#### **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 14:55:28

Project Information:

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

Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.61m<sup>2</sup> Plot Reference: Site Reference : Hermitage Lane Plot 1

Address:

Client Details:

Name: Address:

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 23.15 kg/m<sup>2</sup>

Dwelling Carbon Dioxide Emission Rate (DER) 15.42 kg/m<sup>2</sup> OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 65.4 kWh/m<sup>2</sup>

Dwelling Fabric Energy Efficiency (DFEE) 49.3 kWh/m<sup>2</sup>

OK

2 Fabric U-values

**Element Highest Average** 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 0.10 (max. 0.20) 0.10 (max. 0.35) OK **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

No cylinder thermostat Hot water controls:

No cylinder

OK

# **Regulations Compliance Report**

- 1 P 12		
7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK
8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.91	
Maximum	1.5	OK
MVHR efficiency:	93%	
Minimum	70%	OK
9 Summertime temperature		
Overheating risk (Thames valley):	Medium	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: South West	8.65m <sup>2</sup>	
Ventilation rate:	4.00	
10 Key features		
Air permeablility	3.0 m³/m²h	
Roofs U-value	0.1 W/m <sup>2</sup> K	
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		

		l Isar	Details:						
Assessor Name:	Zahid Ashraf	0301	Stroma	. Num	hor		STDO	001082	
Software Name:	Stroma FSAP 2012	2	Softwa	-				n: 1.0.5.9	
		Propert	y Address:	Plot 1					
Address :									
Overall dwelling dime	ensions:	•	( 2)		A 11-	' l. (/)		M = 1, = / 2	<u> </u>
Ground floor		Ai	rea(m²) 50.61	(1a) x		ight(m) 2.5	(2a) =	Volume(m³	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)-	-		(4)			]` ''	120.00	
Dwelling volume	۵,۰(۱۵,۰(۱۵,۰(۱۵,۰		30.01		)+(3c)+(3c	d)+(3e)+	.(3n) =	106.50	7(5)
				(54) (54)	,	2) ( ( 0 0 )	.(01.)	126.53	(5)
2. Ventilation rate:		condary	other		total			m³ per hou	r
Number of chimneys	heating he	eating +	0	] = [	0	x	40 =	0	(6a)
Number of open flues	0 +	0 +	0	Ј <u>Г</u>	0	x	20 =	0	(6b)
Number of intermittent fa					0	x	10 =	0	(7a)
Number of passive vents				L	0	x	10 =	0	(7b)
Number of flueless gas f				L	0		40 =		(7c)
Number of flueless gas fi	1163				0			0	(70)
							Air ch	anges per ho	ur
Infiltration due to chimne	ys, flues and fans = (6a)	)+(6b)+(7a)+(7b)	)+(7c) =	Γ	0		÷ (5) =	0	(8)
	peen carried out or is intended	l, proceed to (17	), otherwise o	ontinue fr	om (9) to	(16)	,		_ 
Number of storeys in the Additional infiltration	ne aweiling (ns)					[(0)]	-1]x0.1 =	0	(9) (10)
	.25 for steel or timber fr	ame or 0.35	for masonr	v constr	uction	[(0)	1]XO.1 =	0	(11)
	resent, use the value correspo	onding to the gre	eater wall are	a (after					<b>`</b>
deducting areas of opening	ngs); if equal user 0.35 floor, enter 0.2 (unseale	d) or 0.1 (sea	aled) else	enter ()			i	0	(12)
If no draught lobby, en	•	u) 01 0.1 (308	aica), cisc	critor o				0	(13)
•	s and doors draught stri	pped						0	(14)
Window infiltration	-		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	2) + (13)	+ (15) =		0	(16)
•	q50, expressed in cubic	-	•	•	etre of e	envelope	area	3	(17)
If based on air permeabil	•							0.15	(18)
Air permeability value applie  Number of sides sheltere	es if a pressurisation test has l	been done or a d	degree air pei	meability	is being u	sed		2	(19)
Shelter factor	,u		(20) = 1 -	0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18)	x (20) =				0.13	(21)
Infiltration rate modified f	or monthly wind speed								_
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		
			•		•	•		1	

		e (allowi				<u> </u>	(21a) x	(22a)m	•			ı	
0.16 Calculate effe	0.16	0.16	0.14	0.14 he appli	0.12 cable ca	0.12 Se	0.12	0.13	0.14	0.14	0.15		
If mechanica		_	ato for t	пс арри	oabio oa	00					[	0.5	(23a
If exhaust air h	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b	) = (23a)		İ	0.5	(23b
If balanced with	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	entilation	with hea	at recove	ery (MVI	HR) (24a	n)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	ı	(24a
b) If balance	d mech	anical ve	ntilation	without	heat rec	overy (N	ЛV) (24b	)m = (22	2b)m + (2	23b)			
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	ı	(24b
c) If whole h if (22b)r		tract ver < (23b), t		•					5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	ı	(240
d) If natural if (22b)r		on or wh en (24d)		•	•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0	ı	(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	ı	(25)
3. Heat losse	s and he	eat loss r	paramete	er:									
ELEMENT	Gros		Openin		Net Ar	ea	U-valı	re	AXU		k-value	• A	Χk
	area	(m²)	'n		A ,r	n²	W/m2	K	(W/I	<)	kJ/m²-ł	( kJ	J/K
Doors					2	X	1.4	=	2.8				(26)
Windows					8.651	x1,	/[1/( 1.4 )+	0.04] =	11.47				(27)
Floor					32.84	9 x	0.12	=	3.94188	3			(28)
Walls Type1	41.9	98	8.65		33.33	X	0.15	= [	5				(29)
Walls Type2	21.2	26	2		19.26	x	0.14	= [	2.76				(29)
Walls Type3	20.7	72	0		20.72	<u>x</u>	0.13	= [	2.77				(29)
Roof	7.9	)	0		7.9	X	0.1	= [	0.79				(30)
Total area of e	lements	, m²			124.7	,							(31)
* for windows and						ated using	formula 1	/[(1/U-valu	e)+0.04] a	s given in	paragraph	3.2	
** include the area				ls and pan	titions		(26)(30)	± (32) =			i		<b>—</b> (00)
Fabric heat los		,	U)				(20)(30)	` '	.(30) + (32	2) + (225)	(220) -	29.53	(33)
Heat capacity Thermal mass		. ,	) – Cm ·	TEA) ir	k I/m2k			** /	tive Value	, , ,	(326) =	4710.71	(34)
For design assess	•	•		,			ecisely the				able 1f	100	(35)
can be used inste				00//01/00		, p.	<i></i>						
Thermal bridg	es : S (L	x Y) cal	culated (	using Ap	pendix ł	<						13.29	(36)
if details of therma Total fabric he		are not kn	own (36) =	= 0.05 x (3	11)			(33) +	(36) =		ĺ	42.81	(37)
Ventilation hea	at loss ca	alculated	l monthly	/				(38)m	= 0.33 × (	25)m x (5)	)		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ı	
	11.03	10.9	10.23	10.1	9.43	9.43	9.3	9.7	10.1	10.36	10.63	ı	(38)
(38)m= 11.16	11.00												
` ′	<u> </u>	nt, W/K			•			(39)m	= (37) + (37)	38)m			
(38)m= 11.16 Heat transfer (39)m= 53.98	<u> </u>	nt, W/K 53.71	53.04	52.91	52.25	52.25	52.11	(39)m 52.51	= (37) + (3 52.91	38)m 53.18	53.44		

Heat loss par	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.07	1.06	1.06	1.05	1.05	1.03	1.03	1.03	1.04	1.05	1.05	1.06		
		!	Į.	Į.	Į.	Į.	<u> </u>		Average =	Sum(40) <sub>1</sub>	12 /12=	1.05	(40)
Number of da	ays 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 he	ating ene	rgy requ	irement:								kWh/ye	ear:	
Assumed occ if TFA > 13 if TFA £ 13	3.9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		71		(42)
Annual avera Reduce the annu not more that 12	ual average	hot water	usage by	5% if the $c$	lwelling is	designed t			se target o		3.7		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage	in litres pe	r day for ea			ctor from	Table 1c x		! '	!	!			
(44)m= 86.57	83.42	80.28	77.13	73.98	70.83	70.83	73.98	77.13	80.28	83.42	86.57		
										m(44) <sub>112</sub> =	L	944.43	(44)
Energy content	of hot water	used - cal	culated mo	onthly = $4$ .	190 x Vd,r	n x nm x C	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 128.38	112.29	115.87	101.02	96.93	83.64	77.51	88.94	90	104.89	114.49	124.33		
If instantaneous	water heat	na ot noin	of upo (no	hot water	r otorogol	antar O in	hoves (16		Total = Su	m(45) <sub>112</sub> =	- [	1238.3	(45)
			`	·	, , , , , , , , , , , , , , , , , , ,	·	· · ·	, , , <del>,</del>	1	1	<del></del> 1		(40)
(46)m= 19.26 Water storag	1	17.38	15.15	14.54	12.55	11.63	13.34	13.5	15.73	17.17	18.65		(46)
Storage volui		) includir	na anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community	,					_							( )
Otherwise if r	_			_			, ,	ers) ente	er '0' in (	(47)			
Water storag													
a) If manufac	cturer's d	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature	factor fro	m Table	2b								0		(49)
Energy lost fr		•					(48) x (49)	) =		1	10		(50)
b) If manufacture Hot water sto			-								00		(51)
If community	•			G Z (KVV	ii/iiti G/GC	iy <i>)</i>				0.	02		(31)
Volume facto	•									1.	.03		(52)
Temperature	factor fro	m Table	2b							0	.6		(53)
Energy lost fr	om wate	r storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter (50) or	(54) in (	55)								1.	.03		(55)
Water storag	e loss cal	culated t	for each	month			((56)m = (	(55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contai	ns dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	x H	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circu	it loss (ar	nual) fro	m Table	3				•	•		0		(58)
Primary circu	`	,			59)m = (	(58) ÷ 36	65 × (41)	ım			-		` '
(modified b				,	•	. ,	, ,		r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss c	alculated	for each	month (	′61)m =	(60) ÷	365 × (41	)m						
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(61)
	uired for	water he	eating ca	alculated	l for ea	ch month	(62)n	1 = 0.85 ×	(45)m +	(46)m +	(57)m +	- (59)m + (61)m	
(62)m= 183.66	<del>-</del>	171.15	154.51	152.21	137.14		144.2	_	160.17	167.99	179.61	]	(62)
Solar DHW input	t calculated	using App	endix G oı	· Appendix	H (nega	ative quantit	y) (ente	r '0' if no sola	ar contribu	tion to wat	er heating)	) L	
(add addition													
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(63)
Output from v	water hea	ter						•	•	•	•	-	
(64)m= 183.66	162.21	171.15	154.51	152.21	137.14	1 132.78	144.2	2 143.5	160.17	167.99	179.61	]	
							C	utput from w	vater heate	er (annual)	112	1889.14	(64)
Heat gains fro	om water	heating,	kWh/m	onth 0.2	5 ′ [0.8	5 × (45)m	า + (61	)m] + 0.8	x [(46)m	+ (57)m	+ (59)m	າ ]	
(65)m= 86.91	77.28	82.75	76.38	76.45	70.61	69.99	73.7	9 72.72	79.1	80.86	85.56	]	(65)
include (57	)m in cald	culation of	of (65)m	only if c	ylinde	is in the	dwellir	ng or hot v	vater is f	rom com	munity l	- neating	
5. Internal of	gains (see	e Table 5	and 5a	):									
Metabolic gai	ns (Table	e 5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	]	
(66)m= 85.41	85.41	85.41	85.41	85.41	85.41	85.41	85.4	1 85.41	85.41	85.41	85.41	]	(66)
Lighting gains	s (calcula	ted in Ap	pendix	L, equat	ion L9	or L9a), a	also se	e Table 5				_	
(67)m= 13.67	12.14	9.87	7.48	5.59	4.72	5.1	6.63	8.89	11.29	13.18	14.05	]	(67)
Appliances g	ains (calc	ulated in	Append	dix L, eq	uation	L13 or L1	3a), a	lso see Ta	able 5		-	-	
(68)m= 148.82	150.37	146.47	138.19	127.73	117.9	111.34	109.7	9 113.68	121.97	132.43	142.25	]	(68)
Cooking gain	s (calcula	ted in A	ppendix	L, equat	ion L1	5 or L15a	), also	see Table	e 5	•		-	
(69)m= 31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.5	31.54	31.54	31.54	31.54	]	(69)
Pumps and fa	ans gains	(Table 5	ōa)			•		•				-	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)	•		•	•	•		-	
(71)m= -68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.3	2 -68.32	-68.32	-68.32	-68.32	]	(71)
Water heating	g gains (T	able 5)				•				-		-	
(72)m= 116.81	115	111.22	106.09	102.76	98.06	94.08	99.1	9 101	106.31	112.31	115	]	(72)
Total interna	ıl gains =				(6	66)m + (67)n	n + (68)	m + (69)m +	(70)m + (	71)m + (72	)m	-	
(73)m= 327.93	326.12	316.19	300.37	284.7	269.3	259.13	264.2	2 272.2	288.19	306.54	319.93	]	(73)
6. Solar gair	ns:												
Solar gains are	calculated	using sola	r flux from	Table 6a	and asso	ociated equa	ations to	convert to t	he applica	ble orienta	tion.		
Orientation:			Area			lux		g_ Table 6b	. 7	FF		Gains	
	Table 6d		m²		'	able 6a	, ,	Table 60	·	able 6c		(W)	,
Southwest <sub>0.9x</sub>		X	8.6	35	x	36.79	ļĻ	0.63	X	0.7	=	97.28	(79)
Southwest <sub>0.9x</sub>		X	8.6	S5	x	62.67	ļ	0.63	x	0.7	=	165.7	(79)
Southwest <sub>0.9x</sub>		X	8.6	S5	x	85.75	ŢĒ	0.63	x	0.7	=	226.72	(79)
Southwest <sub>0.9x</sub>		Х	8.6	S5	x	106.25	Ţ	0.63	x	0.7	=	280.91	(79)
Southwest <sub>0.9x</sub>	0.77	X	8.6	35	X	119.01		0.63	X	0.7	=	314.65	(79)

