = 1		[1 - ехр	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (	TFA -13.		27		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	$5\%$ if the $\alpha$	lwelling is	designed t	` ,		se target o		.03		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i													
(44)m= 96.84	93.32	89.8	86.27	82.75	79.23	79.23	82.75	86.27	89.8	93.32	96.84		
_						· _				m(44) <sub>112</sub> =	L	1056.42	(44)
Energy content of			culated m				OTm / 3600	) kWh/mor			c, 1d)		
(45)m= 143.61	125.6	129.61	113	108.42	93.56	86.7	99.49	100.67	117.33	128.07	139.08		<b></b>
If instantaneous v	vater heati	ing at point	of use (no	o hot water	r storage).	enter 0 in	boxes (46		Total = Su	m(45) <sub>112</sub> =	- [	1385.13	(45)
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage	1 *												` '
Storage volum	ne (litres	) includir	ng any s	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	•			•			` '						
Otherwise if no		hot wate	er (this ir	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	47)			
Water storage a) If manufact		eclared I	oss fact	or is kno	wn (kWł	n/day).					0		(48)
Temperature f				01 10 1410	(	"aay).					0		(49)
Energy lost fro				ear			(48) x (49)	) =			0		(50)
b) If manufact		_	-		or is not			,			<u> </u>		(00)
Hot water stor	•			le 2 (kW	h/litre/da	ay)					0		(51)
If community he Volume factor	_		on 4.3										(50)
Temperature f			2b							<b>—</b>	0		(52) (53)
Energy lost fro				ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or		_	,	ou.			( ) (- )	, (- , (	,		0		(55)
Water storage	loss cal	culated t	for each	month			((56)m = (	(55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	L rage, (57)	<u>I</u> m = (56)m	x [(50) – (	<u>I</u> [H11)] ÷ (5	0), else (5	<u>I</u> 7)m = (56)	m where (	H11) is fro	m Appendi	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	 ∋ 3							0		(58)
Primary circuit	•	•			59)m =	(58) ÷ 36	65 × (41)	m					
(modified by	/ factor f	rom Tab	le H5 if t	here is s	olar wa	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Oambilaaa a		<b>.</b>		(04)	(00) - 0	OF (44)	\						
Combi loss ci	alculated 0	or each	montn (	61)m = 0	(60) ÷ 3	05 × (41)	)m l o	T 0	0	0	0		(61)
(* )							<u> </u>	_!	<u> </u>	<u> </u>	<u> </u>	(F0)m + (G1)m	(01)
(62)m= 122.07	<u> </u>	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22	(59)m + (61)m	(62)
Solar DHW input													(02)
(add addition									ii continbu	lion to wate	er neating)		
(63)m= 0	0	0	0	0	0	0	0	T 0	0	0	0	]	(63)
Output from v	vater hea	L ter					ļ	1		ļ			
(64)m= 122.07	1	110.17	96.05	92.16	79.53	73.69	84.56	85.57	99.73	108.86	118.22		
	1						Οι	tput from w	ater heate	er (annual)	l12	1177.36	(64)
Heat gains fro	om water	heating,	kWh/mo	onth 0.2	5 ′ [0.85	× (45)m	+ (61)	m] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	1	•
(65)m= 30.52	26.69	27.54	24.01	23.04	19.88	18.42	21.14	21.39	24.93	27.22	29.55	]	(65)
include (57	m in calc	culation o	of (65)m	only if c	vlinder i	s in the	dwellin	or hot w	ater is f	rom com	munity h	ı neating	
5. Internal of	•			-	,						,	<u> </u>	
Metabolic gai	Ì												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34		(66)
Lighting gains	s (calcula	ted in Ap	pendix	L, equati	on L9 o	r L9a), a	lso see	Table 5	•		•	l	
(67)m= 18.58	16.5	13.42	10.16	7.59	6.41	6.93	9.01	12.09	15.35	17.91	19.1		(67)
Appliances g	ains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5		•	•	
(68)m= 199.29	201.35	196.14	185.05	171.05	157.88	149.09	147.02	152.23	163.33	177.33	190.49		(68)
Cooking gain	s (calcula	ted in Ap	pendix	L, equat	ion L15	or L15a	), also	see Table	5	•	•	•	
(69)m= 34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33		(69)
Pumps and fa	ans gains	(Table 5	ia)			•						•	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses e.g. e	vaporatio	n (negat	ive valu	es) (Tab	le 5)	-		-	-	-	-		
(71)m= -90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67		(71)
Water heating	g gains (T	able 5)				-	-	-	-	-	-		
(72)m= 41.02	39.72	37.02	33.35	30.97	27.61	24.76	28.42	29.71	33.51	37.8	39.72		(72)
Total interna	ıl gains =	:			(66	)m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	71)m + (72)	)m		
(73)m= 315.88	314.57	303.58	285.56	266.61	248.91	237.78	241.44	251.03	269.19	290.04	306.31		(73)
6. Solar gair	ns:												
Solar gains are		Ü	flux from	Table 6a		•	tions to	convert to th	ne applica		tion.		
Orientation:	Access F Table 6d	actor	Area m²		Flu	ıx ble 6a		g_ Table 6b	т	FF		Gains	
					Га	Die ba	. –	Table 6b	_ '	able 6c		(W)	,
Southeast 0.9x		X	6.	1	x ;	36.79	×	0.63	X	0.7	=	68.56	(77)
Southeast 0.9x	• • • • • • • • • • • • • • • • • • • •	X	6.	1	X (	62.67	x	0.63	X	0.7	=	116.78	(77)
Southeast 0.9x		X	6.	1	X 8	35.75	×	0.63	x	0.7	=	159.78	(77)
Southeast 0.9x		X	6.	1	x 1	06.25	x	0.63	x	0.7	=	197.98	(77)
Southeast 0.9x	0.77	X	6.	1	x 1	19.01	X	0.63	Х	0.7	=	221.76	(77)

-		_					_						_
Southeast <sub>0.9x</sub>	0.77	X	6.	1	x	118.15	X	0.63	X	0.7	=	220.15	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.	1	X	113.91	X	0.63	X	0.7	=	212.25	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.	1	X	104.39	X	0.63	X	0.7	=	194.51	(77)
Southeast 0.9x	0.77	x	6.	1	x	92.85	X	0.63	X	0.7	=	173.01	(77)
Southeast <sub>0.9x</sub>	0.77	x	6.	1	x	69.27	X	0.63	x	0.7	=	129.07	(77)
Southeast <sub>0.9x</sub>	0.77	x	6.	1	x	44.07	X	0.63	x	0.7	=	82.12	(77)
Southeast 0.9x	0.77	x	6.	1	x	31.49	X	0.63	х	0.7	=	58.67	(77)
Northwest <sub>0.9x</sub>	0.77	×	5.1	1	x	11.28	X	0.63	x	0.7		17.61	(81)
Northwest <sub>0.9x</sub>	0.77	×	5.1	1	x	22.97	X	0.63	x	0.7	_	35.85	(81)
Northwest 0.9x	0.77	×	5.1	1	x	41.38	X	0.63	x	0.7	=	64.58	(81)
Northwest <sub>0.9x</sub>	0.77	x	5.1	1	x	67.96	X	0.63	x	0.7	=	106.06	(81)
Northwest <sub>0.9x</sub>	0.77	x	5.1	1	x	91.35	X	0.63	x	0.7	=	142.57	(81)
Northwest 0.9x	0.77	×	5.1	1	x	97.38	X	0.63	x	0.7	=	151.99	(81)
Northwest 0.9x	0.77	×	5.1	1	x	91.1	X	0.63	x	0.7	=	142.19	(81)
Northwest 0.9x	0.77	×	5.1	1	x	72.63	X	0.63	x	0.7	=	113.35	(81)
Northwest 0.9x	0.77	×	5.1	1	x	50.42	i x	0.63	x	0.7		78.69	(81)
Northwest 0.9x	0.77	×	5.1	1	x	28.07	X	0.63	x	0.7		43.81	(81)
Northwest 0.9x	0.77	×	5.1	1	x	14.2	X	0.63	x	0.7	=	22.16	(81)
Northwest 0.9x	0.77	×	5.1	1	x	9.21	i x	0.63	x	0.7		14.38	(81)
Solar gains in (83)m= 86.17		ulated 24.37	for eac	h month 364.32	372.1	5 354.44	(83)m	n = Sum(74)m . .87   251.71	(82)m		73.05	1	(83)
Total gains – i	<u> </u>						307	.67   251.71	172.0	1 104.28	73.03		(00)
(84)m= 402.05		7.95	589.6	630.93	621.0		549	.31 502.74	442.00	6 394.32	379.37		(84)
` '					L		1						
7. Mean inter	•		`		<i>'</i>	o from To	blo O	Th4 (9C)					(85)
Temperature	ŭ	٠.			•		DIE 9,	, 1111 ( C)				21	(65)
Utilisation fac		Mar	Apr	May	Jur	<del></del>	Τ Δ.	ug Sep	Oct	Nov	Dec		
(86)m= 1		0.99	0.97	0.9	0.74	+	0.6		0.98	1	1		(86)
	<u> </u>					ļ		<u> </u>	0.00	<u> </u>			()
Mean interna (87)m= 19.73	<del> </del>	re in I	1VING are 20.47	ea 11 (fo	20.94	-i	/ In I	<del></del>	20.47	20.04	19.7		(87)
` ′	!!					!			20.47	20.04	19.7		(07)
Temperature		<del></del>			1	<del>-</del>	1		·	T		Ī	(00)
(88)m= 19.96	19.96	9.96	19.98	19.98	19.99	19.99	19.	99 19.99	19.98	19.97	19.97		(88)
Utilisation fac	tor for gains	s for r	est of d	welling,	h2,m (	see Table	9a)		,		ī	1	
(89)m= 1	1 0	0.99	0.95	0.86	0.65	0.45	0.5	0.8	0.97	1	1		(89)
Mean interna	l temperatu	re in t	he rest	of dwell	ing T2	(follow ste	eps 3	to 7 in Tab	le 9c)			_	
(90)m= 18.8	18.95	9.21	19.54	19.82	19.96	19.99	19.	99 19.9	19.55	19.12	18.78		(90)
								1	fLA = Liv	ving area ÷ (	4) =	0.41	(91)
Mean interna	l temperatu	re (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1	– fLA) × T2					
(92)m= 19.18	<del></del>	9.59	19.93	20.21	20.37	1	20.	<del>- i                                   </del>	19.93	19.5	19.16		(92)
Apply adjusts			_	•	*		•		•	-			
Арріу айјизіі	nent to the i	mean	interna	temper	ature f	rom Table	e 4e,	where appro	opriate	!			

8. Space heating requirement  Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Utilisation factor for gains, hm:	(94)
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Utilisation factor for gains, hm:	
the utilisation factor for gains using Table 9a  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec  Utilisation factor for gains, hm:	
Utilisation factor for gains, hm:	
(94)m= 1 0.99 0.98 0.95 0.87 0.69 0.5 0.56 0.83 0.97 0.99 1	
Useful gains, hmGm , W = (94)m x (84)m	
(95)m= 401 464.47 520.02 562.28 546.22 426.47 295.54 307.01 415.94 429.05 392.17 378.63	(95)
Monthly average external temperature from Table 8	
(96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m ]	
(97)m= 1214.69 1174.99 1062.33 883.13 679.7 455.22 300.06 314.85 491.4 745.54 995.68 1207.72	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m	
(98)m= 605.38 477.47 403.48 231.01 99.31 0 0 0 235.47 434.53 616.85	
Total per year (kWh/year) = $Sum(98)_{15,912}$ = 3103.49	(98)
Space heating requirement in kWh/m²/year 43.8	(99)
8c. Space cooling requirement	
Calculated for June, July and August. See Table 10b  Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)	
(100)m= 0 0 0 0 0 741.99 584.12 598.58 0 0 0 0	(100)
Utilisation factor for loss hm	( /
(101)m= 0 0 0 0 0 0 0.87 0.93 0.91 0 0 0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m	` /
(102)m= 0 0 0 0 0 647.13 543.53 542.95 0 0 0 0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)	` '
(103)m= 0 0 0 0 0 810.47 775.08 726.41 0 0 0 0	(103)
Space cooling requirement for month, whole dwelling, continuous ( kWh) = 0.024 x [(103)m - (102)m] x (41)m	` '
set (104)m to zero if (104)m $< 3 \times (98)$ m	
(104)m= 0 0 0 0 0 117.6 172.28 136.49 0 0 0 0	
Total = Sum(1.04) = $426.38$	(104)
Cooled fraction $f C = cooled area \div (4) = 1$	(105)
Intermittency factor (Table 10b)	J
(106)m= 0 0 0 0 0 0.25 0.25 0.25 0 0 0	_
Total = Sum(1.04) = 0	(106)
Space cooling requirement for month = $(104)$ m × $(105)$ × $(106)$ m	
(107)m= 0 0 0 0 0 29.4 43.07 34.12 0 0 0 0	
Total = $Sum(1.07)$ = 106.59	(107)
Space cooling requirement in kWh/m²/year $(107) \div (4) = 1.5$	(108)
8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)	
Fabric Energy Efficiency (99) + (108) = 45.3	(109)
Target Fabric Energy Efficiency (TFEE) 52.1	(109)
	1.

		l Iser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa	are Ve	rsion:			001082 on: 1.0.5.9	
Address :	F	Property	Address	Plot 20					
1. Overall dwelling dime	nsions:								
		Are	a(m²)		Av. He	ight(m)		Volume(m <sup>3</sup>	3)
Ground floor		7	70.86	(1a) x	2	2.5	(2a) =	177.14	(3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	70.86	(4)					
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	177.14	(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	] = [	0	x 2	20 =	0	(6b)
Number of intermittent fa	ns			Ī	0	x 1	10 =	0	(7a)
Number of passive vents				Ī	0	x 1	10 =	0	(7b)
Number of flueless gas fi	res			Ē	0	x 4	40 =	0	(7c)
				L					
				_			Air ch	nanges per ho	our —
•	ys, flues and fans = (6a)+(6b)+( een carried out or is intended, procee			ontinuo fr	0		÷ (5) =	0	(8)
Number of storeys in the		tu to (17),	ourerwise (	onunue n	om (9) to	(10)		0	(9)
Additional infiltration	3 ( )					[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r masoni	y constr	ruction			0	(11)
if both types of wall are pu deducting areas of openir	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 (seale	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 averaged in autic mate		(8) + (10)					0	(16)
•	q50, expressed in cubic metro ity value, then $(18) = [(17) \div 20] + (18)$		•	•	etre or e	envelope	area	3	(17)
•	s 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 for	<del>- 1                                   </del>	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 / 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	4.3   4.4   4.3   3.8	] 3.8	3.1	4	4.3	J 4.0	4.1		
Wind Factor (22a)m = (22	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	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15	]	
Calculate effe		-	rate for t	he appli	cable ca	se				l .			
If mechanica												0.5	(23
If exhaust air h		0		, ,	,	. `	,, .	,	) = (23a)			0.5	(23
If balanced with		•	•	J		`		•				79.05	(23
a) If balance		1				<del>- ` ` </del>	<del>-                                    </del>	ŕ	<del>,                                    </del>	<del>-                                    </del>	<u> </u>	) ÷ 100] 1	(0.
24a)m= 0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25	]	(24
b) If balance						<del></del>	<del>- ^ ` ` - </del>	<del>í `</del>	<del>r ´       `</del>	<del>-                                    </del>	T .	1	(0.
24b)m= 0	0	0	0	0		0	0	0	0	0	0		(24
c) If whole h			ntilation o then (24)	•	•				E (22k	.)			
$\frac{11(220)1}{24c)m=0}$	0.57	0	0	0 = (230)	0	0	$C_0 = (22)$	0	0	0	0	1	(24
d) If natural					<u> </u>	<u> </u>						J	(-
,			m = (221)		•				0.5]				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(24
Effective air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in bo	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 losse	s and he	nat lace i	oaramot	or:			•	•				-	
S. Fleat losse ELEMENT	S and the Gros		Openin		Net Ar	<b>'</b>	U-val	IIΑ	AXU		k-value	ے ل	λΧk
LLLIVILINI	area		m		A ,r		W/m2		(W/	K)	kJ/m²-		J/K
Doors					2	X	1.4	=	2.8				(26
Windows Type	e 1				6.097	7 x1	/[1/( 1.4 )+	0.04] =	8.08				(27
Windows Type	2				5.107	7 X1	/[1/( 1.4 )+	0.04] =	6.77				(27
Floor					49.41	3 X	0.12	=	5.9295	<u> </u>			(28
Walls Type1	35.7	72	11.2	!	24.5	x	0.15	=	3.68	Ħ i			(29
Walls Type2	11.	7	2		9.7	X	0.14	=	1.37				(29
Walls Type3	16.7	76	0		16.76	3 X	0.13	<del>-</del>	2.22	₹ i		<u> </u>	(29
Total area of e	elements	s, m²			113.6	<u>=</u>							 (31
* for windows and	l roof wind	ows, use e	effective wi	ndow U-va	alue calcui	ated using	g formula 1	1/[(1/U-valu	ıe)+0.04] á	as given in	paragraph	n 3.2	
** include the area				ls and par	titions							_	
Fabric heat los		•	U)				(26)(30					30.85	(33
Heat capacity		` '	_					,	(30) + (32	, , ,	(32e) =	4419.71	(34
Thermal mass	•	•		,					tive Value			100	(35
For design asses: can be used inste				construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in T	able 1f		
Thermal bridge				using Ap	pendix l	<						13.79	(36
f details of therma	,	•			•								
Total fabric he	at loss							(33) +	(36) =			44.64	(37
/entilation hea	at loss ca	alculated	monthly	y				(38)m	= 0.33 × (	25)m x (5	)	_	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
38)m= 15.63	15.44	15.25	14.32	14.14	13.2	13.2	13.02	13.58	14.14	14.51	14.88		(38
Heat transfer of	coefficie	nt, W/K						(39)m	= (37) + (	38)m			
(39)m= 60.27	60.08	59.9	58.96	58.78	57.85	57.85	57.66	58.22	58.78	59.15	59.52	<u></u>	
									Average =	Sum(39)	<sub>112</sub> /12=	58.92	(39