Southw	/est <sub>0.9x</sub>	0.77	x	8.6	55	x	1	18.15	]		0.63	x	0.7	=	312.37	(79)
Southw	est <sub>0.9x</sub>	0.77	x	8.6	55	X	1	13.91	Ī		0.63	x	0.7		301.16	(79)
Southw	/est <sub>0.9x</sub>	0.77	х	8.6	55	X	1	04.39	Ī		0.63	×	0.7		275.99	(79)
Southw	est <sub>0.9x</sub>	0.77	х	8.6	55	X	9	92.85	Ī		0.63	x	0.7	=	245.49	(79)
Southw	est <sub>0.9x</sub>	0.77	х	8.6	55	x	6	9.27	Ī		0.63	x [	0.7	<del>=</del> =	183.13	(79)
Southw	/est <sub>0.9x</sub>	0.77	Х	8.6	55	x		14.07	j		0.63	×	0.7		116.52	(79)
Southw	est <sub>0.9x</sub>	0.77	X	8.6	55	X	3	31.49	ĺ		0.63		0.7	╡ -	83.25	(79)
	L								J							
Solar o	gains in	watts, ca	alculated	for eacl	n month	1			(83)m	n = Si	um(74)m .	(82)m				
(83)m=	97.28	165.7	226.72	280.91	314.65	3	12.37	301.16	275	.99	245.49	183.13	116.52	83.25		(83)
Total g	gains – i	nternal a	and solar	(84)m =	(73)m	+ (	83)m	, watts								
(84)m=	425.2	491.82	542.91	581.29	599.34	5	81.68	560.29	540	.22	517.69	471.33	423.05	403.18		(84)
7. Me	an inte	nal temp	perature	(heating	seasor	n)										
Temp	erature	during h	neating p	eriods ir	the livi	ng	area	from Tal	ble 9	, Th	1 (°C)				21	(85)
Utilisa	ation fac	ctor for g	ains for I	iving are	ea, h1,m	า (ร	ee Ta	ıble 9a)								
	Jan	Feb	Mar	Apr	May		Jun	Jul	А	ug	Sep	Oct	Nov	Dec		
(86)m=	0.93	0.9	0.85	0.77	0.66		0.52	0.39	0.4	12	0.59	0.79	0.9	0.94		(86)
Mean	interna	l temper	ature in	living are	ea T1 (f	ollo	w ste	ps 3 to 7	7 in T	able	e 9c)					
(87)m=	19.16	19.45	19.84	20.29	20.64	_	20.87	20.96	20.		20.8	20.35	19.68	19.1		(87)
Temr	erature	durina h	neating p	eriods ir	rest of	-dw	elling	from Ta	able 9	——. 9 Th	n2 (°C)		•	!		
(88)m=	20.03	20.03	20.03	20.04	20.05	_	20.06	20.06	20.		20.05	20.05	20.04	20.04		(88)
l Itilio	ation fac	tor for a	ains for i	est of d	vollina	h2	m (se	o Tablo	(02)			<u> </u>	-1	!		
(89)m=	0.92	0.88	0.83	0.74	0.62	$\overline{}$	0.45	0.31	0.3	34	0.53	0.76	0.88	0.93		(89)
												<u> </u>	1			` /
(90)m=	17.59	18 18	ature in	19.18	19.65	Ť	12 (f 9.94	20.03	20.		19.86	e 9c) 19.28	18.35	17.51		(90)
(50)111=	17.00	10	10.00	13.10	13.03	Т.	3.54	20.00	20.	.02		<u> </u>	ing area ÷ (4		0.65	(91)
													3 (	,	0.00	(0.)
		<del></del>	ature (fo			_		1	<del>-</del>			40.07	1 40 00	10.54	1	(92)
(92)m=	18.61	18.94	19.39	19.9	20.3		20.55	20.63	20.		20.47	19.97	19.22	18.54		(92)
(93)m=	18.61	18.94	he mean 19.39	19.9	20.3	_	20.55	20.63	20.		20.47	19.97	19.22	18.54		(93)
			uirement		20.0		0.00	20.00		<u></u>	20.17	10.07	10.22	10.01		(3-2)
•					e obtair	ned	at st	ep 11 of	Tabl	le 9b	o, so tha	t Ti.m=	(76)m an	d re-calc	culate	
			or gains								,	,				
	Jan	Feb	Mar	Apr	May		Jun	Jul	А	ug	Sep	Oct	Nov	Dec		
			ains, hm			_			i						Ī	
(94)m=	0.9	0.87	0.81	0.74	0.63	Ľ	0.49	0.36	0.3	39	0.56	0.75	0.86	0.91		(94)
		T .	, W = (94	<u> </u>		Τ.			T				T		Ī	(0.5)
(95)m=	383.37	425.68	442.32	427.79	375.92		83.01	201.86	209	0.12	291.13	354.99	365.85	367.4		(95)
(96)m=	niy aver	age exte	rnal tem	8.9	11.7	$\overline{}$	e 8 14.6	16.6	16	1	14.1	10.6	7.1	4.2		(96)
		Į	an intern										1 /.1	4.4		(50)
(97)m=	772.22	756.04	692.32	583.52	454.87	_	10.67	210.61	220		334.53	J 495.82	644.27	766.56		(97)
			ement fo			_										• •
(98)m=	289.31	222	186	112.13	58.74	Τ	0	0	0		0	104.78		296.98		
															I	

	Total per year (kWh/year) = Sum(98) <sub>15,912</sub> =	1470.39	(98)
Space heating requirement in kWh/m²/year		29.05	(99)
9b. Energy requirements – Community heating scheme			
This part is used for space heating, space cooling or water heating praction of space heat from secondary/supplementary heating (Tab		0	(301)
Fraction of space heat from community system $1 - (301) =$	·	1	(302)
The community scheme may obtain heat from several sources. The procedure allow-	۱ s for CHP and up to four other heat sources; th	ne latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See A Fraction of heat from Community boilers	Appendix C.	1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community			(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating	l	kWh/yea	
Annual space heating requirement		1470.39	٦
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1543.91	(307a)
Efficiency of secondary/supplementary heating system in % (from T	able 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating Annual water heating requirement	[	1889.14	7
If DHW from community scheme:	ا		<b>⊿</b> ¬
Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1983.59	(310a)
Electricity used for heat distribution	$0.01 \times [(307a)(307e) + (310a)(310e)] =$	35.28	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outs	side	175.59	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	175.59	(331)
Energy for lighting (calculated in Appendix L)		241.42	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-510.48	(333)
Electricity generated by wind turbine (Appendix M) (negative quantit	ty)	0	(334)
12b. CO2 Emissions – Community heating scheme			
	Energy Emission factor   kWh/year kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)  Efficiency of heat source 1 (%)  If there is CHP using two	fuels repeat (363) to (366) for the second fuel	94	(367a)
CO2 associated with heat source 1 [(307b)+(310b	o)] x 100 ÷ (367b) x 0.22 =	810.58	(367)
Electrical energy for heat distribution [(313	0.52 =	18.31	(372)

Total CO2 associated with community sys	stems	(363)(366) + (368)(372	2)	=	828.88	(373)
CO2 associated with space heating (second	ndary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion	on heater or instanta	neous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space and wat	er heating	(373) + (374) + (375) =			828.88	(376)
CO2 associated with electricity for pumps	and fans within dwe	elling (331)) x	0.52	=	91.13	(378)
CO2 associated with electricity for lighting	J	(332))) x	0.52	=	125.3	(379)
Energy saving/generation technologies (3 Item 1	33) to (334) as appl	cable	0.52 x 0.01	= [	-264.94	(380)
Total CO2, kg/year	sum of (376)(382) =				780.37	(383)
Dwelling CO2 Emission Rate	383) ÷ (4) =				15.42	(384)
El rating (section 14)					89.06	(385)

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

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

Property Details: Plot 1

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: No Number of storeys: 1

Front of dwelling faces: North East

Overshading: Average or unknown

None

Thermal mass parameter: Indicative Value Low

**Night ventilation:** False

Blinds, curtains, shutters:

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

Overheating Details

Summer ventilation heat loss coefficient: 167.02 (P1)

Transmission heat loss coefficient: 42.8

Summer heat loss coefficient: 209.83 (P2)

Overhangs:

Overhangs:

Orientation: Ratio: Z\_overhangs:

South West (SW) 0 1

Solar shading:

Orientation:Z blinds:Solar access:Overhangs:Z summer:South West (SW)10.910.9

Solar gains:

Orientation FF Area Flux Shading Gains  $g_{-}$ 119.92 0.9 370.59 South West (SW) 0.9 x8.65 0.63 0.7 **Total** 370.59 (P3/P4)

Internal gains:

June July **August** 360.74 Internal gains 366.95 354.11 755.98 724.7 (P5) Total summer gains 706.45 Summer gain/loss ratio 3.6 3.45 3.37 (P6) Mean summer external temperature (Thames valley) 16 17.9 17.8 Thermal mass temperature increment 1.3 1.3 1.3 (P7) Threshold temperature 20.9 22.65 22.47 Likelihood of high internal temperature Slight Medium Medium

Assessment of likelihood of high internal temperature: Medium

		l lser I	Details:											
Assessor Name: Software Name:	sessor Name: Zahid Ashraf Stroma Number: ST oftware Name: Stroma FSAP 2012 Software Version: Ver Property Address: Plot 1													
	F	roperty	Address	: Plot 1										
Address: 1. Overall dwelling dime	oneione:													
1. Overall awelling aime	511310113.	Are	a(m²)		Av. He	ight(m)		Volume(m <sup>3</sup>	<sup>3</sup> )					
Ground floor				(1a) x		2.5	(2a) =	126.53	(3a)					
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	50.61	(4)			_							
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	.(3n) =	126.53	(5)					
2. Ventilation rate:														
	main seconda heating heating	ry	other		total			m³ per hou	ır					
Number of chimneys	0 + 0	7 + [	0	=	0	X 4	40 =	0	(6a)					
Number of open flues	0 + 0	<u> </u>	0	Ī = Ī	0	x 2	20 =	0	(6b)					
Number of intermittent fa	ins				2	x <sup>2</sup>	10 =	20	(7a)					
Number of passive vents	3			Ē	0	x ′	10 =	0	(7b)					
Number of flueless gas f	ires				0	X 4	40 =	0	(7c)					
				_				_						
				_			Air ch	nanges per ho	our —					
	ys, flues and fans = (6a)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b			continuo fi	20		÷ (5) =	0.16	(8)					
Number of storeys in t		u 10 (17),	ourier wise t	continue n	OIII (9) 10	(10)		0	(9)					
Additional infiltration						[(9)-	-1]x0.1 =	0	(10)					
	.25 for steel or timber frame o			•	ruction			0	(11)					
if both types of wall are p deducting areas of openi	resent, use the value corresponding t ngs); if equal user 0.35	o the grea	ter wall are	ea (atter										
•	floor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)					
If no draught lobby, en	•							0	(13)					
Percentage of window Window infiltration	s and doors draught stripped		0.25 - [0.2	) v (14) ± 1	1001 -			0	(14)					
Infiltration rate			(8) + (10)	. ,	-	+ (15) =		0	(15)					
	q50, expressed in cubic metre	es per h					area	3	(17)					
,	lity value, then $(18) = [(17) \div 20] + (18)$	-	•	•		•		0.31	(18)					
	es if a pressurisation test has been do	ne or a de	gree air pe	rmeability	is being u	sed			_					
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0.075 x (*	19)] =			0.85	(19)					
Infiltration rate incorpora	ting shelter factor		(21) = (18		-71			0.85	(21)					
Infiltration rate modified f	•		. , ,	, , ,				0.20	(=./					
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec							
Monthly average wind sp	peed from Table 7	-			-	-		•						
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7							
Wind Factor (22a)m = (2	2)m ∸ 4													
(22a)m = 1.27   1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18	]						
			<del>-</del>	<u> </u>		Ц	<u> </u>	J						

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.33 Calculate effec	0.33	0.32	0.29	0.28	0.25	0.25	0.24	0.26	0.28	0.29	0.31	]	
If mechanica		•	ale ioi i	пе арри	саые са	3E						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	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h	) =				0	(23c)
a) If balance	d mech	anical ve	ntilation	with he	at recove	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	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)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	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	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	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55		(25)
3. Heat losse	s and he	eat loss p	paramete	er:									
ELEMENT	Gros	SS	Openin	gs	Net Ar		U-val		AXU		k-value		AXk
	area	(m²)	m	l <sup>2</sup>	A ,r	n²	W/m2	K .	(W/I	K) 	kJ/m²-l	K	kJ/K
Doors					2	X	1.4	= [	2.8	ᆗ			(26)
Windows					8.651	x1,	/[1/( 1.4 )+	0.04] = [	11.47	ᆜ .			(27)
Floor					32.84	9 X	0.12	= [	3.94188			╡	(28)
Walls Type1	41.9	98	8.65		33.33	3 X	0.15	= [	5	<u> </u>		_	(29)
Walls Type2	21.2	26	2	_	19.26	x	0.14	=	2.76	<u> </u>		╡	(29)
Walls Type3	20.7	72	0		20.72	2 x	0.13	=	2.77	<u> </u>		_	(29)
Roof	7.9		0		7.9	х	0.1	=	0.79				(30)
Total area of e					124.7								(31)
* for windows and  ** include the area						ated using	formula 1	/[(1/U-valu	ie)+0.04] a	is given in	paragraph	1 3.2	
Fabric heat los							(26)(30)	+ (32) =				29.53	(33)
Heat capacity	Cm = S(	(A x k )						((28)	.(30) + (32	2) + (32a).	(32e) =	4710.71	(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 instea				construct	ion are not	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Thermal bridge	es : S (L	x Y) cal	culated (	using Ap	pendix ł	<						13.29	(36)
if details of therma Total fabric he		are not kn	own (36) =	= 0.05 x (3	1)			(33) +	(36) =			42.81	(37)
Ventilation hea	at loss ca	alculated	l monthly	/				(38)m	= 0.33 × (	25)m x (5)	)		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 23.2	23.11	23.03	22.61	22.53	22.17	22.17	22.1	22.31	22.53	22.69	22.85		(38)
Heat transfer of	oefficie	nt, W/K						(39)m	= (37) + (37)	38)m		-	
(39)m= 66.02	65.93	65.84	65.42	65.35	64.98	64.98	64.92	65.12	65.35	65.5	65.67	<u> </u>	
									Average =	Sum(39) <sub>1</sub>	12 /12=	65.42	(39)