Heat loss para	meter (I	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.85	0.85	0.85	0.83	0.83	0.82	0.82	0.81	0.82	0.83	0.83	0.84		
		<u>!</u>		<u> </u>	<u>I</u>	<u>I</u>	<u>I</u>	,	L Average =	: Sum(40) <sub>1.</sub>	12 /12=	0.83	(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)
4. Water heat	ting ene	rgy requi	rement:								kWh/ye	ear:	
Assumed see	inanai/	NI									1		(40)
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 (	ΓFA -13		27		(42)
Annual averag	e hot wa										.67		(43)
Reduce the annua	-				-	-	to achieve	a water us	se target o	of			
not more that 125	litres per	person per	day (all w	ater use, i	not and co	ia)	1	1					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage ii	n litres pe	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)		_				
(44)m= 101.93	98.23	94.52	90.81	87.11	83.4	83.4	87.11	90.81	94.52	98.23	101.93		
Energy content of	hot water	used - cal	culated m	onthly – 4	190 x Vd r	пуптуГ	Tm / 3600			ım(44) <sub>112</sub> =		1112.02	(44)
(45)m= 151.17	132.21	136.43	118.94	114.13	98.48	91.26	104.72	105.97	123.5	134.81	146.4		
(40)1112	102.21	100.40	110.04	114.10	30.40	01.20	104.72			Im(45) <sub>112</sub> =	l l	1458.03	(45)
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		rotar – od	1111(40)112 -	- I	1430.00	(,
(46)m= 22.67	19.83	20.46	17.84	17.12	14.77	13.69	15.71	15.9	18.53	20.22	21.96		(46)
Water storage	loss:			<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>			
Storage volum	e (litres)	) includin	ig 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	velling, e	nter 110	litres in	(47)						
Otherwise if no	stored	hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	(47)			
Water storage													
a) If manufact				or is kno	wn (kWł	n/day):					0		(48)
Temperature fa	actor fro	m Table	2b								0		(49)
Energy lost fro		_	-				(48) x (49)	) =		1	10		(50)
b) If manufact			-										(54)
Hot water stora	•			e z (KVV	n/iitre/aa	ıy)				0.	02		(51)
Volume factor	_		011 4.3								03		(52)
Temperature fa			2b							-	.6		(53)
Energy lost fro				oar			(47) v (51)	) x (52) x (	53) -				(54)
Enter (50) or (		_	, KVVII/yt	sai			(47) X (01)	/ X (02) X (	00) =		03 03		(55)
Water storage	. , .	,	or each	month			((56)m = (	55) × (41)ı	m		00		(00)
	1					1	., , ,	, , ,	ı	1 00 00	00.04		(EC)
(56)m= 32.01 If cylinder contains	28.92 dedicate	d solar sto	30.98	32.01	30.98 x [(50) = (	32.01 H11)1 ÷ (5)	32.01 0) else (5	30.98 7)m = (56)	32.01 m where (	30.98 (H11) is fro	32.01	ix H	(56)
(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)
					30.96	32.01	32.01	30.96	32.01	ļ			, ,
Primary circuit	•	•			FO)	(EO) 00	\F . /44\				0		(58)
Primary circuit				,	•	. ,	, ,		r tharma	otot)			
(modified by					ı —	ı —			ı —	<del>-                                    </del>	00.00		(EO)
(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 os	laulatad	for oach	month	(61)m –	(60) · 2(	SE (41)	\m						
Combi loss ca	0 0	0	0	0	00) + 3	05 × (41)	0	T 0	0	0	0	]	(61)
											<u> </u>	J · (59)m + (61)m	` ,
(62)m= 206.44	182.14	191.71	172.44	169.41	151.98	146.54	160	159.47	178.78	188.31	201.67	]	(62)
Solar DHW input		l		<u> </u>		<u> </u>							` ,
(add additiona											ooag)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from w	ater hea	ter		Į.		ļ.					•		
(64)m= 206.44	182.14	191.71	172.44	169.41	151.98	146.54	160	159.47	178.78	188.31	201.67	1	
				ı			Ot	utput from w	ater heate	r (annual)	112	2108.87	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)	m] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	 n ]	
(65)m= 94.48	83.9	89.58	82.34	82.17	75.54	74.57	79.04		85.29	87.62	92.9	]	(65)
include (57)	m in cald	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 g	ains (see	Table 5	and 5a	):	-								
Metabolic gair	ns (Table	5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m= 136	136	136	136	136	136	136	136	136	136	136	136		(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	e Table 5				_	
(67)m= 46.45	41.25	33.55	25.4	18.99	16.03	17.32	22.51	30.22	38.37	44.78	47.74	]	(67)
Appliances ga	ins (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), als	so see Ta	ble 5	-	_	_	
(68)m= 297.44	300.53	292.75	276.19	255.29	235.65	222.52	219.44	227.21	243.77	264.67	284.32		(68)
Cooking gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a	), also	see Table	5		-	-	
(69)m= 50.87	50.87	50.87	50.87	50.87	50.87	50.87	50.87	50.87	50.87	50.87	50.87	]	(69)
Pumps and fa	ns gains	(Table 5	<del></del>								-	_	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(70)
Losses e.g. ev	vaporatio	n (nega	tive valu	es) (Tab	le 5)	-			-			_	
(71)m= -90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	]	(71)
Water heating	gains (T	able 5)	-	-		-		-	-	-	-	_	
(72)m= 127	124.85	120.41	114.37	110.44	104.92	100.22	106.24	1 108.38	114.63	121.69	124.86	]	(72)
Total internal	gains =			•	(66)	)m + (67)m	n + (68)n	n + (69)m +	(70)m + (7	71)m + (72)	)m	-	
(73)m= 567.09	562.84	542.91	512.16	480.92	452.8	436.27	444.39	462.01	492.97	527.35	553.12	]	(73)
6. Solar gain	s:												
Solar gains are	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	ations to	convert to th	ne applical	ole orienta	tion.		
Orientation:			Area		Flu			g_ Table 6b	_	FF		Gains	
-	Table 6d		m²		Ta	ble 6a	. –	Table 6b	_ '	able 6c		(W)	,
Southeast 0.9x	0.77	X	6.	1	x 3	36.79	X	0.63	x	0.7	=	68.56	(77)
Southeast 0.9x	0.77	X	6.	1	x 6	62.67	X	0.63	x	0.7	=	116.78	(77)
Southeast 0.9x	0.77	X	6.	1	X 8	35.75	x	0.63	x	0.7	=	159.78	(77)
Southeast 0.9x	0.77	X	6.	1	x 1	06.25	X	0.63	x	0.7	=	197.98	(77)
Southeast 0.9x	0.77	X	6.	1	x 1	19.01	x	0.63	x	0.7	=	221.76	(77)