Heat loss para	meter (l	HLP). W/	m²K					(40)m	= (39)m ÷	÷ (4)			
(40)m= 1.3	1.3	1.3	1.29	1.29	1.28	1.28	1.28	1.29	1.29	1.29	1.3		
( )			-			<u> </u>				Sum(40) <sub>1</sub> .	<u> </u>	1.29	(40)
Number of day	s in mo	nth (Tabl	e 1a)						3	( 5)		-	`
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>I</u>			
4. Water heat	ing one	rav regui	romont:								kWh/ye	oor:	
4. Water Heat	ing ene	rgy requi	rement.								KVVII/yt	zai.	
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>	TFA -13		71		(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		3.7		(43)
			- '			·	I .	_		1	I _	I	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	,		ich monun	1		rabie icx	, ,				1	I	
(44)m= 86.57	83.42	80.28	77.13	73.98	70.83	70.83	73.98	77.13	80.28	83.42	86.57		<b>—</b> 1
Energy content of	hot water	used - cal	culated mo	onthly = $4$ .	190 x Vd,r	n x nm x D	OTm / 3600			ım(44) <sub>112</sub> = ables 1b, 1		944.43	(44)
(45)m= 128.38	112.29	115.87	101.02	96.93	83.64	77.51	88.94	90	104.89	114.49	124.33		
									Total = Su	ım(45) <sub>112</sub> =	=	1238.3	(45)
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46,	) to (61)				i	
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage		. inaludin	a ony o	olor or M	WHDC	otorogo	within oc	ama vaa	ool		_	1	(47)
Storage volum	` '		•			•		airie ves	SEI		0		(47)
If community h Otherwise if no	•			•			` '	ers) ente	≥r '∩' in <i>(</i>	(47)			
Water storage		not wate	/ (tillo li	ioiddos i	iiotaiitai	10000 00	ATTION DOIN	oro, oric	JI O III (	(47)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature fa	actor fro	m Table	2b								0		(49)
Energy lost fro				ear			(48) x (49)	) =			0		(50)
b) If manufact		_	-		or is not	known:							, ,
Hot water stora	_			e 2 (kW	h/litre/da	ay)					0		(51)
If community h	•		on 4.3									ı	
Volume factor			2h							-	0		(52)
Temperature fa											0		(53)
Energy lost fro		•	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	-	0		(54)
Enter (50) or (		,					((50) (	EE) (44).			0		(55)
Water storage	ioss cai	culated t	or eacn	montn			((56)m = (	55) × (41)	m 	1	1	ı	
(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	<u></u>							0		(58)
Primary circuit	loss cal	culated f	or each	month (	•	. ,	, ,					•	
(modified by	factor f	rom Tabl	e H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	ostat)		İ	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss o	alculated	for each	month (	(61)m =	(60) ÷ 3	365 x (41	)m						
(61)m= 0	0	0	0	0	0	0	)   0	0	0	Ιο	0	1	(61)
	guired for	water h	L eating ca	Lalculated	L I for eac	ch month	(62)n	n = 0.85 x	 (45)m +	(46)m +	(57)m +	ן - (59)m + (61)m	
(62)m= 109.1	<del>-</del>	98.49	85.87	82.39	71.1	65.88	75.6		89.16	97.32	105.68	]	(62)
Solar DHW inpu	ıt calculated	using App	endix G o	r Appendix	H (nega	tive quantity	y) (ente	r '0' if no sola	ar contribu	tion to wate	er heating)	) L	
(add addition													
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(63)
Output from	water hea	ter				•	•	•	•	•	•	•	
(64)m= 109.1	3 95.44	98.49	85.87	82.39	71.1	65.88	75.6	76.5	89.16	97.32	105.68	]	
	•	•	•		•	•		Output from w	ater heate	er (annual)	112	1052.55	(64)
Heat gains fr	om water	heating	kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	n + (61	)m] + 0.8	x [(46)m	+ (57)m	+ (59)m	າ ]	
(65)m= 27.28	23.86	24.62	21.47	20.6	17.77	16.47	18.9	19.13	22.29	24.33	26.42	]	(65)
include (57	7)m in calc	culation	of (65)m	only if c	ylinder	is in the	dwellii	ng or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a	):									
Metabolic ga	ins (Table	5), Wat	ts										
Jan		Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	]	
(66)m= 85.41	85.41	85.41	85.41	85.41	85.41	85.41	85.4	1 85.41	85.41	85.41	85.41	]	(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equat	ion L9 d	or L9a), a	ilso se	e Table 5		-	-	-	
(67)m= 13.67	12.14	9.87	7.48	5.59	4.72	5.1	6.63	8.89	11.29	13.18	14.05	]	(67)
Appliances g	ains (calc	ulated ir	Append	dix L, eq	uation l	_13 or L1	3a), a	lso see Ta	ble 5	-	•	-	
(68)m= 148.8	2 150.37	146.47	138.19	127.73	117.9	111.34	109.7	79 113.68	121.97	132.43	142.25	]	(68)
Cooking gair	ns (calcula	ted in A	ppendix	L, equat	ion L15	or L15a	), also	see Table	5	-	-	-	
(69)m= 31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.5	4 31.54	31.54	31.54	31.54	]	(69)
Pumps and f	ans gains	(Table	ба)					•				-	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)	-		-		-	-	-	
(71)m= -68.32	2 -68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.3	2 -68.32	-68.32	-68.32	-68.32	]	(71)
Water heatin	g gains (T	able 5)				-				-		-	
(72)m= 36.67	35.51	33.09	29.81	27.68	24.69	22.14	25.4	26.56	29.96	33.79	35.51	]	(72)
Total interna	al gains =			•	(66	6)m + (67)m	n + (68)	m + (69)m +	(70)m + (	71)m + (72)	)m	-	
(73)m= 247.7	8 246.64	238.06	224.1	209.63	195.93	187.19	190.4	14 197.76	211.84	228.02	240.44	]	(73)
6. Solar gai	ns:												
Solar gains are	e calculated	using sola	r flux from	Table 6a	and asso	ciated equa	ations to	convert to the	ne applica		tion.		
Orientation:			Area m²			ux able 6a		g_ Table 6b	7	FF able 6c		Gains	
	Table 6d					able ba	, ,	Table ob	_ '	able 60		(W)	,
Southwest <sub>0.9</sub> x		X	8.6	35	X	36.79	ļĻ	0.63	x	0.7	=	97.28	(79)
Southwest <sub>0.9</sub> x		X	8.6	S5	x	62.67	ļĻ	0.63	x	0.7	=	165.7	(79)
Southwest <sub>0.9</sub> x		×	8.6	S5	x	85.75	Ţ	0.63	x	0.7	=	226.72	(79)
Southwest <sub>0.9</sub> x	• • • • • • • • • • • • • • • • • • • •	x	8.6	65	x	106.25	Ţ	0.63	x	0.7	=	280.91	(79)
Southwest <sub>0.9</sub> x	0.77	X	8.6	35	X	119.01	] [	0.63	X	0.7	=	314.65	(79)

Southwest <sub>0.9x</sub> 0.77	x	8.6	5	x	118.15			0.63	x	0.7	=	312.37	(79)
Southwest <sub>0.9x</sub> 0.77	x	8.6	5	x	113.91			0.63	_ x [	0.7	=	301.16	(79)
Southwest <sub>0.9x</sub> 0.77	x	8.6	5	x	104.39			0.63	_ x [	0.7	=	275.99	(79)
Southwest <sub>0.9x</sub> 0.77	x	8.6	5	x	92.85			0.63	_ x [	0.7	=	245.49	(79)
Southwest <sub>0.9x</sub> 0.77	x	8.6	5	x	69.27			0.63	_ x [	0.7	=	183.13	(79)
Southwest <sub>0.9x</sub> 0.77	x	8.6	5	x	44.07			0.63	_ x [	0.7	=	116.52	(79)
Southwest <sub>0.9x</sub> 0.77	x	8.6	5	x	31.49			0.63	_ x [	0.7	=	83.25	(79)
	<u></u>			•									_
Solar gains in watts, ca	alculated	for each	n month			(83	3)m = S	um(74)m .	(82)m				
(83)m= 97.28 165.7	226.72	280.91	314.65	31	2.37 301	.16 2	275.99	245.49	183.13	116.52	83.25		(83)
Total gains – internal a	and solar	(84)m =	(73)m	+ (8	33)m , wat	ts	_					1	
(84)m= 345.06 412.34	464.78	505.01	524.27	50	08.3 488	.35 4	466.44	443.25	394.97	344.53	323.69		(84)
7. Mean internal temp	perature (	(heating	season	)									
Temperature during h	neating p	eriods ir	the livi	ng a	area from	Table	9, Th	1 (°C)				21	(85)
Utilisation factor for g	ains for I	iving are	a, h1,m	(se	ee Table 9	a)							_
Jan Feb	Mar	Apr	May		Jun Ju	ıl	Aug	Sep	Oct	Nov	Dec		
(86)m= 0.96 0.94	0.9	0.85	0.76	0	0.64 0.5	51	0.54	0.71	0.87	0.94	0.96		(86)
Mean internal temper	ature in I	iving are	ea T1 (fo	ollo	w steps 3	to 7 ir	n Table	e 9c)					
(87)m= 18.41 18.73	19.2	19.77	20.29	т —	0.69 20.8		20.84	20.55	19.87	19.03	18.34		(87)
Temperature during h	neating p	eriods ir	rest of	dw	elling from	n Tabl	le 9 Th	n2 (°C)				l	
(88)m= 19.84 19.84	19.84	19.85	19.85	т —	9.85 19.8		19.85	19.85	19.85	19.85	19.84		(88)
Utilisation factor for g	nine for r	oct of d	volling	h2 i	m (soo Ta	blo 0							
(89)m= 0.95 0.93	0.89	0.82	0.71	1	0.56 0.4		0.44	0.65	0.84	0.93	0.96		(89)
` '	<u> </u>					!_				0.00	0.00		()
Mean internal temper (90)m= 17.5 17.82	ature in t	18.83	of dwell 19.32	Ť	12 (follow 9.66 19.		s 3 to 7 19.78	19.56	e 9c) 18.93	18.11	17.43		(90)
(90)111= 17.5 17.62	10.20	10.03	19.32		9.00   19.	.0	19.70			ig area ÷ (4		0.65	(91)
										.g a. oa . (	.,	0.03	(01)
Mean internal temper	<del> </del>			_			<u> </u>					1	(00)
(92)m= 18.09 18.41	18.88	19.44	19.95	<u> </u>	0.33 20.4		20.47	20.2	19.54	18.71	18.02		(92)
Apply adjustment to t (93)m= 18.09 18.41	ne mean 18.88	19.44	19.95	1	0.33 20.4		e, whe	20.2	19.54	18.71	18.02		(93)
8. Space heating requ		13.44	15.55		20.	10 1	20.41	20.2	10.04	10.71	10.02		(33)
Set Ti to the mean in		nperatur	e obtair	ned	at step 11	l of Ta	able 9t	so tha	t Ti m=(	76)m an	d re-calc	culate	
the utilisation factor for								, 00					
Jan Feb	Mar	Apr	May		Jun Ju	ıl	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for g	ains, hm	:					,					ı	
(94)m= 0.94 0.91	0.87	0.81	0.72	0	0.59 0.4	6	0.5	0.67	0.83	0.91	0.95		(94)
Useful gains, hmGm	<del>`</del>	<u> </u>										1	(05)
(95)m= 323.81 375.4	404.8	408.57	376.78		1.42 225	.76 2	231.04	296.81	328.21	315.07	306.13		(95)
Monthly average exterior (96)m= 4.3 4.9	ernai tem	8.9	11.7	$\overline{}$	4.6 16.	6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for me	<u> </u>			<u> </u>						'.1	4.4		(50)
(97)m= 910.59 890.85	814.97	689.73	539.16	1	72.16 253		264.34	397.43	584.05	760.26	907.76		(97)
Space heating require													
(98)m= 436.56 346.38	305.17	202.43	120.81	<u> </u>	0 0	-	0	0	190.35	320.54	447.62		
L												I	

								Tota	l per year	(kWh/yeaı	r) = Sum(9	08)15,912 =	2369.86	(98)
Space	e heating	g require	ement in	kWh/m²	/year								46.82	(99)
8c. Sp	pace co	oling req	quiremer	nt										
Calcu	lated for	r June, J	July and	August.	See Tal	ole 10b					_			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat I	loss rate	Lm (ca	lculated	using 25	o°C inter	nal temp	erature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	610.85	480.88	493.37	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.74	0.8	0.78	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = (	(100)m x	(101)m	-								
(102)m=	0	0	0	0	0	449.42	384.6	384.93	0	0	0	0		(102)
Gains	(solar g	gains cal	lculated	for appli	cable we	eather re	gion, se	e Table	10)		•	•		
(103)m=	0	0	0	0	0	658.68	634.18	609.54	0	0	0	0		(103)
						lwelling,	continu	ous ( kW	h = 0.0	24 x [(10	03)m – (	102)m]:	x (41)m	
set (1	04)m to	zero if (	104)m <	3 × (98	)m									
(104)m=	0	0	0	0	0	150.67	185.69	167.11	0	0	0	0		_
										= Sum(	'	=	503.47	(104)
	I fraction			_					f C =	cooled	area ÷ (4	4) =	1	(105)
r			able 10b					г					İ	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
		_				(4.5)	( )		Total	l = Sum(	(104)	=	0	(106)
· .			1			× (105)		1			ı	ſ	I	
(107)m=	0	0	0	0	0	37.67	46.42	41.78	0	0	0	0		_
									Total	= Sum(	107)	=	125.87	(107)
Space	cooling	requirer	ment in k	:Wh/m²/y	/ear				(107)	÷ (4) =			2.49	(108)
8f. Fab	ric Ener	gy Effici	iency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabric	Energy	/ Efficier	псу						(99)	+ (108) =	=		49.31	(109)

#### **SAP Input**

Address:

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

**UPRN:** 

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

New dwelling design stage Assessment type:

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

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

PCDF Version: 466

Flat Dwelling type:

Detachment:

2020 Year Completed:

Floor Location: Floor area:

Storey height:

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

32.849 m<sup>2</sup> (fraction 0.649) Living area:

North East Front of dwelling faces:

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

Solid NE Manufacturer

SW Manufacturer Windows double-glazed Yes

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

Name: Type-Name: Location: Orient: Width: Height: NE Corridor Wall North East

External Wall South West 0 SW 0

Average or unknown Overshading:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Карра:
External Element	<u>'S</u>						
External Wall	41.977	8.65	33.33	0.15	0	False	N/A
Corridor Wall	21.261	2	19.26	0.15	0.31	False	N/A
Stairwell Wall	20.716	0	20.72	0.15	0.82	False	N/A
Flat Roof	7.898	0	7.9	0.1	0		N/A
Ground Floor	32.849			0.12			N/A
Landania al Elemento							

**Internal Elements** 

Party Elements

User-defined (individual PSI-values) Y-Value = 0.1066 Thermal bridges:

> Length Psi-value

Other lintels (including other steel lintels) 4.795 0.291 E2

#### **SAP Input**

13.2	0.048	E4	Jamb
28.46	0.144	E5	Ground floor (normal)
7.023	0.16	E21	Exposed floor (inverted)
15.249	0.058	E7	Party floor between dwellings (in blocks of flats)
6.188	0.12	E24	Eaves (insulation at ceiling level - inverted)
6.188	0.56	E15	Flat roof with parapet
11.8	0.08	E16	Corner (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 :heat from boilers - mains gas

No hot water cylinder Solar panel: False

Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown

Consequents and the sense protection of the sense protecti

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: 0.62 Tilt of collector: 30°

Overshading: None or very little Collector Orientation: South West

Assess Zero Carbon Home: No

		User_[	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa					0001082 on: 1.0.5.9	
		Property	Address	: Plot 1					
Address :									
1. Overall dwelling dime	ensions:								
Ground floor			ea(m²)	14-2		ight(m)	_	Volume(m <sup>3</sup>	<u>`</u>
			50.61	(1a) x		2.5	(2a) =	126.53	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(	In)	50.61	(4)					
Dwelling volume				(3a)+(3b	)+(3c)+(3c	d)+(3e)+	(3n) =	126.53	(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	<b>=</b> + [	0	<u> </u>	0	x	20 =	0	(6b)
Number of intermittent fa	ins				2	×	10 =	20	(7a)
Number of passive vents	;				0	x	10 =	0	(7b)
Number of flueless gas fi				L	0		40 =	0	(7c)
rvambor or naciose gao n				L				0	(10)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+$	(7a)+(7b)+	(7c) =	Γ	20		÷ (5) =	0.16	(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)							0	(9)
	.25 for steel or timber frame of	or 0 35 fc	or macon	ry coneti	ruction	[(9	9)-1]x0.1 =	0	(10)
	resent, use the value corresponding			•	uction			0	(11)
deducting areas of opening									_
·	floor, enter 0.2 (unsealed) or	0.1 (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	(14)
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)				0.41	(18)
	es if a pressurisation test has been d	one or a de	egree air pe	rmeability	is being u	sed			_
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0.075 x (	19)] =			2	(19) (20)
Infiltration rate incorporate	ting shelter factor		(21) = (18	`	/,1			0.85	(21)
Infiltration rate modified f	•		( ) ( -	, ( -,				0.33	(21)
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec	]	
Monthly average wind sp	1 ' 1 ' 1	1	<u>,                                     </u>			1		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	]	
	2)	1	1	1	•	•	1	ı	
Wind Factor (22a)m = (2.32)m $= (2.32)$ m	<del></del>	T 0.05	0.00		1 4 00	1 4 40	1 4 40	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	J	

0.44	ation rate	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41		
Calculate effe							0.02	0.00	0.01	0.00	0.41		
If mechanic												0	(23
If exhaust air h		0		, ,	,	. `	,, .	•	) = (23a)			0	(231
If balanced wit		-	•	_								0	(23
a) If balance	1 1					<del>- `</del>	<del></del>	<u> </u>	<u> </u>		<del>r ` ´</del>	÷ 100]	(0.4
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a
b) If balance						<u> </u>	<u> </u>	,	- i				(0.4)
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24)
c) If whole h	nouse ext ກ < 0.5 ×			-	-				5 v (23h	.\			
$\frac{11(220)1}{(24c)m=0}$	0.5 x	0	0	0	0	0	0	0	0	0	0		(24
d) If natural	لــــــــــــــــــــــــــــــــــــــ												(
	n = 1, the								0.5]				
(24d)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(24
Effective air	change	rate - en	ter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)			•		
(25)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(25)
2 Hoot loose	o and ha	ot lose r	aramata	r.									
3. Heat losse		·			Not A.		المدالا		A V I I		مريامير با	. ^	V L
ELEMENT	Gros area		Openin m		Net Ar A ,n		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²-k		X k /K
Doors		` '			2	X	1	=	2	,			(26)
Windows					8.651	x1/	/[1/( 1.4 )+	0.04] =	11.47				(27)
Floor					32.84	=	0.13		4.27037	<del>,</del>		<b>-</b>	(28)
Walls Type1	41.9	, R	8.65	$\neg$	33.33	=	0.18	<u> </u>	6	<b>=</b>		╡┝	(29)
Walls Type2	21.2		2	=	19.26	=	0.18	<del>-</del>	3.47	=			(29)
Walls Type3	20.7		0	=	20.72	=	0.18	<del>-</del>	3.73	=			(29)
Roof	7.9		0	=		=		╣┇		႕ ¦		╣ ├─	(30)
11001					7.9	×	0.13		1.03				
Total area of a		, 111											
		)WO UOO O	ffootivo wi	adow II ve	124.7		formula 1	/[/1/      volu	0 0 0 0 0 0 0 0	o givon in	norogranh		(31)
* for windows and	d roof windo				alue calcul		formula 1,	/[(1/U-valu	e)+0.04] a	s given in	paragraph	3.2	(31)
* for windows and ** include the are	d roof windd as on both	sides of in	ternal wall		alue calcul	ated using	formula 1,		e)+0.04] a	s given in	paragraph	31.96	_
* for windows and ** include the are Fabric heat los	d roof windo as on both ss, W/K =	sides of in	ternal wall		alue calcul	ated using		+ (32) =	e)+0.04] a .(30) + (32				(33)
* for windows and ** include the are Fabric heat los Heat capacity	d roof windo as on both ss, W/K = Cm = S(	sides of in = S (A x A x k)	ternal wall U)	s and part	lue calcula iitions	ated using		+ (32) = ((28)		2) + (32a).		31.96	(33)
Total area of e * for windows and ** include the are. Fabric heat los Heat capacity Thermal mass For design asses	d roof windo as on both ss, W/K = Cm = S( s parame	sides of in = S (A x A x k ) ter (TMP	ternal wall U) P = Cm ÷	s and part	alue calcula itions kJ/m²K	ated using	(26)(30)	+ (32) = ((28)	.(30) + (32 tive Value:	2) + (32a). Medium	(32e) =	31.96 4710.71	(33)
* for windows and ** include the are. Fabric heat lose Heat capacity Thermal mass For design assess can be used inste	d roof windo as on both ss, W/K = Cm = S( s parame sments who ead of a det	sides of in  = S (A x   A x k )  ter (TMF)  ere the detailed calculates.	ternal wall U) P = Cm ÷ tails of the	s and part · TFA) in	alue calcula ititions kJ/m²K ion are not	ated using	(26)(30)	+ (32) = ((28)	.(30) + (32 tive Value:	2) + (32a). Medium	(32e) =	31.96 4710.71	(33)
* for windows and ** include the are. Fabric heat lose Heat capacity Thermal mass For design assess can be used inste Thermal bridg	d roof windo as on both ss, W/K = Cm = S( s parame sments who ead of a det es : S (L	sides of in  = S (A x k)  A x k)  ter (TMP  ere the det  tailed calcu  x Y) calcu	ternal wall U) $P = Cm \div tails of the ulation. culated t$	s and part TFA) in constructi	alue calculations  kJ/m²K  fon are not	ated using	(26)(30)	+ (32) = ((28)	.(30) + (32 tive Value:	2) + (32a). Medium	(32e) =	31.96 4710.71	(33)
* for windows and ** include the are. Fabric heat lose Heat capacity Thermal masses. For design assess can be used inste Thermal bridg	d roof windo as on both ss, W/K = Cm = S( s parame sments who ead of a det es : S (L al bridging	sides of in  = S (A x k)  A x k)  ter (TMP  ere the det  tailed calcu  x Y) calcu	ternal wall U) $P = Cm \div tails of the ulation. culated t$	s and part TFA) in constructi	alue calculations  kJ/m²K  fon are not	ated using	(26)(30)	+ (32) =	.(30) + (32 tive Value: values of	2) + (32a). Medium	(32e) =	31.96 4710.71 250 14.78	(33)
* for windows and ** include the are. Fabric heat lose Heat capacity Thermal mass For design assess can be used inste Thermal bridg if details of thermal Total fabric he	d roof windo as on both ss, W/K = Cm = S( s parame sments who ead of a det es : S (L al bridging eat loss	sides of in  = S (A x   A x k )  ter (TMF) ere the det tailed calcu x Y) calcu are not know	ternal wall U) P = Cm ÷ tails of the lation. culated to	· TFA) in constructiusing Ap	alue calculations  kJ/m²K  fon are not	ated using	(26)(30)	+ (32) = ((28) Indica indicative (33) +	.(30) + (32 tive Value: values of (36) =	2) + (32a). Medium TMP in Ta	(32e) =   	31.96 4710.71 250	(33)
* for windows and ** include the are. Fabric heat los Heat capacity Thermal mass For design asses can be used inste Thermal bridg if details of thermal Total fabric head	d roof windo as on both ss, W/K = Cm = S( s parame sments whe ead of a det es : S (L al bridging eat loss at loss ca	sides of in  = S (A x A x k)  ter (TMF ere the det tailed calcu x Y) calcu are not known	ternal wall U) $P = Cm \div tails of the ulation. culated ulated ula$	TFA) in constructions and part	alue calculatitions  a kJ/m²K  fon are not  pendix h	ated using	(26)(30)	+ (32) = ((28) Indica indicative (33) + (38)m	.(30) + (32) tive Value: values of (36) = = 0.33 × (30)	2) + (32a).  Medium  TMP in Ta	(32e) =    able 1f	31.96 4710.71 250 14.78	(33 (34 (35) (36)
* for windows and ** include the are. Fabric heat los Heat capacity Thermal mass For design assess can be used inste Thermal bridg if details of therm. Total fabric he Ventilation hea	d roof windo as on both ss, W/K = Cm = S( s parame sments who ead of a det es : S (L al bridging eat loss at loss ca	sides of in  = S (A x   A x k )  ter (TMF ere the detailed calculated  Mar	ternal wall U) P = Cm ÷ tails of the ulation. culated u own (36) =	· TFA) in constructiusing Ap	alue calculatitions  kJ/m²K fon are not pendix k  1)  Jun	ated using known pro	(26)(30) ecisely the	+ (32) =	.(30) + (32 tive Value: values of (36) = = 0.33 × (30)	2) + (32a).  Medium  TMP in Ta  25)m x (5)  Nov	(32e) =    able 1f	31.96 4710.71 250 14.78	(33) (34) (35) (36)
* for windows and ** include the are. Fabric heat los Heat capacity Thermal mass For design assess can be used inste Thermal bridg if details of therm. Total fabric he Ventilation hea  [38]m= 24.96	d roof windo as on both ss, W/K = Cm = S( s parame sments who ad of a det es : S (L al bridging eat loss at loss ca Feb	sides of in  = S (A x   A x k )  ter (TMF) ere the detailed calculated are not known alculated  Mar  24.65	ternal wall U) $P = Cm \div tails of the ulation. culated ulated ula$	TFA) in constructions and part	alue calculatitions  a kJ/m²K  fon are not  pendix h	ated using	(26)(30)	+ (32) =	.(30) + (32 tive Value: values of (36) = = 0.33 × (32) Oct 23.78	2) + (32a).  Medium  TMP in Ta  25)m x (5)  Nov  24.06	(32e) =    able 1f	31.96 4710.71 250 14.78	(33) (34) (35) (36) (37)
* for windows and ** include the are. Fabric heat los Heat capacity Thermal mass For design assess can be used inste Thermal bridg if details of therm. Total fabric he Ventilation hea	d roof windo as on both ss, W/K = Cm = S( s parame sments who ad of a det es : S (L al bridging eat loss at loss ca Feb	sides of in  = S (A x   A x k )  ter (TMF) ere the detailed calculated are not known alculated  Mar  24.65	ternal wall U) P = Cm ÷ tails of the ulation. culated u own (36) =	· TFA) in constructiusing Ap	alue calculatitions  kJ/m²K fon are not pendix k  1)  Jun	ated using known pro	(26)(30) ecisely the	+ (32) =	.(30) + (32 tive Value: values of (36) = = 0.33 × (30)	2) + (32a).  Medium  TMP in Ta  25)m x (5)  Nov  24.06	(32e) =    able 1f	31.96 4710.71 250 14.78	(31) (33) (34) (35) (36) (37)