							_						_
Southeast <sub>0.9x</sub>	0.77	X	6.	1	X	118.15	X	0.63	X	0.7	=	220.15	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.	1	x	113.91	X	0.63	X	0.7	=	212.25	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.	1	X	104.39	X	0.63	X	0.7	=	194.51	(77)
Southeast 0.9x	0.77	X	6.	1	x	92.85	X	0.63	X	0.7	=	173.01	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.	1	x	69.27	X	0.63	X	0.7	=	129.07	(77)
Southeast 0.9x	0.77	X	6.	1	x	44.07	X	0.63	x	0.7	=	82.12	(77)
Southeast 0.9x	0.77	X	6.	1	x	31.49	X	0.63	X	0.7	=	58.67	(77)
Northwest <sub>0.9x</sub>	0.77	X	5.1	1	x	11.28	X	0.63	X	0.7	=	17.61	(81)
Northwest <sub>0.9x</sub>	0.77	X	5.1	1	x	22.97	X	0.63	x	0.7		35.85	(81)
Northwest 0.9x	0.77	X	5.1	1	x	41.38	X	0.63	X	0.7	=	64.58	(81)
Northwest <sub>0.9x</sub>	0.77	x	5.1	1	x	67.96	X	0.63	x	0.7	=	106.06	(81)
Northwest 0.9x	0.77	X	5.1	1	x	91.35	X	0.63	x	0.7	=	142.57	(81)
Northwest 0.9x	0.77	x	5.1	1	x	97.38	j x	0.63	×	0.7	=	151.99	(81)
Northwest 0.9x	0.77	x	5.1	1	x	91.1	X	0.63	x	0.7	=	142.19	(81)
Northwest 0.9x	0.77	x	5.1	1	x	72.63	j×	0.63	x	0.7	=	113.35	(81)
Northwest <sub>0.9x</sub>	0.77	x	5.1	1	x	50.42	j×	0.63	×	0.7		78.69	(81)
Northwest <sub>0.9x</sub>	0.77	x	5.1	1	x	28.07	j×	0.63	x	0.7		43.81	(81)
Northwest <sub>0.9x</sub>	0.77	X	5.1	1	x	14.2	X	0.63	×	0.7		22.16	(81)
Northwest 0.9x	0.77	x	5.1	1	x	9.21	j×	0.63	×	0.7	_ =	14.38	(81)
							_	<u> </u>					_
Solar gains in	watts, cal	culated	for eacl	h month			(83)m	n = Sum(74)m .	(82)m				
(83)m= 86.17		224.37	304.04	364.32	372.1	5 354.44	307	.87 251.71	172.87	104.28	73.05		(83)
Total gains – i	nternal an	nd solar	(84)m =	= (73)m ·	T (83)	m watte					•	•	
			(- ')'''	` '	+ (03)	iii, wallo							
(84)m= 653.26		767.28	816.2	845.25	824.9		752	.26 713.72	665.85	6 631.63	626.18		(84)
(84)m= 653.26 7. Mean inter	715.47	767.28	816.2	845.25	824.9		752	.26 713.72	665.85	631.63	626.18		(84)
` '	715.47	767.28 erature (	816.2 (heating	845.25 season	824.9	790.7			665.85	631.63	626.18	21	(84)
7. Mean inter	715.47 rnal tempe during he	767.28 erature (eating pe	816.2 (heating	845.25 season the livii	824.9 ) ng are	4 790.7			665.85	631.63	626.18	21	
7. Mean inter	715.47 rnal tempe during he	767.28 erature (eating pe	816.2 (heating	845.25 season the livii	824.9 ) ng are	4 790.7 a from Tal Table 9a)	ble 9		665.85		626.18 Dec	21	
7. Mean inter Temperature Utilisation fac	715.47 rnal tempe during he	767.28  erature ( eating periods for li	816.2 (heating eriods in ving are	season the livinga, h1,m	824.9 ng are	a from Tal Table 9a)	ble 9	, Th1 (°C)				21	
7. Mean inter Temperature Utilisation face  Jan (86)m= 0.89	715.47  rnal temper during he ctor for gain Feb 0.86	rerature (eating peins for li	816.2 (heating eriods in Apr 0.71	season the livings, h1,m May	824.9 ) ng are (see Jur 0.43	a from Tal Table 9a) Dul 0.32	ble 9 A	, Th1 (°C) ug Sep 34 0.52	Oct	Nov	Dec	21	(85)
7. Mean intel Temperature Utilisation fac	715.47  rnal temper during he ctor for gain Feb 0.86	rerature (eating peins for li	816.2 (heating eriods in Apr 0.71	season the livings, h1,m May	824.9 ) ng are (see Jur 0.43	a from Tal Table 9a)  Jul 0.32	ble 9 A	, Th1 (°C)  ug Sep  4 0.52  Table 9c)	Oct	Nov 0.85	Dec	21	(85)
7. Mean intercontrol Temperature Utilisation factor Jan (86)m= 0.89  Mean internation (87)m= 19.81	rnal temper during he ctor for gain Feb 0.86 al temperar 20.01	erature (eating period ins for lime Mar 0.81 ture in lage)	816.2 (heating eriods in Apr 0.71 iving are 20.62	season the living a, h1,m May 0.58 ea T1 (for 20.84	824.9 ) ng are (see     Jur     0.43 pllow s     20.96	a from Tal Table 9a) 1 Jul 0.32 steps 3 to 7	ble 9  A 0.3 7 in T 20.	Sep 0.52 Table 9c) 98 20.92	Oct 0.73	Nov 0.85	Dec 0.9	21	(85)
7. Mean intercontrol of the Temperature  Utilisation factor of the Temperature  (86)m= 0.89  Mean internation (87)m= 19.81  Temperature	715.47  rnal temper during he ctor for gain per	erature (eating poins for limited Mar 0.81 ture in label 20.3 eating poins for limited poins for limited limit	816.2 (heating eriods in Apr 0.71 iving are 20.62 eriods ir	season the livin ea, h1,m May 0.58 ea T1 (for 20.84	824.9 ) ng are (see Jur 0.43 ollow s 20.96 dwelli	a from Tal Table 9a)  Jul 0.32 steps 3 to 7 6 20.99  ng from Ta	ble 9  A  0.3  7 in T  20.  able 9	Sep 34 0.52 Sable 9c) 98 20.92 9, Th2 (°C)	Oct 0.73	Nov 0.85	Dec 0.9	21	(85) (86) (87)
7. Mean intercept Temperature Utilisation factors  Jan (86)m= 0.89  Mean internations (87)m= 19.81  Temperature (88)m= 20.21	715.47  rnal temper during he ctor for gain selection for gain selecti	erature (eating poins for limited in leading point 20.3 eating point 20.21	816.2 (heating eriods in Apr 0.71 iving are 20.62 eriods in 20.23	season the livin ea, h1,m May 0.58 ea T1 (for 20.84 rest of 20.23	824.9 ) ng are (see Jur 0.43 pllow s 20.96 dwelli 20.24	a from Tal Table 9a)  Jul 0.32 steps 3 to 7 6 20.99  ng from Ta 4 20.24	ble 9  A 0.3 7 in T 20. able 9	Sep 34 0.52 Sable 9c) 98 20.92 9, Th2 (°C)	Oct 0.73	Nov 0.85	Dec 0.9	21	(85)
7. Mean intercent Temperature Utilisation fact  Jan (86)m= 0.89  Mean internation (87)m= 19.81  Temperature (88)m= 20.21  Utilisation fact	715.47  rnal temper during he ctor for gain service with temperate 20.01  during he 20.21  ctor for gain service with temperate ctor for gain service with the	erature (eating poins for limiture in land) eating poins for limiture in land) eating poins for residual limiture for residual limit	816.2 (heating eriods in Apr 0.71 iving are 20.62 eriods in 20.23 est of decrease in the apr 20.23	season the livin ea, h1,m May 0.58 ea T1 (for 20.84 rest of 20.23 welling,	824.9 ) ng are (see Jur 0.43 pllow s 20.90 dwelli 20.20 h2,m	a from Tal Table 9a)  Jul 0.32 steps 3 to 7 20.99  ng from Ta 20.24 (see Table	ble 9  A 0.3 7 in T 20. able 9 20.	Sep 34 0.52 Table 9c) 98 20.92 9, Th2 (°C) 24 20.23	Oct 0.73 20.65	Nov 0.85 20.2	Dec 0.9 19.77	21	(85) (86) (87) (88)
7. Mean intercent Temperature Utilisation fact Jan (86)m= 0.89  Mean internation (87)m= 19.81  Temperature (88)m= 20.21  Utilisation fact (89)m= 0.88	715.47  rnal temper during he ctor for gain and temperary 20.01  during he 20.21  ctor for gain and temperary 20.85	erature (eating poins for limiture in land) eating poins for limiture in land) eating poins for record on the land limiture in land limiture i	816.2 (heating eriods in Apr 0.71 iving are 20.62 eriods in 20.23 est of do 0.68	season the livin ea, h1,m May 0.58 ea T1 (for 20.84 n rest of 20.23 welling, 0.54	824.9 ) ng are (see Jur 0.43 pllow s 20.90 dwelli 20.20 h2,m 0.38	a from Tal Table 9a)  1 Jul 1 0.32  Steps 3 to 7 2 20.99  Ing from Tal 2 20.24  (see Table 0.26	ble 9  A 0.3 7 in T 20. able 9 20. 99a) 0.2	Sep  34 0.52  Table 9c)  98 20.92  9, Th2 (°C)  24 20.23	Oct 0.73 20.65 20.23	Nov 0.85	Dec 0.9	21	(85) (86) (87)
7. Mean intercent Temperature Utilisation fact  [86]m= 0.89  Mean internation [87]m= 19.81  Temperature [88]m= 20.21  Utilisation fact [89]m= 0.88  Mean internation [88]	715.47  rnal temper during he ctor for gain selection with temperature and temperature during he ctor for gain selection selection for gain selection selection for gain selection selection for gain selection selecti	erature (eating poins for limiture in land) eating poins for limiture in land) eating poins for round in some for round limiture in table	816.2 (heating eriods in ving are 20.62 eriods in 20.23 est of do 0.68 he rest	season the livin ea, h1,m May 0.58 ea T1 (for 20.84 n rest of 20.23 welling, 0.54 of dwelling	824.9 ) ng are (see Jur 0.43 bllow s 20.9 dwelli 20.2 h2,m 0.38	a from Tal Table 9a)  Jul 0.32 steps 3 to 7 20.99  ng from Ta 20.24 (see Table 0.26 (follow ste	ble 9  A 0.3  7 in T 20.  able 9  20.  9a) 0.2  eps 3	Sep 34 0.52  Table 9c) 98 20.92  9, Th2 (°C) 24 20.23  10 7 in Table	Oct 0.73 20.65 20.23 0.7 e 9c)	Nov 0.85 20.2 20.22	Dec 0.9 19.77 20.22 0.89	21	(85) (86) (87) (88) (89)
7. Mean intercent Temperature Utilisation fact Jan (86)m= 0.89  Mean internation (87)m= 19.81  Temperature (88)m= 20.21  Utilisation fact (89)m= 0.88	715.47  rnal temper during he ctor for gain and temperary 20.01  during he 20.21  ctor for gain and temperary 20.85	erature (eating poins for limiture in land) eating poins for limiture in land) eating poins for record on the land limiture in land limiture i	816.2 (heating eriods in Apr 0.71 iving are 20.62 eriods in 20.23 est of do 0.68	season the livin ea, h1,m May 0.58 ea T1 (for 20.84 n rest of 20.23 welling, 0.54	824.9 ) ng are (see Jur 0.43 pllow s 20.90 dwelli 20.20 h2,m 0.38	a from Tal Table 9a)  Jul 0.32 steps 3 to 7 20.99  ng from Ta 20.24 (see Table 0.26 (follow ste	ble 9  A 0.3 7 in T 20. able 9 20. 99a) 0.2	Sep 34 0.52  Table 9c) 98 20.92 9, Th2 (°C) 24 20.23  to 7 in Table 23 20.15	Oct 0.73 20.65 20.23 0.7 e 9c) 19.81	Nov 0.85 20.2 20.22 19.19	Dec 0.9 19.77 20.22 0.89		(85) (86) (87) (88) (89)
7. Mean intercent Temperature Utilisation fact  [86]m= 0.89  Mean internation [87]m= 19.81  Temperature [88]m= 20.21  Utilisation fact [89]m= 0.88  Mean internation [88]	715.47  rnal temper during he ctor for gain selection with temperature and temperature during he ctor for gain selection selection for gain selection selection for gain selection selection for gain selection selecti	erature (eating poins for limiture in land) eating poins for limiture in land) eating poins for round in some for round limiture in table	816.2 (heating eriods in ving are 20.62 eriods in 20.23 est of do 0.68 he rest	season the livin ea, h1,m May 0.58 ea T1 (for 20.84 n rest of 20.23 welling, 0.54 of dwelling	824.9 ) ng are (see Jur 0.43 bllow s 20.9 dwelli 20.2 h2,m 0.38	a from Tal Table 9a)  Jul 0.32 steps 3 to 7 20.99  ng from Ta 20.24 (see Table 0.26 (follow ste	ble 9  A 0.3  7 in T 20.  able 9  20.  9a) 0.2  eps 3	Sep 34 0.52  Table 9c) 98 20.92 9, Th2 (°C) 24 20.23  to 7 in Table 23 20.15	Oct 0.73 20.65 20.23 0.7 e 9c) 19.81	Nov 0.85 20.2 20.22	Dec 0.9 19.77 20.22 0.89	0.41	(85) (86) (87) (88) (89)
7. Mean intercent Temperature Utilisation fact  [86]m= 0.89  Mean internation [87]m= 19.81  Temperature [88]m= 20.21  Utilisation fact [89]m= 0.88  Mean internation [88]	715.47  rnal temper during he ctor for gain services and temperature and tempe	erature (eating period ins for line 1 20.3 eating period 20.21 eating eating 20.21 eating 20.21 eating eating 20.21	816.2 (heating eriods in ving are 20.62 eriods in 20.23 est of do 0.68 he rest 19.76	season the livin ea, h1,m May 0.58 ea T1 (for 20.84 n rest of 20.23 welling, 0.54 of dwelling	824.9 ) ng are (see     Jur 0.43  collow s 20.9  dwelli 20.2  h2,m 0.38  ing T2 20.2	a from Tal Table 9a)  Jul 0.32 steps 3 to 7 20.99  ng from Ta 4 20.24 (see Table 0.26 (follow steps 20.23	ble 9  A 0.3 7 in T 20. able 9 20. 9a) 0.2 eps 3 20.	Th1 (°C)  ug Sep  4 0.52  Table 9c)  98 20.92  9, Th2 (°C)  24 20.23  10 7 in Table  10 7 in Table  11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Oct 0.73 20.65 20.23 0.7 e 9c) 19.81	Nov 0.85 20.2 20.22 19.19	Dec 0.9 19.77 20.22 0.89		(85) (86) (87) (88) (89)
7. Mean intercent Temperature Utilisation factors  Jan (86)m= 0.89  Mean internations (87)m= 19.81  Temperature (88)m= 20.21  Utilisation factors (89)m= 0.88  Mean internations (90)m= 18.63	rnal temper during he ctor for gain and temperary 20.01 during he 20.21 ctor for gain 18.92 distemperary 19.37	erature (eating period ins for line 1 20.3 eating period 20.21 eating 20.21 eati	816.2 (heating eriods in ving are 20.62 eriods in 20.23 est of do 0.68 he rest 19.76  r the wh	season the livin ea, h1,m May 0.58 ea T1 (for 20.84 n rest of 20.23 welling, 0.54 of dwelling 20.05	824.9 ) ng are (see     Jur 0.43  Dllow s 20.9  dwelli 20.2  h2,m 0.38  ing T2 20.2	a from Tal Table 9a)  Jul 0.32 steps 3 to 7 20.99  ng from Ta 20.24 (see Table 0.26 (follow steps 20.23)  = fLA × T1 1 20.54	ble 9  A 0.3 7 in T 20. able 9  20. 9a) 0.2 eps 3 20. + (1 20.	y Th1 (°C)  ug Sep  4 0.52  Table 9c)  98 20.92  9, Th2 (°C)  24 20.23  10 7 in Table  23 20.15  11 - fLA) × T2  12 20.47	Oct 0.73 20.65 20.23 0.7 e 9c) 19.81 LA = Liv	Nov 0.85 20.2 20.22 0.83 19.19 ing area ÷ (-	Dec 0.9 19.77 20.22 0.89		(85) (86) (87) (88) (89)