Heat loss par	ameter (I	HLP). W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.42	1.41	1.41	1.4	1.39	1.38	1.38	1.38	1.39	1.39	1.4	1.4		
	Į.	!		ļ	ļ.	ļ	ļ		L Average =	Sum(40) <sub>1</sub>	12 /12=	1.4	(40)
Number of da	ys in mo	nth (Tab	le 1a)	1	<b>-</b>			1		1			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ating ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occ if TFA > 13 if TFA £ 13	.9, N = 1		[1 - exp	0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		71		(42)
Annual avera Reduce the annu	ge hot wa ge average	hot water	usage by	5% if the $c$	lwelling is	designed t			se target o		.77		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage								1		1			
(44)m= 82.24	79.25	76.26	73.27	70.28	67.29	67.29	70.28	73.27	76.26	79.25	82.24		
, ,	·			l .		<u> </u>	<u> </u>		I Total = Su	m(44) <sub>112</sub> =		897.21	(44)
Energy content of	of hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	m x nm x E	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 121.97	106.67	110.08	95.97	92.08	79.46	73.63	84.49	85.5	99.64	108.77	118.12		
					, ,	. 0:			Total = Su	m(45) <sub>112</sub> =	= [	1176.38	(45)
If instantaneous	water heati	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46)	to (61)					
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage Storage volur		) includin	na anv so	olar or W	/WHRS	storane	within sa	ame ves	ച		150		(47)
If community	•		•			Ū		a	00.		150		(47)
Otherwise if r	•			•			` '	ers) ente	er '0' in (	(47)			
Water storage	e loss:		`					,	·	,			
a) If manufac	cturer's d	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature	factor fro	m Table	2b								0		(49)
Energy lost fr		_	-				(48) x (49)	) =			0		(50)
b) If manufac			-								1		(=4)
Hot water sto If community	•			ie Z (KVV	n/litre/da	ly)					0		(51)
Volume factor	_		JII 4.5								0		(52)
Temperature			2b								0		(53)
Energy lost fr	om wate	r storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or		_	,								0		(55)
Water storage	e loss cal	culated f	or each	month			((56)m = (	(55) × (41)	m		'		
(56)m= 0	Το	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	ns dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	<u>I</u> H11)] ÷ (5	0), else (5	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	it loss (ar	nual) fro	m Table	e 3							0		(58)
Primary circuit	•	•			59)m = (	(58) ÷ 36	65 × (41)	m					
(modified b					•	. ,	, ,		r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combiless	ام مغمل دمام	fo., o.o.b		(04)	(00) . 0	CE (44)	١						
Combi loss of (61)m= 0	calculated 0	or each	montn (	(61)m =	(60) ÷ 3	05 × (41)	)m   0	0	0	0	0	1	(61)
` '	!	<u> </u>		<u> </u>			<u> </u>	Ļ	<u> </u>	<u> </u>	<u> </u>	(E0) m + (61) m	(01)
(62)m= 103.6	<del></del>	93.56	81.57	78.27	67.54	62.59	71.82	72.68	84.7	92.45	100.4	· (59)m + (61)m ]	(62)
Solar DHW inpu								1				]	(02)
(add addition									ii continbu	lion to wate	er neating)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from	water hea	ter		<u> </u>		<u> </u>	l		<u> </u>	ļ	<u> </u>	1	
(64)m= 103.6		93.56	81.57	78.27	67.54	62.59	71.82	72.68	84.7	92.45	100.4	]	
		<u> </u>				<u> </u>	Ou	put from w	ater heate	r (annual)₁	l12	999.93	(64)
Heat gains fi	rom water	heating,	kWh/m	onth 0.2	5 ′ [0.85	× (45)m	ı + (61)ı	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m		-
(65)m= 25.92	1	23.39	20.39	19.57	16.89	15.65	17.95	18.17	21.17	23.11	25.1	1	(65)
include (5	7)m in cal	culation o	of (65)m	only if c	vlinder i	s in the	dwelling	or hot w	ater is f	rom com	munity h	ı neating	
5. Internal			. ,		,						• •		
Metabolic ga				,									
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
(66)m= 85.41	1 85.41	85.41	85.41	85.41	85.41	85.41	85.41	85.41	85.41	85.41	85.41	1	(66)
Lighting gair	ns (calcula	ted in Ap	pendix	L, equat	on L9 o	r L9a), a	lso see	Table 5	•		•		
(67)m= 13.67	7 12.14	9.87	7.48	5.59	4.72	5.1	6.63	8.89	11.29	13.18	14.05	]	(67)
Appliances of	gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5		•	•	
(68)m= 148.8	2 150.37	146.47	138.19	127.73	117.9	111.34	109.79	113.68	121.97	132.43	142.25		(68)
Cooking gair	ns (calcula	ted in Ap	pendix	L, equat	ion L15	or L15a	), also s	ee Table	5	•	•	•	
(69)m= 31.5 <sup>4</sup>	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54		(69)
Pumps and f	fans 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= -68.3	2 -68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.32	]	(71)
Water heating	ng gains (T	able 5)		-			-			-			
(72)m= 34.84	4 33.73	31.44	28.32	26.3	23.45	21.03	24.13	25.24	28.46	32.1	33.74	]	(72)
Total intern	al gains =	1			(66	)m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	71)m + (72)	)m	-	
(73)m= 245.9	5 244.86	236.41	222.61	208.24	194.69	186.09	189.17	196.43	210.34	226.33	238.66		(73)
6. Solar gai	ins:												
Solar gains ar		•				•	itions to c	onvert to th	ne applica		tion.		
Orientation:	Access F Table 6d		Area m²		Flu Ta	ıx ble 6a	-	g_ Fable 6b	т	FF able 6c		Gains (W)	
0							, –		_				٦
Southwesto.9		X	8.6		-	36.79	! <u> </u>	0.63	X	0.7	=	97.28	(79)
Southwesto s	<u> </u>	X	8.6			62.67	<u> </u>	0.63		0.7	_ =	165.7	[(79)
Southwesto.9	<u> </u>	X	8.6			35.75	<u> </u>	0.63	×	0.7	_ =	226.72	∫(79) 1,>
Southwesto.9		X	8.6		-	06.25	! <u> </u>	0.63		0.7	=	280.91	(79)
Southwest <sub>0.9</sub>	X 0.77	X	8.6	35	x 1	19.01	l L	0.63	X	0.7	=	314.65	(79)

Southwe	est <sub>0.9x</sub>	0.77	X	8.6	5	x	1	18.15	] [		0.63	x	0.7	=	312.37	(79)
Southwe	est <sub>0.9x</sub>	0.77	x	8.6	5	X	1	13.91	Ī [		0.63	×	0.7		301.16	(79)
Southwe	est <sub>0.9x</sub>	0.77	x	8.6	5	X	1	04.39	<u> </u>		0.63	×	0.7		275.99	(79)
Southwe	est <sub>0.9x</sub>	0.77	X	8.6	5	X	9	92.85	j i		0.63	×	0.7	=	245.49	(79)
Southwe	est <sub>0.9x</sub>	0.77	X	8.6	5	X	6	69.27	וֹ וֹ		0.63	×	0.7	<u> </u>	183.13	(79)
Southwe	est <sub>0.9x</sub>	0.77	X	8.6	5	X	4	14.07	j i		0.63	×	0.7	=	116.52	(79)
Southwe	est <sub>0.9x</sub>	0.77	X	8.6	5	X	3	31.49	j i		0.63	×	0.7	=	83.25	(79)
																_
Solar ga	ains in w	atts, ca	alculated	for eacl	n month	1			(83)m	= St	um(74)m .	(82)m			_	
(83)m=	97.28	165.7	226.72	280.91	314.65	3	12.37	301.16	275.	.99	245.49	183.13	116.52	83.25		(83)
Total ga	ains – in	ternal a	nd solar	(84)m =	(73)m	+ (	83)m	, watts							-	
(84)m=	343.23	410.56	463.13	503.52	522.89	5	07.06	487.24	465.	.17	441.92	393.48	342.85	321.91		(84)
7. Mea	an intern	al temp	erature	(heating	seasor	1)										
Tempe	erature c	during h	eating p	eriods ir	the livi	ng	area	from Tal	ble 9,	Th	1 (°C)				21	(85)
Utilisat	tion facto	or for ga	ains for I	iving are	a, h1,m	ı (s	ee Ta	ıble 9a)								
	Jan	Feb	Mar	Apr	May		Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(86)m=	1	0.99	0.98	0.96	0.89		0.76	0.6	0.6	64	0.85	0.97	0.99	1		(86)
Mean	internal	tempera	ature in	living are	ea T1 (f	ollo	w ste	ps 3 to 7	7 in T	able	e 9c)		-	-		
(87)m=	19.49	19.68	19.97	20.34	20.66	_	20.89	20.97	20.9		20.81	20.37	19.86	19.45		(87)
Tempe	erature c	lurina h	eating n	eriods ir	rest of	Чw	elling	from Ta	ahle C	 3 Th	n2 (°C)				ı	
(88)m=	19.75	19.75	19.76	19.77	19.77	_	9.78	19.78	19.7		19.77	19.77	19.76	19.76		(88)
					م مثال م	<u>لــ</u>	/o		. 0 - )				<u> </u>	ļ		
(89)m=	tion facto	or for ga	0.98	0.94	veiling, 0.84	$\overline{}$	,m (se 0.66	0.45	9a) 0.4	<u>.                                      </u>	0.77	0.95	0.99	1	]	(89)
													0.99			(00)
Г	internal					Ť	•		<del>i                                     </del>				T		Ī	(00)
(90)m=	18.39	18.59	18.88	19.24	19.54		9.73	19.77	19.7	77	19.67	19.28	18.78	18.37		(90)
											•	LA = LIVI	ng area ÷ (4	+) =	0.65	(91)
	internal	<del></del>				_	<u> </u>	LA × T1	+ (1 ·	– fL	A) × T2		1		1	
(92)m=	19.1	19.3	19.59	19.95	20.27		20.48	20.55	20.5		20.41	19.99	19.48	19.07		(92)
· · · · r	adjustm					_		1	1			•	T		Ī	(00)
(93)m=	19.1	19.3	19.59	19.95	20.27	2	20.48	20.55	20.5	54	20.41	19.99	19.48	19.07		(93)
•	to the m	•		nn o rotuu	o obtoi	200	l ot ot	on 11 of	Tobl	م 0h	o o tha	t Tim	(76)m on	d ro ool	vulata	
	lisation f					ieu	al Si	ерттог	rabi	e ar	o, so ma	t 11,111=	(76)m an	u re-caic	Julate	
Γ	Jan	Feb	Mar	Apr	May		Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
Utilisat	tion facto	or for ga	ains, hm	:		•							•		•	
(94)m=	0.99	0.99	0.97	0.94	0.87		0.72	0.54	0.5	9	0.81	0.95	0.99	1		(94)
Useful	l gains, h	nmGm ,	W = (94)	l)m x (84	4)m								_		•	
(95)m=	341.34	405.68	451.27	473.72	452.73	3	64.78	265.41	274.	.04	359.34	375.53	339.16	320.56		(95)
	ly avera					_			_					<del> </del>	1	
(96)m=	4.3	4.9	6.5	8.9	11.7		14.6	16.6	16.		14.1	10.6	7.1	4.2		(96)
	oss rate					_		<del>-``</del>	<del></del>	<del>'</del> т	· ,	Ī	676.5	4057 : 5	1	(07)
` ′ L	1061.41		934.35	780.89	604.33	_	411	276	288.		442.31	662.26		1057.12		(97)
	heating 535.73	require 419.63	359.41	r each m 221.17	112.79	vvn T	/mon <sup>-</sup> 0	$\frac{\text{th} = 0.02}{0}$	24 x [ 0		m – (95 0	)MJ X (4 213.33	T	548	]	
(90)111=	555.73	+13.03	JJ9.41	ZZ 1.1 <i>1</i>	112.79		U				U	Z 13.33	300.74	340	l	

								Tota	l per year	(kWh/year	) = Sum(9	8)15,912 =	2796.81	(98)
Space	e heatino	g require	ement in	kWh/m²	/year								55.26	(99)
8c. Sp	pace cod	oling req	uiremen	it										
Calcu	lated for	June, J	luly and	August.	See Tal	ole 10b							i	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat	oss rate	Lm (ca	lculated	using 25	5°C inter	nal temp		and exte	ernal ten	nperatur	e from T	able 10)	ı	
(100)m=	0	0	0	0	0	656.92	517.15	530.23	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm										1	
(101)m=	0	0	0	0	0	0.81	0.89	0.86	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = (	100)m x	(101)m								1	
(102)m=	0	0	0	0	0	534.41	457.77	458.44	0	0	0	0		(102)
Gains	(solar g	ains cal	culated	for appli	cable we	eather re	gion, se	e Table	10)			_	ı	
(103)m=	0	0	0	0	0	657.45	633.07	608.27	0	0	0	0		(103)
			ement fo. 104)m <			lwelling,	continue	ous ( kW	h') = 0.02	24 x [(10	03)m – (	102)m]:	x (41)m	
(104)m=	0	0	0	0	0	88.59	130.42	111.47	0	0	0	0		
l	•								Total	= Sum(	104)	=	330.48	(104)
Cooled	I fraction	1							f C =	cooled	area ÷ (4	4) =	1	(105)
Intermi	ttency fa	actor (Ta	able 10b	)									1	_
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
									Total	' = Sum(	104)	=	0	(106)
	cooling	requirer	nent for	month =	(104)m	× (105)	× (106)r	n					1	<u> </u>
(107)m=	0	0	0	0	0	22.15	32.61	27.87	0	0	0	0		
									Total	= Sum(	107)	=	82.62	(107)
Space	cooling	requiren	nent in k	:Wh/m²/y	/ear				(107)	÷ (4) =			1.63	(108)
8f. Fab	ric Ener	gy Effici	ency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabrio	Energy	/ Efficier	псу						(99) -	+ (108) =	=		56.89	(109)
Targe	et Fabric	Energ	y Efficie	ncy (TF	EE)								65.43	(109)

		l Isar	Details:						
Assessor Name:	Zahid Ashraf	0301	Stroma	. Num	hor		STDO	001082	
Software Name:	Stroma FSAP 2012	2	Softwa	-				n: 1.0.5.9	
		Propert	y Address:	Plot 1					
Address :									
Overall dwelling dime	ensions:	•	( 2)		A 11-	' l. (/)		M = 1, = / 2	<u> </u>
Ground floor		Ai	rea(m²) 50.61	(1a) x		ight(m) 2.5	(2a) =	Volume(m³	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)-	-		(4)			]` ''	120.00	
Dwelling volume	۵,۰(۱۵,۰(۱۵,۰(۱۵,۰		30.01		)+(3c)+(3c	d)+(3e)+	.(3n) =	106.50	7(5)
				(54) (54)	,	2) ( ( 0 0 )	.(01.)	126.53	(5)
2. Ventilation rate:		condary	other		total			m³ per hou	r
Number of chimneys	heating he	eating +	0	] = [	0	x 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0	J _ L ] = Г	0	x	20 =	0	(6b)
Number of intermittent fa					0	x	10 =	0	(7a)
Number of passive vents				L	0	x	10 =	0	(7b)
Number of flueless gas f				L	0		40 =		(7c)
Number of flueless gas fi	1163				0			0	(70)
							Air ch	anges per ho	ur
Infiltration due to chimne	ys, flues and fans = (6a)	)+(6b)+(7a)+(7b)	)+(7c) =	Γ	0		÷ (5) =	0	(8)
	peen carried out or is intended	l, proceed to (17	), otherwise o	ontinue fr	om (9) to	(16)	,		_ 
Number of storeys in the Additional infiltration	ne aweiling (ns)					[(9)]	-1]x0.1 =	0	(9) (10)
	.25 for steel or timber fr	ame or 0.35	for masonr	v constr	uction	[(0)	1]XO.1 =	0	(11)
	resent, use the value correspo	onding to the gre	eater wall are	a (after					<b>`</b>
deducting areas of opening	ngs); if equal user 0.35 floor, enter 0.2 (unseale	d) or 0.1 (sea	aled) else	enter ()			i	0	(12)
If no draught lobby, en	•	u) 01 0.1 (308	aica), cisc	critor o				0	(13)
•	s and doors draught stri	pped						0	(14)
Window infiltration	-		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	2) + (13)	+ (15) =		0	(16)
•	q50, expressed in cubic	-	•	•	etre of e	envelope	area	3	(17)
If based on air permeabil	•							0.15	(18)
Air permeability value applie  Number of sides sheltere	es if a pressurisation test has l	been done or a d	degree air pei	meability	is being u	sed		2	(19)
Shelter factor	,u		(20) = 1 -	0.075 x (1	9)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18)	x (20) =				0.13	(21)
Infiltration rate modified f	or monthly wind speed								_
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		
			•		•	•		1	