(93)m= 19.12	19.37	19.72	20.12	20.38	20.51	20.54	20.54	20.47	20.16	19.61	19.08		(93)
8. Space hea	ting req	uirement											
Set Ti to the r			•		ed 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 fac		l		iviay	Juli	Jui	L	Sep	Oct	INOV	Dec		
(94)m= 0.86	0.83	0.77	0.68	0.55	0.4	0.29	0.31	0.49	0.7	0.82	0.87		(94)
Useful gains,	hmGm	, W = (94	1 4)m x (8	1 4)m									
(95)m= 564.21	593.28	593.31	553.34	465.31	330.49	225.37	235.01	348.24	462.88	517.54	547.43		(95)
Monthly avera	age exte	ernal 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	for me	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m	]			•	
(97)m= 893.27	869.37	791.91	661.51	510.14	342.03	228.18	238.84	370.78	561.65	739.85	885.58		(97)
Space heatin	<u> </u>		i	i	T		24 x [(97)	)m – (95	)m] x (4 <sup>-</sup>	ŕ	ı	Ī	
(98)m= 244.81	185.53	147.76	77.89	33.35	0	0	0	0	73.48	160.06	251.58		_
							Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	1174.46	(98)
Space heatin	g requir	ement in	kWh/m²	<sup>2</sup> /year								16.58	(99)
9b. Energy red	quiremer	nts – Cor	mmunity	heating	scheme								
This part is use			• .		•		<b>.</b>	•		unity sch	neme.		_
Fraction of spa	ace heat	from se	condary,	/supplen	nentary I	neating	(Table 1	1) '0' if 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, h Fraction of hea		-			rom powei	r stations.	See Appei	ndix C.				1	(303a)
Fraction of total	al space	heat fro	m Comn	nunity be	oilers				(3	02) x (303	a) =	1	(304a)
Factor for cont	rol and	charging	method	(Table	4c(3)) fo	r comm	unity hea	iting sys	tem			1	(305)
Distribution los	s factor	(Table 1	2c) for o	commun	ity heatii	ng syste	m					1.05	(306)
Space heating	9										,	kWh/yeaı	
Annual space	heating	requiren	nent									1174.46	
Space heat fro	m Com	munity b	oilers					(98) x (30	04a) x (30	5) x (306) =	=	1233.19	(307a)
Efficiency of se	econdar	y/supple	mentary	heating	system	in % (fro	om Table	4a or A	ppendix	E)		0	(308
Space heating	require	ment fro	m secon	dary/su	oplemen	tary sys	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water heating	1												
Annual water h		requirem	ent									2108.87	
If DHW from co								(6.4) × (20	)2a) v (20)	E) v (206)	'	0044.04	_ 
Water heat fro Electricity used		•					0.01	× [(307a).		5) x (306) =		2214.31	(310a) (313)
Cooling Syster				0			0.01	x [(307a).	(307 <del>6</del> ) <del>1</del>	(310a)(	[310 <del>e</del> )] =	34.48	(314)
	_	-	•		a if not a	ntor O		(407)	(24.4)			0	╡
Space cooling	,			•		,		= (107) ÷	(314) =			0	(315)
Electricity for p mechanical ve							outside					245.83	(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) =	245.83	(331)
Energy for lighting (calculated in Appe	ndix L)		328.11	(332)
Electricity generated by PVs (Appendix	x M) (negative quantity)		-716.31	(333)
Electricity generated by wind turbine (A	Appendix M) (negative quantity)		0	(334)
10b. Fuel costs – Community heating	scheme			
	<b>Fuel</b> kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating from CHP	(307a) x	4.24 x 0.01	52.29	(340a)
Water heating from CHP	(310a) x	4.24 x 0.01	93.89	(342a)
		Fuel Price		_
Pumps and fans	(331)	13.19 × 0.01	32.4Z	(349)
Energy for lighting	(332)	13.19 × 0.01	43.28	(350)
Additional standing charges (Table 12)			120	(351)
Energy saving/generation technologies  Total energy cost	<b>S</b> = (340a)(342e) + (345)(354) =		341.88	(355)
11b. SAP rating - Community heating	scheme			
Energy cost deflator (Table 12)			0.42	(356)
Energy cost factor (ECF)	[(355) x (356)] ÷ [(4) + 45.0] =		1.24	(357)
SAP rating (section12)			82.71	(358)
12b. CO2 Emissions – Community hea	ating scheme			
	Ener kWh	gy Emission facto /year kg CO2/kWh	r Emissions kg CO2/year	
CO2 from other sources of space and		rycai kg 002/kwii	ng OOZiyeai	
Efficiency of heat source 1 (%)	<b>3</b> ,	repeat (363) to (366) for the second	fuel 94	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 10	00 ÷ (367b) x 0.22	= 792.19	(367)
Electrical energy for heat distribution	[/212] v		= 17.89	<b>7</b>
	[(313) x	0.52	17.09	(372)
Total CO2 associated with community		0.52 6) + (368)(372)	= 810.08	](372) ](373)
Total CO2 associated with community CO2 associated with space heating (see	systems (363)(366		17.03	_
·	systems (363)(366 econdary) (309) x	5) + (368)(372)	= 810.08	(373)
CO2 associated with space heating (se	systems (363)(366 econdary) (309) x rsion heater or instantaneous heat	6) + (368)(372) 0 er (312) x 0.22	= 810.08	(373)
CO2 associated with space heating (so CO2 associated with water from imme	systems (363)(366) econdary) (309) x rsion heater or instantaneous heat water heating (373) + (374)	6) + (368)(372) 0 er (312) x 0.22 4) + (375) =	= 810.08 = 0 = 0	(373) (374) (375)
CO2 associated with space heating (so CO2 associated with water from imme Total CO2 associated with space and	systems (363)(366) econdary) (309) x rsion heater or instantaneous heat water heating (373) + (374) nps and fans within dwelling (331))	6) + (368)(372) 0 er (312) x 0.22 4) + (375) =	= 810.08 = 0 = 0 810.08	(373) (374) (375) (376)
CO2 associated with space heating (see CO2 associated with water from immed Total CO2 associated with space and CO2 associated with electricity for pure CO2 associated with electricity for light Energy saving/generation technologies	systems (363)(366) econdary) (309) x rsion heater or instantaneous heat water heating (373) + (374) nps and fans within dwelling (331)) ting (332))) x	6) + (368)(372)  o  er (312) x 0.22  4) + (375) =  x 0.52	= 810.08 = 0 = 0 810.08 = 127.58 = 170.29	(373) (374) (375) (376) (378) (379)
CO2 associated with space heating (so CO2 associated with water from imme Total CO2 associated with space and CO2 associated with electricity for pun CO2 associated with electricity for light	systems (363)(366) econdary) (309) x rsion heater or instantaneous heat water heating (373) + (374) nps and fans within dwelling (331)) ting (332))) x	6) + (368)(372)  o  er (312) x 0.22  4) + (375) =  x 0.52	= 810.08 = 0 = 0 810.08 = 127.58 = 170.29	(373) (374) (375) (376) (378)

Dwelling CO2 Emission Rate (383) ÷ (4) =			10.39	(384)
El rating (section 14)			91.49	(385)
13b. Primary Energy – Community heating scheme				
	Energy kWh/year	Primary factor	P.Energy kWh/year	
Energy from other sources of space and water heating (not CF Efficiency of heat source 1 (%)  If there is CHP usi	HP) ng two fuels repeat (363) to	(366) for the second f	iuel 94	(367a)
Energy associated with heat source 1 [(307b)	)+(310b)] x 100 ÷ (367b) x	1.22	= 4474.4	(367)
Electrical energy for heat distribution	[(313) x		= 105.8	4 (372)
Total Energy associated with community systems	(363)(366) + (368)(37	2)	= 4580.2	25 (373)
if it is negative set (373) to zero (unless specified otherwise,	see C7 in Appendix C	C)	4580.2	25 (373)
Energy associated with space heating (secondary)	(309) x	0	= 0	(374)
Energy associated with water from immersion heater or instan	taneous heater(312) x	1.22	= 0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =		4580.2	(376)
Energy associated with space cooling	(315) x	3.07	= 0	(377)
Energy associated with electricity for pumps and fans within de	welling (331)) x	3.07	= 754.6	9 (378)
Energy associated with electricity for lighting	(332))) x	3.07	= 1007.	3 (379)
Energy saving/generation technologies Item 1		3.07 × 0.01	-2199.0	08 (380)
Total Primary Energy, kWh/year sum of (376)	(382) =		4143.1	(383)

		Hear	Details:						
Access Name:	Zabid Ashraf	USEI		. Mirros	hau.		CTDO	001000	
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Stroma Softwa	-				001082 on: 1.0.5.9	
			y Address:						
Address :									
1. Overall dwelling dime	ensions:	_							
Ground floor		Ar	ea(m²) 70.86	(1a) x		ight(m) 2.5	(2a) =	Volume(m <sup>3</sup>	(3a)
	a) (1b) (1a) (1d) (1a)	(1p)				2.5	(2a) -	177.14	(Ja)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)-	+(111)	70.86	(4)	) . (2-) . (2-	4) . (2 -) .	(2-)		_
Dwelling volume				(3a)+(3b)	)+(3C)+(3C	d)+(3e)+	.(3h) =	177.14	(5)
2. Ventilation rate:	main sec	condary	other		total			m³ per hou	r
Number of chimneys	heating he	ating		1 = [			40 =		_
·			0	]	0		20 =	0	(6a)
Number of open flues		0 +	0	] <sup>-</sup> [	0			0	(6b)
Number of intermittent fa				Ļ	3		10 =	30	(7a)
Number of passive vents				Ļ	0		10 =	0	(7b)
Number of flueless gas f	ires			L	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	30		÷ (5) =	0.17	(8)
If a pressurisation test has b	peen carried out or is intended	, proceed to (17)	), otherwise o	ontinue fr			` ′		`` <i>`</i>
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration	.056	2.05.1				[(9)	-1]x0.1 =	0	(10)
	0.25 for steel or timber fra resent, use the value correspond			•	uction			0	(11)
deducting areas of openi		orianig to the gro	ator wan are	a (ano					
•	floor, enter 0.2 (unseale	d) or 0.1 (sea	ıled), else	enter 0				0	(12)
If no draught lobby, en								0	(13)
· ·	s and doors draught stri	pped						0	(14)
Window infiltration			0.25 - [0.2			(45)		0	(15)
Infiltration rate	50 1: 1:		(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 $k$				is heina u	sad		0.42	(18)
Number of sides sheltere		occir done or a d	egree an per	meability	is being a	300		2	(19)
Shelter factor			(20) = 1 - [	0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18)	x (20) =				0.36	(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								
(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		
` '					L			J	