0.16	ation rat	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15		
Calculate effe	ctive air	change i	rate for t	l	cable ca		<u> </u>	<u> </u>					
If mechanic											ļ	0.5	(23
If exhaust air h		0 11		, ,	,	. ,	,, .	,	) = (23a)		ļ	0.5	(231
If balanced wit		•	-	_								79.05	(23
a) If balance						<del>- `</del>	<del>- ^ ` </del>	<del>í `</del>	<del>– `</del>	<del></del>	<del>- `                                   </del>	÷ 100]	(0.4
(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				i			<del>-                                    </del>	<del>í `</del>	<del> </del>	<del>-                                    </del>			(0.4
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h	nouse ex n < 0.5 ×								5 v (23h	.)			
(24c)m = 0	0.5 x	0	0	0 = (230)	0	0	$\frac{C}{C} = (221)$	0	0	0	0		(24
d) If natural						<u> </u>							(
	n = 1, the								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 (24k	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	e and he	at loss r	naramete	or:									
ELEMENT	Gros	•	Openin		Net Ar	<b>A</b> 2	U-val	IIA	AXU		k-value	Δ	Χk
LLLIVILINI	area		m		A ,r		W/m2		(W/I	<b>K</b> )	kJ/m²-k		/K
Doors					2	X	1.4	=	2.8				(26
Windows					8.651	x1.	/[1/( 1.4 )+	0.04] =	11.47				(27
Floor					32.84	9 x	0.12	i	3.94188	<u>=</u> ₃ [		7	(28
Walls Type1	41.9	)8	8.65	5	33.33	3 x	0.15	<b>=</b> i	5	Ħ i		ī	(29
Walls Type2	21.2	26	2		19.26	x	0.14	<u> </u>	2.76	F i		ī	(29
Walls Type3	20.7	<u> </u>	0		20.72	<u>x</u>	0.13	<u> </u>	2.77	F i		ī	(29
Roof	7.9	=	0		7.9	X	0.1	<b>=</b>	0.79	F i		7 -	(30
Total area of e	elements	 , m²			124.7	<del></del>							` (31
* for windows and			effective wi	ndow U-va			g formula 1	/[(1/U-valu	ıe)+0.04] a	ıs given in	paragraph	3.2	(-
** include the are						_				-			
Fabric heat lo	ss, W/K =	= S (A x	U)				(26)(30)	) + (32) =				29.53	(33
Heat capacity	Cm = S(	Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	4710.71	(34
Thermal mass	parame	ter (TMF	P = Cm -	: TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35
For design asses can be used inste				construct	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Thermal bridg				usina Ar	nendix k	<					Γ	13.29	(36
if details of therm	•	,		• .	•	`					L	13.29	(50
			()	(1	,			(33) +	(36) =		[	42.81	(37
		alculated	l monthly	У				(38)m	= 0.33 × (	25)m x (5)	)		
Total fabric he	at loss ca					11	Aug	Sep	Oct	Nov	Dec		
Total fabric he	at loss ca Feb	Mar	Apr	May	Jun	Jul	Aug			1404	Dec		
Total fabric he			Apr 10.23	May 10.1	Jun 9.43	9.43	9.3	9.7	10.1	10.36	10.63		(38
Ventilation head Salum 11.16	Feb 11.03	Mar 10.9		— <u> </u>			<del>l                                     </del>	9.7		10.36			(38
Total fabric he Ventilation hea	Feb 11.03	Mar 10.9		— <u> </u>			<del>l                                     </del>	9.7	10.1	10.36			(38)

Heat loss par	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.07	1.06	1.06	1.05	1.05	1.03	1.03	1.03	1.04	1.05	1.05	1.06		
		!	Į.	Į.	Į.	Į.	<u> </u>		Average =	Sum(40) <sub>1</sub>	12 /12=	1.05	(40)
Number of da	ays 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 he	ating ene	rgy requ	irement:								kWh/ye	ear:	
Assumed occ if TFA > 13 if TFA £ 13	3.9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x ( <sup>-</sup>	TFA -13		71		(42)
Annual avera Reduce the annu not more that 12	ual average	hot water	usage by	5% if the $c$	lwelling is	designed t			se target o		3.7		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage	in litres pe	r day for ea			ctor from	Table 1c x		! '	!	!			
(44)m= 86.57	83.42	80.28	77.13	73.98	70.83	70.83	73.98	77.13	80.28	83.42	86.57		
										m(44) <sub>112</sub> =	L	944.43	(44)
Energy content	of hot water	used - cal	culated mo	onthly = $4$ .	190 x Vd,r	n x nm x C	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 128.38	112.29	115.87	101.02	96.93	83.64	77.51	88.94	90	104.89	114.49	124.33		
If instantaneous	water heat	na ot noin	of upo (no	hot water	r otorogol	antar O in	hoves (16		Total = Su	m(45) <sub>112</sub> =	- [	1238.3	(45)
			`	·	, , , , , , , , , , , , , , , , , , ,	·	· · ·	, , , <del>,</del>	1	1	<del></del> 1		(40)
(46)m= 19.26 Water storag	1	17.38	15.15	14.54	12.55	11.63	13.34	13.5	15.73	17.17	18.65		(46)
Storage volui		) includir	na anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community	,					_							( )
Otherwise if r	_			_			, ,	ers) ente	er '0' in (	(47)			
Water storag													
a) If manufac	cturer's d	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature	factor fro	m Table	2b								0		(49)
Energy lost fr		•					(48) x (49)	) =		1	10		(50)
b) If manufacture Hot water sto			-								00		(51)
If community	•			G Z (KVV	ii/iiti G/GC	iy <i>)</i>				0.	02		(31)
Volume facto	•									1.	.03		(52)
Temperature	factor fro	m Table	2b							0	.6		(53)
Energy lost fr	om wate	r storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =	1.	03		(54)
Enter (50) or	(54) in (	55)								1.	.03		(55)
Water storag	e loss cal	culated t	for each	month			((56)m = (	(55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contai	ns dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	x H	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circu	it loss (ar	nual) fro	m Table	3				•	•		0		(58)
Primary circu	`	,			59)m = (	(58) ÷ 36	65 × (41)	ım			-		` '
(modified b				,	•	. ,	, ,		r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss	ralculated	for each	month (	(61)m –	(60) ± '	365 🗸 (41	\m						
(61)m= 0	0	0	0	0	00)	1 0	) T o	T 0	0	0	0	1	(61)
	!			alculated	l for ea	ch month						」 · (59)m + (61)m	` ,
(62)m= 183.6	<del>-i</del>	171.15	154.51	152.21	137.14		144.2		160.17	167.99	179.61	1	(62)
Solar DHW inpo		L	<u> </u>	. Appendix			l v) (ente					<u></u>	` ,
(add addition											,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from	water hea	ter	ļ.				ļ.		·!	·!		_	
(64)m= 183.6		171.15	154.51	152.21	137.14	132.78	144.2	2 143.5	160.17	167.99	179.61	1	
	L	<u>!</u>	!	l .			C	utput from w	ater heate	er (annual)	12	1889.14	(64)
Heat gains f	rom water	heating,	, kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	า + (61	)m] + 0.8	x [(46)m	+ (57)m	+ (59)m	   ]	_
(65)m= 86.9°		82.75	76.38	76.45	70.61	69.99	73.7	<del></del>	79.1	80.86	85.56	1	(65)
include (5	7)m in cald	culation	of (65)m	only if c	ylinder	is in the	dwellir	ng or hot w	ater is f	rom com	munity h	neating	
5. Internal					•								
Metabolic ga	ains (Table	e 5), Wat	ts										
Jar	r Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec	]	
(66)m= 102.4	9 102.49	102.49	102.49	102.49	102.49	102.49	102.4	9 102.49	102.49	102.49	102.49	]	(66)
Lighting gair	ns (calcula	ted in Ap	opendix	L, equat	ion L9	or L9a), a	also se	e Table 5				_	
(67)m= 34.18	30.35	24.69	18.69	13.97	11.79	12.74	16.5	7 22.23	28.23	32.95	35.13	]	(67)
Appliances (	gains (calc	ulated ir	n Append	dix L, eq	uation	L13 or L1	3a), a	lso see Ta	ble 5		_	_	
(68)m= 222.1	2 224.43	218.62	206.25	190.64	175.97	166.17	163.8	7 169.68	182.04	197.65	212.32	]	(68)
Cooking gai	ns (calcula	ited in A	ppendix	L, equat	ion L1	or L15a	), also	see Table	5	-	-	_	
(69)m= 46.96	6 46.96	46.96	46.96	46.96	46.96	46.96	46.9	6 46.96	46.96	46.96	46.96	]	(69)
Pumps and	fans gains	(Table 5	5a)									_	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0	]	(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)						-	_	
(71)m= -68.3	2 -68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.3	2 -68.32	-68.32	-68.32	-68.32	]	(71)
Water heatir	ng gains (T	able 5)		-				-		-	-	_	
(72)m= 116.8	1 115	111.22	106.09	102.76	98.06	94.08	99.1	9 101	106.31	112.31	115	]	(72)
Total intern	al gains =				(6	6)m + (67)n	n + (68)	m + (69)m +	(70)m + (7	71)m + (72)	)m	_	
(73)m= 454.2	3 450.89	435.64	412.15	388.49	366.95	354.11	360.7	4 374.03	397.7	424.03	443.57	]	(73)
6. Solar ga	ins:												
Solar gains ar	e calculated	using sola	r flux from	Table 6a	and asso	ciated equa	ations to	convert to the	ne applica		tion.		
Orientation:			Area			ux able 6a		g_ Table 6b	т	FF able 6c		Gains	
	Table 6d		m²			able ba	, ,	Table 6b	_ '	able oc		(W)	,
Southwest <sub>0.9</sub>		X	8.6	S5	x	36.79	ļĻ	0.63	x	0.7	=	97.28	(79)
Southwest <sub>0.9</sub>	• • • • • • • • • • • • • • • • • • • •	x	8.6	S5	x	62.67	ŢĒ	0.63	x	0.7	=	165.7	(79)
Southwest <sub>0.9</sub>	<u> </u>	х	8.6	S5	x	85.75	Ţ	0.63	x	0.7	=	226.72	(79)
Southwest <sub>0.9</sub>		X	8.6	S5	x	106.25	<u> </u>	0.63	x	0.7	=	280.91	(79)
Southwest <sub>0.9</sub>	× 0.77	X	8.6	S5	X	119.01		0.63	X	0.7	=	314.65	(79)

Southwest <sub>0.9x</sub> 0.77	X	8.6	5	x	118.15			0.63	x	0.7	=	312.37	(79)
Southwest <sub>0.9x</sub> 0.77	x	8.6	5	x	113.91			0.63	x	0.7	=	301.16	(79)
Southwest <sub>0.9x</sub> 0.77	x	8.6	5	x	104.39	)		0.63	x	0.7	=	275.99	(79)
Southwest <sub>0.9x</sub> 0.77	Х	8.6	5	x	92.85			0.63	x	0.7	=	245.49	(79)
Southwest <sub>0.9x</sub> 0.77	х	8.6	5	x	69.27			0.63	x [	0.7	=	183.13	(79)
Southwest <sub>0.9x</sub> 0.77	x	8.6	5	x	44.07			0.63	x	0.7	=	116.52	(79)
Southwest <sub>0.9x</sub> 0.77	X	8.6	5	x	31.49			0.63	x	0.7	=	83.25	(79)
Solar gains in watts, ca	alculated	for eacl	n month			(8	83)m = S	Sum(74)m .	(82)m	1	ī	•	
(83)m= 97.28 165.7	226.72	280.91	314.65		2.37 301		275.99	245.49	183.13	116.52	83.25		(83)
Total gains – internal a		<del>`                                    </del>		Ò	<del></del>			1		1	ı	1	
(84)m= 551.51 616.59	662.36	693.06	703.13	67	9.32 655	5.27	636.73	619.52	580.84	540.55	526.82		(84)
7. Mean internal temp	perature (	(heating	season	)									
Temperature during h	neating p	eriods ir	the livi	ng a	area from	Tabl	le 9, Th	11 (°C)				21	(85)
Utilisation factor for g	ains for l	ving are	a, h1,m	(se	e Table 9	9a)						•	
Jan Feb	Mar	Apr	May		Jun Ju	ul	Aug	Sep	Oct	Nov	Dec		
(86)m= 0.88 0.84	0.79	0.71	0.59	0	.46 0.3	34	0.36	0.52	0.71	0.84	0.89		(86)
Mean internal temper	ature in I	iving are	ea T1 (fo	ollov	w steps 3	to 7	in Tab	le 9c)					
(87)m= 19.49 19.74	20.07	20.44	20.73	20	0.91 20.	.97	20.96	20.86	20.5	19.95	19.43		(87)
Temperature during h	neating p	eriods ir	rest of	dwe	elling fron	n Tab	ble 9, T	h2 (°C)					
(88)m= 20.03 20.03	20.03	20.04	20.05	20	0.06 20.	.06	20.06	20.05	20.05	20.04	20.04		(88)
Utilisation factor for g	ains for r	est of d	wellina.	h2.r	m (see Ta	able 9	9a)			•		•	
(89)m= 0.87 0.82	0.77	0.67	0.55		0.4 0.2		0.29	0.46	0.68	0.82	0.88		(89)
Mean internal temper	ature in t	he rest	of dwelli	na .	T2 (follow	v ster	ns 3 to	7 in Tahl	le 9c)				
(90)m= 18.05 18.4	18.86	19.38	19.75	Ť	9.97 20.		20.03	19.92	19.48	18.72	17.98		(90)
	!!				!			1	L fLA = Livir	ng area ÷ (4	4) =	0.65	(91)
Mean internal temper	atura (fo	r tha wh	olo dwo	llino	η) — fl Λ ν	· T1 ച	∟ /1 _ fl	۸) ی T2					
(92)m= 18.98 19.27	19.64	20.07	20.39	<del>–</del>	$\begin{array}{c c} 0.58 & 20. \end{array}$		20.64	20.53	20.14	19.52	18.92		(92)
Apply adjustment to t													, ,
(93)m= 18.98 19.27	19.64	20.07	20.39	1	0.58 20.		20.64	20.53	20.14	19.52	18.92		(93)
8. Space heating requ	uirement							•		•			
Set Ti to the mean int				ed	at step 1	1 of 7	Table 9	b, so tha	t Ti,m=	(76)m an	d re-calc	culate	
the utilisation factor for	<del></del>				<del></del>					1	_	I	
Jan Feb	Mar	Apr	May	٠	Jun Ju	ul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for g	0.76	0.67	0.57	<u> </u>	.43 0.3	31	0.33	0.49	0.68	0.8	0.86		(94)
Useful gains, hmGm					.45 0.0		0.55	0.49	0.00	0.0	0.00		(01)
(95)m= 467.69 499.09	500.68	467.52	398.24	29	92.1 205	5.07	213.23	306.05	395.86	433.94	452.72		(95)
Monthly average exte				ı— able	<del></del>	!			ļ				
(96)m= 4.3 4.9	6.5	8.9	11.7		4.6 16	5.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for me	an intern	al tempe	erature,	Lm	, W =[(39	9)m x	: [( <u>9</u> 3)m	n— (96)m	]				
(97)m= 792.5 773.56	705.98	592.4	459.56	31	2.44 211	.21	220.81	337.53	504.97	660.34	786.96		(97)
Space heating require	r	each m		/Vh/	month =	0.024	4 x [(97	')m – (95	)m] x (4	1)m		•	
(98)m= 241.66 184.44	152.75	89.91	45.62		0 0		0	0	81.18	163.01	248.67		