0.45	0.45	0.44	0.39	0.38	0.34	0.34	0.33	0.36	0.38	0.4	0.42		
Calculate effe		•	rate for t	he appli	cable ca	se							
If mechanica												0	(23
If exhaust air h		0		, ,	, ,	. `	,, .	`	) = (23a)			0	(23
If balanced with		•	•	_								0	(23
a) If balance	i	i			1	<del>-                                    </del>	<del>- ^ `</del>	<del>í `</del>	<del> </del>	<del></del>	<del>1 ` ` `</del>	÷ 100]	
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
b) If balance	ı	i			1	<del>, , ,</del>	ЛV) (24b	<del>í `</del>	2b)m + (	<del>-                                    </del>		I	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole h				•	•				E (00k	. \			
	i	(230), t	nen (240	, ,	o); other	· ` `	<del>É `</del>	ŕ	<del>`</del>	<del>í –</del>			(2
	0			0		0	0	0	0	0	0	l	(2
d) If natural if (22b)n					ve input erwise (2				0.51				
24d)m= 0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(2
Effective air	change	rate - er	nter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)			<u>!</u>	l	
25)m= 0.6	0.6	0.6	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59		(2
					l	l	l		l	l		l	
3. Heat losse					<b>N.</b>				A 37.11				
LEMENT	Gros area	-	Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/	K)	k-value kJ/m²-l		A X k kJ/K
oors		` /			2	x	1		2	$\stackrel{\prime}{\Box}$			(2
Vindows Type	e 1				6.097		/[1/( 1.4 )+	0.04] =	8.08	=			(2
Vindows Type					5.107	=  ,	- /[1/( 1.4 )+		6.77	=			(2
loor	_				49.41		0.13		6.42368			- I	(2
Valls Type1	35.7	<u>'2</u>	11.2		24.51	=	0.13	╡ [	4.41			╡ ├─	(2
Valls Type1				_		=		=				╡╠	(2
Valls Type2 Valls Type3	11.		2	_	9.7	×	0.18	=	1.75			╡╠	
	16.7		0		16.76	=	0.18	=	3.02			_	(2
otal area of e			.ffa ativa vui	ndou II v	113.6		, formula 1	/[/1/	10 0 0 0 1	a airan in		. 2.2	(3
for windows and * include the area						ateu using	i iorriiula i	/[( I/ <b>U-</b> VaIU	ie)+0.04j č	as given in	ı paragrapı	3.2	
abric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				32.45	(3
leat capacity	Cm = S(	Axk)						((28).	(30) + (3	2) + (32a).	(32e) =	4419.71	(3
hermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(3
or design assess	sments wh	ere the de	tails of the	construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
an be used inste											,		
hermal bridge	•	,			•	K						13.9	(3
details of therma otal fabric he		are not kn	own (36) =	= 0.05 x (3	31)			(33) +	(36) =			40.00	
entilation hea		alculator	l monthly	,					$= 0.33 \times ($	(25)m v (5	)	46.36	(3
	1	1			lup	lul	Δυα		1	1	<u> </u>	1	
Jan 38)m= 35.27	Feb 35.03	Mar 34.8	Apr 33.72	May 33.52	Jun 32.58	Jul 32.58	Aug 32.41	Sep 32.94	Oct 33.52	33.93	34.36		(3
	I 55.55	I 57.5	00.72	00.02	J 02.00	J 02.00	J 02.71	02.94	00.02	00.90	J50	l	ζ,
,	· · ·								4				
leat transfer of 89)m= 81.62	coefficier 81.39	nt, W/K 81.16	80.08	79.88	78.94	78.94	78.76	(39)m 79.3	= (37) + ( 79.88	38)m 80.28	80.71	<b>!</b>	

Heat loss para	meter (l	-II P) \//	m²K					(40)m	= (39)m ÷	. (4)			
(40)m= 1.15	1.15	1.15	1.13	1.13	1.11	1.11	1.11	1.12	1.13	1.13	1.14		
(40)1112	1.10	1.10	1.10	1.10	1	1	1.11		<u> </u>	Sum(40) <sub>1</sub> .	L	1.13	(40)
Number of day	s in mo	nth (Tab	le 1a)					,	-werage =	Ouiii(40)1.	12 / 12-	1.10	(10)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
		<u> </u>		<u> </u>		<u> </u>		l	<u> </u>	<u> </u>	<u> </u>		
											1200		
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	0, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	ΓFA -13.		27		(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36  Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of											(43)		
not more that 125	litres per	person per	day (all w	ater use, l	not and co	ld) 			_				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage ir	n litres per	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m= 96.84	93.32	89.8	86.27	82.75	79.23	79.23	82.75	86.27	89.8	93.32	96.84		
										m(44) <sub>112</sub> =		1056.42	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D	Tm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 143.61	125.6	129.61	113	108.42	93.56	86.7	99.49	100.67	117.33	128.07	139.08		
<b>*</b>					, ,				Total = Su	m(45) <sub>112</sub> =	=	1385.13	(45)
If instantaneous w	ater neati	ng at point	of use (no	not water	storage),	enter 0 in	boxes (46)	) to (61)					
(46)m= 21.54	18.84	19.44	16.95	16.26	14.03	13	14.92	15.1	17.6	19.21	20.86		(46)
Water storage		منام دار دان د		olor or M	MALLIDO	otoro ao	within or		ool				(47)
Storage volum	` '					•		ame ves	sei		150		(47)
If community h Otherwise if no	•			•			` '	ore) onto	or 'O' in <i>(</i>	(47)			
Water storage		not wate	:i (iiii5 ii	iciuues i	HStaritai	ieous co	יווטם וטוויי	ers) erite	יווו ט ווין	47)			
a) If manufacti		eclared l	oss facto	or is kno	wn (kWł	n/dav):				1	39		(48)
Temperature fa					`	, ,					54		(49)
Energy lost from				oar			(48) x (49)	١ _					, ,
b) If manufacti		_	-		or is not		(40) X (49)	, –		0.	75		(50)
Hot water stora			-								0		(51)
If community h	eating s	ee secti	on 4.3										
Volume factor											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.	75		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (	55) × (41)ı	m				
(56)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(56)
If 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	x H	
(57)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Primary circuit	loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit				,	•	. ,	, ,						
(modified by						ı —			ı —	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$													
(61)m= 0	0	0	0	0 0	00) + 30	05 x (41)	0	0	0	0	0	1	(61)
							<u> </u>		<u> </u>			J · (59)m + (61)m	` ,
(62)m= 190.2	167.69	176.2	158.09	155.02	138.65	133.29	146.08		163.92	173.16	185.67	]	(62)
` '		<u> </u>		<u> </u>		<u> </u>						J	` ,
Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)  (add additional lines if FGHRS and/or WWHRS applies, see Appendix G)													
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(63)
Output from w	ater hea	ter		Į.		ļ.						ı	
(64)m= 190.2	167.69	176.2	158.09	155.02	138.65	133.29	146.08	145.77	163.92	173.16	185.67	]	
				ı			Ou	tput from w	ater heate	r (annual)	12	1933.75	(64)
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]											_		
(65)m= 85.03	75.43	80.37	73.64	73.33	67.18	66.1	70.36	69.55	76.29	78.66	83.52	]	(65)
include (57)	m in cald	culation (	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is f	rom com	munity h	neating	
5. Internal g	ains (see	Table 5	and 5a	):									
Metabolic gains (Table 5), Watts													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
(66)m= 113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	113.34	]	(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	on L9 o	r L9a), a	lso see	Table 5				•	
(67)m= 18.58	16.5	13.42	10.16	7.59	6.41	6.93	9.01	12.09	15.35	17.91	19.1	]	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m= 199.29	201.35	196.14	185.05	171.05	157.88	149.09	147.02	152.23	163.33	177.33	190.49	]	(68)
Cooking gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a	, also s	see Table	5			-	
(69)m= 34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	]	(69)
Pumps and fa	ns gains	(Table 5	<del></del>									-	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3	]	(70)
Losses e.g. ev	vaporatio	n (nega	tive valu	es) (Tab	le 5)		=	-	-	-			
(71)m= -90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	-90.67	]	(71)
Water heating	gains (T	able 5)	-	-		-	-	-	-	-	-	-	
(72)m= 114.28	112.25	108.03	102.28	98.56	93.31	88.85	94.56	96.59	102.54	109.25	112.26	]	(72)
Total internal	gains =	:			(66)	)m + (67)m	ı + (68)m	+ (69)m +	(70)m + (7	'1)m + (72)	)m		
(73)m= 392.15	390.11	377.59	357.49	337.2	317.6	304.87	310.59	320.92	341.21	364.49	381.85	]	(73)
6. Solar gain	s:												
Solar gains are	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to d	convert to th	ne applical	ole orientat	tion.		
Orientation:			Area		Flu			g_ Tabla 6b	-	FF		Gains	
_	Table 6d		m²		Tai	ble 6a	. –	Table 6b	_ '	able 6c		(W)	7
Southeast 0.9x	0.77	X	6.	1	x 3	36.79	X	0.63	X	0.7	=	68.56	(77)
Southeast 0.9x	0.77	X	6.	1	x 6	62.67	X	0.63	X	0.7	=	116.78	(77)
Southeast 0.9x	0.77	X	6.	1	x8	35.75	x	0.63	X	0.7	=	159.78	(77)
Southeast 0.9x	0.77	Х	6.	1	x 1	06.25	х	0.63	x	0.7	=	197.98	(77)
Southeast 0.9x	0.77	X	6.	1	x 1	19.01	X	0.63	X	0.7	=	221.76	(77)

_								-						
Southeast <sub>0.9x</sub>	0.77	X	6.	1	X	1	18.15	X	0.63	X	0.7	=	220.15	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.	1	X	1	13.91	X	0.63	X	0.7	=	212.25	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.′	1	X	1	04.39	X	0.63	X	0.7	=	194.51	(77)
Southeast 0.9x	0.77	X	6.1	1	X	9	2.85	X	0.63	X	0.7	=	173.01	(77)
Southeast 0.9x	0.77	X	6.	1	X	6	9.27	X	0.63	X	0.7	=	129.07	(77)
Southeast <sub>0.9x</sub>	0.77	X	6.′	1	X	4	4.07	x	0.63	X	0.7	=	82.12	(77)
Southeast 0.9x	0.77	X	6.′	1	X	3	31.49	x	0.63	X	0.7	=	58.67	(77)
Northwest <sub>0.9x</sub>	0.77	X	5.1	1	X	1	1.28	x	0.63	x	0.7	=	17.61	(81)
Northwest <sub>0.9x</sub>	0.77	X	5.1	1	X	2	22.97	x	0.63	x	0.7	=	35.85	(81)
Northwest 0.9x	0.77	X	5.1	1	X	4	1.38	x	0.63	x	0.7	=	64.58	(81)
Northwest <sub>0.9x</sub>	0.77	X	5.1	1	x	6	7.96	x	0.63	X	0.7	=	106.06	(81)
Northwest <sub>0.9x</sub>	0.77	X	5.1	1	x	9	1.35	х	0.63	X	0.7	=	142.57	(81)
Northwest <sub>0.9x</sub>	0.77	x	5.1	1	X	9	7.38	x	0.63	x	0.7		151.99	(81)
Northwest <sub>0.9x</sub>	0.77	X	5.1	1	x	9	91.1	x	0.63	X	0.7	=	142.19	(81)
Northwest <sub>0.9x</sub>	0.77	X	5.1	1	x	7	2.63	x	0.63	X	0.7		113.35	(81)
Northwest <sub>0.9x</sub>	0.77	x	5.1	1	X	5	50.42	x	0.63	x	0.7		78.69	(81)
Northwest <sub>0.9x</sub>	0.77	x	5.1	1	X	2	28.07	x	0.63	x	0.7	_ =	43.81	(81)
Northwest <sub>0.9x</sub>	0.77	X	5.1	1	x ·		14.2	x	0.63	X	0.7	=	22.16	(81)
Northwest <sub>0.9x</sub>	0.77	x	5.1	1	X	9	9.21	x	0.63	x	0.7	_ =	14.38	(81)
Solar gains in					_	70.45		ÈΈ	n = Sum(74)m			70.05	1	(02)
(83)m= 86.17   152.63   224.37   304.04   364.32   372.15   354.44   307.87   251.71   172.87   104.28   73.05   Total gains – internal and solar (84)m = (73)m + (83)m , watts														
(84)m= 478.32		601.96	661.54	701.52	·	89.75	659.3	618	.46 572.62	514.0	9 468.77	454.9	7	(84)
` '						03.73	009.5	010	.40   372.02	314.0	9   400.77	434.9		(04)
7. Mean inter			`						<b>-</b>					<b>–</b>
Temperature	•	•			_			ole 9	, Th1 (°C)				21	(85)
Utilisation fac	<del></del>				Ť						1		7	
Jan	Feb	Mar	Apr	May	+	Jun	Jul	<del>                                     </del>	ug Sep	Oct		Dec	_	(86)
(86)m= 1	0.99	0.98	0.95	0.86		0.69	0.52	0.5	0.82	0.97	0.99	1		(00)
Mean interna		1			1		i	1		1		ī	٦	
(87)m= 19.83	19.98	20.22	20.55	20.81	2	20.96	20.99	20.	99 20.89	20.55	20.14	19.8		(87)
Temperature	during he	ating p	eriods ir	rest of	dw	elling/	from Ta	able 9	9, Th2 (°C)				_	
(88)m= 19.96	19.96	19.96	19.98	19.98	1	9.99	19.99	19.	99 19.99	19.98	19.97	19.97		(88)
Utilisation fac	tor for gai	ns for r	est of d	welling,	h2	,m (se	e Table	9a)					_	
(89)m= 1	0.99	0.98	0.93	0.81		0.6	0.4	0.4	5 0.74	0.95	0.99	1		(89)
Mean interna	l temperat	ure in t	he rest	of dwell	ing	T2 (f	ollow ste	eps 3	to 7 in Tab	le 9c)				
(90)m= 18.4	18.63	18.98	19.45	19.8	1	9.96	19.99	19.	99 19.9	19.47	18.87	18.38		(90)
									1	fLA = Li	√ing area ÷ (	4) =	0.41	(91)
Mean interna	l temperat	ure (fo	r the wh	ole dwe	ellin	g) = fl	LA × T1	+ (1	– fLA) × T2					
(92)m= 18.99	19.19	19.5	19.9	20.22	_	20.37	20.4	20	<del>- i -</del>	19.92	19.39	18.97	]	(92)
Apply adjustr	nent to the	mean	internal	tempe	atu	ire fro	m Table	4e,	where appro	opriate	:	<u>I</u>	_	

(02)	40.00	10.10	40.5	40.0	20.22	20.27	20.4	00.4	20.24	40.00	40.00	40.07	1	(93)
(93)m=	18.99	19.19	19.5	19.9	20.22	20.37	20.4	20.4	20.31	19.92	19.39	18.97		(93)
			uirement				44 -4	Table 0	41	4 T: /	70)	-11-	lete	
			or gains			ed at ste	ер ттог	rable 9	o, so tha	t 11,m=(	rojm an	d re-calc	culate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			ains, hm					,					•	
(94)m=	0.99	0.99	0.97	0.93	0.82	0.63	0.45	0.5	0.77	0.95	0.99	1		(94)
Usefu			W = (94)	<del></del>			ı	,			1	1	•	
(95)m=	475.45	536.4	586.15	615.22	577.53	436.01	297.36	310.31	440	487.27	463.12	452.75		(95)
Monthly average external temperature from Table 8											•			
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
							<del>-``</del>	<del>- `                                   </del>	– (96)m				•	
	1199.22				680.47	455.82	300.22	315.13	492.76	744.4	986.83	1191.83		(97)
Space			ı	r each n	nonth, k\	Wh/mon	th = 0.02	24 x [(97	)m – (95	)m] x (4	1)m		•	
(98)m=	538.48	420.86	348.73	191.49	76.59	0	0	0	0	191.3	377.07	549.88		_
								Tota	l per year	(kWh/yeaı	r) = Sum(9	8)15,912 =	2694.4	(98)
Space	e heatin	g require	ement in	kWh/m²	<sup>2</sup> /year								38.03	(99)
9a En	erav rea	uiremer	nts – Indi	vidual h	eating sy	vstems i	ncluding	micro-C	'HPI					
	e heatir		ito iriai	Madai II	caming 5	y Storris r	ricidaling	inicio c	<i>/</i>					
•		•	at from so	econdar	v/supple	mentarv	svstem						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)			
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 A
Space			ement (c	<u> </u>			1	1					, , , , , ,	
•	538.48	420.86	348.73	191.49	76.59	0	0	0	0	191.3	377.07	549.88		
(211)m	 	m x (20	)4)] } x 1	00 ÷ (20	16)		ļ				!		l	(211)
(211)11	575.92	450.11	372.98	204.8	81.91	0	0	0	0	204.6	403.28	588.1		(=::)
									l (kWh/yea				2881.71	(211)
Cnaa	o bootin	a fuel /e		\ Id\/b/	manth					(	/15,1012		2001.71	_(=,
•		• '	econdar 00 ÷ (20	• •	monun									
(215)m=		0	0 . (20	0	0	0	0	0	0	0	0	0		
( - /		_							l (kWh/yea	ar) =Sum(2	1 215), <sub>540 4</sub> ,	=	0	(215)
Motor	hootine									(	- /15,1012		0	_(=.0)
	heating		ter (calc	ulated a	hove)									
Output	190.2	167.69	176.2	158.09	155.02	138.65	133.29	146.08	145.77	163.92	173.16	185.67		
Efficier	ncy of w	ater hea	ıter						l		l	l	79.8	(216)
(217)m=		87.17	86.6	85.33	83.05	79.8	79.8	79.8	79.8	85.23	86.84	87.54		」` (217)
. ,			kWh/mo		_						<u> </u>	<u>I</u>	I	•
		•	) ÷ (217)											
	217.53	192.37	203.46	185.27	186.66	173.75	167.03	183.06	182.66	192.34	199.41	212.11		
								Tota	I = Sum(2	19a) <sub>112</sub> =		•	2295.66	(219)
Annua	al totals									k'	Wh/year	•	kWh/year	_
Space	heating	fuel use	ed, main	system	1						=		2881.71	
												!	-	_

Water heating fuel used				2295.66	٦							
Electricity for pumps, fans and electric keep-hot					_							
central heating pump:			30	1	(230c)							
boiler with a fan-assisted flue			45	]	(230e)							
Total electricity for the above, kWh/year	sum of (230		75	(231)								
Electricity for lighting				328.11	(232)							
12a. CO2 emissions – Individual heating systems including micro-CHP												
	<b>Energy</b> kWh/year	Emission fac	ctor	Emissions kg CO2/yea								
Space heating (main system 1)	(211) x	0.216	=	622.45	(261)							
Space heating (secondary)	(215) x	0.519	=	0	(263)							
Water heating	(219) x	0.216	=	495.86	(264)							
Space and water heating	(261) + (262) + (263) + (264) =			1118.31	(265)							
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)							
Electricity for lighting	(232) x	0.519	=	170.29	(268)							
Total CO2, kg/year	sui	m of (265)(271) =		1327.52	(272)							

TER =

(273)

18.74