	Total per year	$(kWh/year) = Sum(98)_{15,912} =$	1207.24	(98)
Space heating requirement in kWh/m²/year			23.85	(99)
9b. Energy requirements – Community heating scheme				
This part is used for space heating, space cooling or water Fraction of space heat from secondary/supplementary hea			0	(301)
Fraction of space heat from community system $1 - (301) =$	,		1	(302)
The community scheme may obtain heat from several sources. The proce		up to four other heat sources; t	the latter	
includes boilers, heat pumps, geothermal and waste heat from power star Fraction of heat from Community boilers	ions. See Appendix C.		1	(303a)
Fraction of total space heat from Community boilers		(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for co	mmunity heating sys	tem	1	(305)
Distribution loss factor (Table 12c) for community heating s	system		1.05	(306)
Space heating			kWh/yea	 r
Annual space heating requirement			1207.24	
Space heat from Community boilers	(98) x (3	04a) x (305) x (306) =	1267.61	(307a)
Efficiency of secondary/supplementary heating system in %	% (from Table 4a or A	ppendix E)	0	(308
Space heating requirement from secondary/supplementary	system (98) x (3	01) x 100 ÷ (308) =	0	(309)
Water heating				_
Annual water heating requirement			1889.14	
If DHW from community scheme: Water heat from Community boilers	(64) x (3	03a) x (305) x (306) =	1983.59	(310a)
Electricity used for heat distribution	0.01 × [(307a)	(307e) + (310a)(310e)] =	32.51	(313)
Cooling System Energy Efficiency Ratio			0	(314)
Space cooling (if there is a fixed cooling system, if not enter	r 0) = (107) -	÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f):	fuore outoido			
mechanical ventilation - balanced, extract or positive input	irom outside		175.59	(330a)
warm air heating system fans			0	(330b)
pump for solar water heating	_(220a)	. (220b) . (220a) -	0	(330g) (331)
Total electricity for the above, kWh/year	=(330a)	+ (330b) + (330g) =	175.59	_՝ ՝
Energy for lighting (calculated in Appendix L)	:4\		241.42	(332)
Electricity generated by PVs (Appendix M) (negative quant	• •		-510.48	(333)
Electricity generated by wind turbine (Appendix M) (negative	ve quantity)		0	(334)
10b. Fuel costs – Community heating scheme				
<b>Fuel</b> kWh/y	ear	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating from CHP (307a)	x	4.24 x 0.01 =	53.75	(340a)
Water heating from CHP (310a)	x	4.24 x 0.01 =	84.1	(342a)

		F	uel Price		
Pumps and fans	(331)	Ĺ	13.19 × 0.01 =	23.16	(349)
Energy for lighting	(332)		13.19 x 0.01 =	31.84	(350)
Additional standing charges (Table 12)				120	(351)
Energy saving/generation technologies	= (340a)(342e) + (345)	(354) -			7,055
Total energy cost		.(354) =		312.85	(355)
11b. SAP rating - Community heating	scneme				
Energy cost deflator (Table 12)	[(055) (050)] [(4) 456			0.42	(356)
Energy cost factor (ECF)	$[(355) \times (356)] \div [(4) + 45.0]$	)] =		1.37	(357)
SAP rating (section12)	ting a calculation			80.83	(358)
12b. CO2 Emissions – Community hea	ting scheme	Energy	Emission facto	r Emissions	
		kWh/year	kg CO2/kWh	kg CO2/year	
CO2 from other sources of space and v Efficiency of heat source 1 (%)			) to (366) for the second for	uel 94	(367a)
CO2 associated with heat source 1	[(307b)	)+(310b)] x 100 ÷ (367b)	x 0.22	= 747.08	(367)
Electrical energy for heat distribution		[(313) x	0.52	= 16.87	(372)
Total CO2 associated with community s	systems	(363)(366) + (368)	(372)	= 763.96	(373)
CO2 associated with space heating (se	condary)	(309) x	0	= 0	(374)
CO2 associated with water from immer	sion heater or instantar	neous heater (312)	x 0.22	= 0	(375)
Total CO2 associated with space and v	vater heating	(373) + (374) + (375) =	:	763.96	(376)
CO2 associated with electricity for pum	ps and fans within dwe	lling (331)) x	0.52	91.13	(378)
CO2 associated with electricity for light	ing	(332))) x	0.52	125.3	(379)
Energy saving/generation technologies Item 1	(333) to (334) as applie	cable	0.52 x 0.01 =	-264.94	(380)
Total CO2, kg/year	sum of (376)(382) =	_		715.45	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.14	(384)
El rating (section 14)				89.97	(385)
13b. Primary Energy - Community hea	ting scheme				
		Energy kWh/year	Primary factor	P.Energy kWh/year	
Energy from other sources of space an Efficiency of heat source 1 (%)	d water heating (not CF If there is CHP usi	HP) ing two fuels repeat (363	) to (366) for the second for	uel 94	(367a)
Energy associated with heat source 1	[(307b)	)+(310b)] x 100 ÷ (367b)	x 1.22	= 4219.64	(367)
Electrical energy for heat distribution		[(313) x		= 99.81	(372)
Total Energy associated with communit	ry systems	(363)(366) + (368)	(372)	= 4319.46	(373)
if it is negative set (373) to zero (unle	ess specified otherwise,	see C7 in Appendi	x C)	4319.46	(373)
Energy associated with space heating (	(secondary)	(309) x	0	= 0	(374)

Energy associated with water from immersion heater or instal	ntaneous heater(312) x	1.22	=	0	(375)
Total Energy associated with space and water heating	(373) + (374) + (375) =			4319.46	(376)
Energy associated with space cooling	(315) x	3.07	=	0	(377)
Energy associated with electricity for pumps and fans within o	dwelling (331)) x	3.07	=	539.06	(378)
Energy associated with electricity for lighting	(332))) x	3.07	=	741.16	(379)
Energy saving/generation technologies Item 1		3.07 × 0.0	1 =	-1567.16	(380)
Total Primary Energy, kWh/year sum of (376	5)(382) =			4032.51	(383)

		l Iser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	<del>- 036</del> 11	Strom Softwa					0001082 on: 1.0.5.9	
	F	roperty	Address	Plot 1					
Address :									
Overall dwelling dimer	nsions:	Δro	a(m²)		Δν Ηο	ight(m)		Volume(m <sup>3</sup>	3)
Ground floor				(1a) x		2.5	(2a) =	126.53	) (3a)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	50.61	(4)			_		
Dwelling volume	, ( -, ( -, ( -, ( -,	′	30.01		)+(3c)+(3c	d)+(3e)+	.(3n) =	126.53	(5)
							,	120.55	
2. Ventilation rate:	main seconda	ry	other		total			m³ per hou	ır
Number of chimneys	heating heating beauting heating	<b>¬</b> + Г	0	] = Г	0	x 4	40 =	0	(6a)
Number of open flues	0 + 0	_    +	0	] <sub>=</sub> [	0	x :	20 =	0	(6b)
Number of intermittent far				J	2	x	10 =	20	(7a)
Number of passive vents	.0			L		x	10 =		(7b)
Number of flueless gas fir	os.			Ļ	0		40 =	0	= 1
Number of flueless gas in	65				0		10 –	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimney	rs, flues and fans = $(6a)+(6b)+(6b)$	7a)+(7b)+	(7c) =	Г	20		÷ (5) =	0.16	(8)
	een carried out or is intended, procee	ed to (17),	otherwise o	continue fr	om (9) to	(16)			_
Number of storeys in th Additional infiltration	e dwelling (ns)					[(0)	-1]x0.1 =	0	(9)
	25 for steel or timber frame o	0.35 fo	r masoni	v constr	uction	[(9)	-1]XU.1 =	0	(10)
if both types of wall are pre	esent, use the value corresponding t			•					()
deducting areas of opening	gs); if equal user 0.35 oor, enter 0.2 (unsealed) or 0	1 (soal	ad) also	ontor O					7(12)
If no draught lobby, ent	,	. i (Scaii	eu), eise	enter o				0	(12)
•	and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
•	q50, expressed in cubic metre			•	etre of e	envelope	area	5	(17)
· ·	ty value, then $(18) = [(17) \div 20] + (18)$ is if a pressurisation test has been do.				is haina u	sad		0.41	(18)
Number of sides sheltered		ie or a de	gree an pe	THEADING	is being u	seu		2	(19)
Shelter factor			(20) = 1 -	[0.0 <b>75</b> x (1	19)] =			0.85	(20)
Infiltration rate incorporati	ng shelter factor		(21) = (18	) x (20) =				0.35	(21)
Infiltration rate modified for	or monthly wind speed							1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind spe	<del> </del>		1				ı	1	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (22	?)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		

0.44	0.43	0.42	0.38	0.37	o.33	0.33	0.32	0.35	0.37	0.39	0.41		
Calculate effe		l -			1		0.52	0.55	0.57	0.55	0.41		
If mechanica	al ventila	ition:										0	(2:
If exhaust air he	eat pump i	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b	) = (23a)			0	(2:
If balanced with	n heat reco	overy: effic	iency in %	allowing f	for in-use f	actor (fron	n Table 4h	) =				0	(2:
a) If balance	d mech	anical ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (2)	2b)m + (	23b) × [	1 – (23c)	÷ 100]	
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
b) If balance	d mech	anical ve	ntilation	without	heat red	covery (N	ЛV) (24b	m = (22)	2b)m + (	23b)		•	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole h				-									
if (22b)n		· · · ·	· ` ·	<u> </u>	<del></del>	<u> </u>	<del>´`</del>	ŕ –	<u> </u>	<del>í                                      </del>		ĺ	(0
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural if (22b)n									0.51				
4d)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	I	(2
Effective air		rate - er	ter (24a	) or (24h	n) or (24	c) or (24		(25)				I	·
25)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	I	(2
·					L		<u> </u>		<u> </u>	L		I	<u> </u>
3. Heat losse													
LEMENT	Gros area	-	Openin m	-	Net Ar A ,r		U-valı W/m2		A X U (W/		k-value kJ/m²-ł		X X k J/K
oors	u. • u.	( )	•••		2	 x	1	 	2				(2
/indows					8.651	╡,	/[1/( 1.4 )+	0.04] =	11.47	=			(2
loor					32.84	<del>_</del>	0.13		4.2703	 7		<b>–</b>	(2
/alls Type1	41.9	10	8.65		33.33	=	0.18	=	6			╡	(2
/alls Type2	21.2	_	2	_	19.26	=	0.18	╡ [	3.47	<del>-</del>		┥	(2
/alls Type3		=		_				=		<b> </b>		$\dashv$ $\models$	(2
oof	20.7		0	_	20.72	=	0.18	_ =	3.73	<u> </u>		╡	==
	7.9		0		7.9	×	0.13	=	1.03			_	(3
otal area of e			.ffa ativa vui	ndou II v	124.7		, formula 1	/[/1/	·a) · 0 041 ·	a airan in	norogranh		(3
for windows and include the area						ated using	i iorriiula i	/[( I/ <b>U-</b> vait	ie)+0.04] č	as given in	paragrapri	3.2	
abric heat los	s, W/K :	= S (A x	U)				(26)(30)	+ (32) =				31.96	(3
eat capacity	Cm = S(	(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	4710.71	(3
hermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(3
or design assess	ments wh	ere the de	tails of the	construct	ion are no	t known pr	ecisely the	indicative	e values of	TMP in T	able 1f		
n be used inste						,					ı		
nermal bridge	,	,			•	<b>&lt;</b>						14.78	(3
details of therma otal fabric he		are not kn	own (36) =	= 0.05 x (3	31)			(33) +	(36) =			46.74	(3
entilation hea		alculated	l monthly	,					= 0.33 × (	(25)m x (5)	) )	40.74	(
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
3411	24.8	24.65	23.92	23.78	23.14	23.14	23.03	23.39	23.78	24.06	24.34		(3
8)m= 24.96	1 27.0			1		<u> </u>					L	į.	•
·		<u> </u>						(30)~	- (37) + (	38)m			
8)m= 24.96 eat transfer of 29)m= 71.7		<u> </u>	70.66	70.52	69.89	69.89	69.77	(39)m 70.13	= (37) + ( 70.52	38)m 70.8	71.09	I	

Heat loss par	ameter (I	HLP), W	/m²K					(40)m	= (39)m ÷	· (4)			
(40)m= 1.42	1.41	1.41	1.4	1.39	1.38	1.38	1.38	1.39	1.39	1.4	1.4		
	<u>!</u>	!	<u> </u>	ļ		ļ	ļ		L Average =	Sum(40) <sub>1</sub> .	12 /12=	1.4	(40)
Number of da	ys 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 hea	ating ene	rgy requi	irement:								kWh/ye	ar:	
Assumed occ if TFA > 13 if TFA £ 13	.9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9	)2)] + 0.0	0013 x (¯	TFA -13:		71		(42)
Annual avera Reduce the annu not more that 12	ual average	hot water	usage by	$5\%$ if the $\alpha$	lwelling is	designed t	` ,		se target o		.77		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage	in litres pe	r day for ea			ctor from	Table 1c x			ļ.	ļ.			
(44)m= 82.24	79.25	76.26	73.27	70.28	67.29	67.29	70.28	73.27	76.26	79.25	82.24		
	-1								Total = Su	m(44) <sub>112</sub> =	=	897.21	(44)
Energy content of	of hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	n x nm x D	OTm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 121.97	106.67	110.08	95.97	92.08	79.46	73.63	84.49	85.5	99.64	108.77	118.12		
If instantaneous	water boots	'na at naint	of upo /pa	hat water	, ataragal	antar O in	haves (46		Total = Su	m(45) <sub>112</sub> =	= [	1176.38	(45)
If instantaneous	1		· `		,.		· · ·		1	ī			(15)
(46)m= 18.29 Water storage	16 2 loss:	16.51	14.4	13.81	11.92	11.04	12.67	12.83	14.95	16.32	17.72		(46)
Storage volur		) includir	ng anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community						_							( )
Otherwise if r	_			_			, ,	ers) ente	er '0' in (	47)			
Water storage													
a) If manufac	cturer's d	eclared I	oss facto	or is kno	wn (kWł	n/day):				1.	39		(48)
Temperature	factor fro	m Table	2b							0.	.54		(49)
Energy lost fr		•					(48) x (49)	) =		0.	75		(50)
<ul><li>b) If manufact</li><li>Hot water sto</li></ul>			-								0		(51)
If community	•			ie z (KVV	ii/iiti G/GC	, y <i>)</i>					0		(31)
Volume facto	-										0		(52)
Temperature	factor fro	m Table	2b								0		(53)
Energy lost fr	om wate	r storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
Enter (50) or	(54) in (	55)								0.	75		(55)
Water storage	e loss cal	culated t	for each	month			((56)m = (	55) × (41)	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 contain	ns dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5 <sup>-</sup>	7)m = (56)	m where (	H11) is fro	m Appendi	хН	
(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 circu	it loss (ar	nual) fro	m Tahla								0		(58)
Primary circu	•	•			59)m = (	(58) ÷ 36	65 × (41)	m					, ,
(modified b				,	•	` '	, ,		r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss	a laulata d	for oach	month /	(64)m	(en) . a	GE (44	١,,,,						
Combi loss (61)m= 0	0 0	o each	0	0	00) - 3	00 × (41	0	0	0	0	0	1	(61)
				<u> </u>			<u> </u>	<u> </u>		<u> </u>	<u> </u>	J (59)m + (61)m	(- /
(62)m= 168.5	<del></del>	156.67	141.06	138.68	124.55	120.23	131.09	130.59	146.24	153.86	164.71		(62)
Solar DHW inp		L	endix G o	<u> </u>				<u> </u>	I contribut	<u> </u>	I er heating)	1	. ,
(add addition											3,		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from	water hea	ter											
(64)m= 168.5	6 148.76	156.67	141.06	138.68	124.55	120.23	131.09	130.59	146.24	153.86	164.71		_
	•						Out	put from w	ater heate	r (annual) <sub>1</sub>	112	1725	(64)
Heat gains f	rom water	heating,	kWh/m	onth 0.2	5 ´ [0.85	5 × (45)m	+ (61)r	n] + 0.8	x [(46)m	+ (57)m	+ (59)m	1]	
(65)m= 77.83	69.14	73.88	67.98	67.89	62.49	61.76	65.37	64.5	70.41	72.24	76.55		(65)
include (5	7)m in cal	culation of	of (65)m	only if c	ylinder	is in the	dwelling	or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a	):									
Metabolic ga	ains (Table	e 5), Wat	ts										
Jar		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 85.4°	1 85.41	85.41	85.41	85.41	85.41	85.41	85.41	85.41	85.41	85.41	85.41		(66)
Lighting gair	ns (calcula	ted in Ap	pendix	L, equat	on L9 c	r L9a), a	lso see	Table 5					
(67)m= 13.67	7 12.14	9.87	7.48	5.59	4.72	5.1	6.63	8.89	11.29	13.18	14.05		(67)
Appliances (	gains (calc	ulated in	Append	dix L, eq	uation L	.13 or L1	3a), als	o see Ta	ble 5	•			
(68)m= 148.8	2 150.37	146.47	138.19	127.73	117.9	111.34	109.79	113.68	121.97	132.43	142.25		(68)
Cooking gair	ns (calcula	ted in A	ppendix	L, equat	ion L15	or L15a	), also s	ee Table	5	-			
(69)m= 31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54	31.54		(69)
Pumps and	fans gains	(Table 5	5a)							-			
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporatio	n (negat	tive valu	es) (Tab	le 5)								
(71)m= -68.3	2 -68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.32	-68.32		(71)
Water heating	ng gains (T	able 5)		-		-		-	-		-		
(72)m= 104.6	1 102.88	99.3	94.42	91.25	86.8	83.01	87.86	89.59	94.63	100.33	102.89		(72)
Total intern	al gains =	:			(66	i)m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	'1)m + (72)	)m		
(73)m= 318.7	2 317.01	307.27	291.71	276.19	261.04	251.06	255.9	263.79	279.52	297.56	310.82		(73)
6. Solar ga	ins:												
Solar gains ar		_	r flux from	Table 6a			ations to c	onvert to th	ne applicat		tion.		
Orientation:	Access F Table 6d		Area m²		Flu	ıx ble 6a	_	g_ Fable 6b	т	FF able 6c		Gains (W)	
						DIE Ga	. –	able ob	_ '	able oc		(۷۷)	,
Southwest <sub>0.9</sub>		X	8.6	55	X	36.79	<u> </u>	0.63	x	0.7	=	97.28	(79)
Southwest <sub>0.9</sub>	0.77	X	8.6	35	х	62.67	ļ <u>Ļ</u>	0.63	x	0.7	=	165.7	(79)
Southwest <sub>0.9</sub>	0.77	X	8.6	35	X	85.75	ļ <u>Ļ</u>	0.63	x	0.7	=	226.72	(79)
Southwest <sub>0.9</sub>		X	8.6	35	X 1	06.25	ļ <u>L</u>	0.63	X	0.7	=	280.91	(79)
Southwest <sub>0.9</sub>	× 0.77	X	8.6	35	X 1	19.01		0.63	X	0.7	=	314.65	(79)

Southw	/est <sub>0.9x</sub>	0.77	x	8.6	55	х	118.15	5		0.63	х	0.7		312.37	(79)
Southw	est <sub>0.9x</sub>	0.77	x	8.6	i5	х	113.91			0.63	_ x [	0.7	<del>-</del>	301.16	(79)
Southw	est <sub>0.9x</sub>	0.77	x	8.6	55	х	104.39	)		0.63		0.7	╡ -	275.99	(79)
Southw	est <sub>0.9x</sub>	0.77	x	8.6	55	x	92.85			0.63	x	0.7	<b>=</b>	245.49	(79)
Southw	est <sub>0.9x</sub>	0.77	x	8.6	55	x	69.27			0.63	x	0.7	= =	183.13	(79)
Southw	est <sub>0.9x</sub> /	0.77	X	8.6	55	x $\Box$	44.07			0.63	x	0.7	= =	116.52	(79)
Southw	est <sub>0.9x</sub>	0.77	×			x	31.49		i ⊨	0.63	╡ょ┝	0.7	╡ -	83.25	(79)
	L					_									`
Solar	gains in	watts, ca	alculated	d for eacl	h month				(83)m = S	Sum(74)m .	(82)m				
(83)m=	97.28	165.7	226.72	280.91	314.65	312.	37 301	1.16	275.99	245.49	183.13	116.52	83.25		(83)
Total g	gains – i	nternal a	and sola	r (84)m =	= (73)m	+ (83	m , wa	tts		•	!	•	!	•	
(84)m=	416	482.71	533.98	572.62	590.84	573.	41 552	2.22	531.9	509.27	462.65	414.08	394.07		(84)
7. Me	ean inter	nal temp	perature	(heating	season	)									
				eriods ir			ea from	Tab	ole 9, Th	n1 (°C)				21	(85)
Utilisa	ation fac	ctor for g	ains for	living are	ea, h1,m	(see	Table 9	9a)							
	Jan	Feb	Mar	Apr	May	Ju	n J	ul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.99	0.97	0.93	0.85	0.7	0.5	54	0.58	0.79	0.94	0.99	0.99		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ıllow	stens 3	to 7	' in Tabl	e 9c)		•		•	
(87)m=	19.61	19.8	20.08	20.43	20.73	20.9	<del>i</del>		20.97	20.86	20.47	19.98	19.58		(87)
		during h	L	ariada ir	root of	اميرما	ina fron		bla O T		<u> </u>			l	
(88)m=	19.75	19.75	19.76	eriods ir	19.77	19.7	<u> </u>		19.78	19.77	19.77	19.76	19.76		(88)
							<u> </u>			13.77	15.77	13.70	13.70		(00)
			1	rest of d			<del>`                                    </del>			T		Ι		1	(00)
(89)m=	0.99	0.98	0.96	0.91	0.8	0.6	0.	.4	0.44	0.7	0.92	0.98	0.99		(89)
Mean	interna	l temper	ature in	the rest	of dwell	ing T	2 (follov	v ste	ps 3 to	7 in Tab	le 9c)	т	1	Ī	
(90)m=	17.95	18.23	18.63	19.12	19.51	19.7	3 19.	.77	19.77	19.67	19.19	18.49	17.9		(90)
										1	fLA = Livir	ng area ÷ (4	4) =	0.65	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	lling)	= fLA ×	: T1	+ (1 – fl	_A) × T2				-	
(92)m=	19.03	19.25	19.57	19.97	20.3	20.			20.55	20.44	20.02	19.46	18.99		(92)
			1	1		1				ere appro	r			1	
(93)m=	19.03	19.25	19.57	19.97	20.3	20.	5 20.	.56	20.55	20.44	20.02	19.46	18.99		(93)
		iting requ							<b>T</b> 0			(70)			
				mperatui using Ta		ned a	step 1	1 Of	Table 9	b, so tha	it II,m=(	76)m an	d re-cald	culate	
	Jan	Feb	Mar	Apr	May	Ju	n J	ul	Aug	Sep	Oct	Nov	Dec		
Utilisa		ctor for g								1					
(94)m=	0.99	0.98	0.96	0.91	0.82	0.6	6 0.4	49	0.53	0.75	0.93	0.98	0.99		(94)
Usefu	ul gains,	hmGm	, W = (9	4)m x (84	4)m										
(95)m=	411.23	472.36	511.92	523.32	486.07	379	.1 269	9.5	279.9	383.89	428.27	405.22	390.41		(95)
Mont	hly aver	age exte	rnal tem	perature	from T	able 8	3							•	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.		6.6	16.4	14.1	10.6	7.1	4.2		(96)
							<del></del>	_		n– (96)m		Ι	ī	1	/ <del>***</del>
(97)m=		1026.59	933.34	782.33	606.62	412.		5.46	289.59	444.57	664.6	874.71	1051.31		(97)
-		<del>i i</del>				T				')m – (95 T	<del> </del>	T	101 =:	1	
(98)m=	479.7	372.44	313.54	186.49	89.7	0		0	0	0	175.82	338.03	491.71		

							,		_
			Tota	l per year	(kWh/year	) = Sum(9	8) <sub>15,912</sub> =	2447.43	(98)
Space heating requirement in kWh/m²/year								48.36	(99)
9a. Energy requirements – Individual heating syst	tems ir	ncluding	micro-C	HP)					
Space heating:		a					ſ		7(204)
Fraction of space heat from secondary/supplement	entary	•	(202) 1	(204)			Į	0	(201)
Fraction of space heat from main system(s)			(202) = 1 -		(202)]		ļ	1	(202)
Fraction of total heating from main system 1			(204) = (20	02) <b>x</b> [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1							ļ	93.5	(206)
Efficiency of secondary/supplementary heating s	system	, %			,			0	(208)
Jan Feb Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space heating requirement (calculated above)			•		175.00		104.74		
479.7 372.44 313.54 186.49 89.7	0	0	0	0	175.82	338.03	491.71		
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206)$ $513.05  398.34  335.34  199.45  95.93$	, 1		0		100.05	204.52	505.0		(211)
513.05   398.34   335.34   199.45   95.93	0	0	0 Tota	0 L(kWh/yea	188.05 ar) =Sum(2	361.53	525.9	2617.58	(211)
Space heating fuel (secondary) k\\l/\h/menth			1010	i (kvvii) y oc	ar) – <b>C</b> arri(2	- ' '/15,1012		2017.30	(211)
Space heating fuel (secondary), kWh/month = $\{[(98)m \times (201)]\} \times 100 \div (208)$									
(215)m= 0 0 0 0 0	0	0	0	0	0	0	0		
			Tota	l (kWh/yea	ar) =Sum(2	215) <sub>15,1012</sub>	=	0	(215)
Water heating							<u> </u>		
Output from water heater (calculated above)						Г			
	124.55	120.23	131.09	130.59	146.24	153.86	164.71		<b>—</b> (-,-)
Efficiency of water heater								79.8	(216)
` '	79.8	79.8	79.8	79.8	85.31	86.86	87.55		(217)
Fuel for water heating, kWh/month $(219)m = (64)m \times 100 \div (217)m$									
(219)m= 192.75 170.66 180.85 164.87 165.71 1	156.08	150.66	164.27	163.65	171.43	177.14	188.13		
			Tota	I = Sum(2	19a) <sub>112</sub> =			2046.2	(219)
Annual totals					k\	Wh/year		kWh/yea	ir_
Space heating fuel used, main system 1								2617.58	
Water heating fuel used								2046.2	
Electricity for pumps, fans and electric keep-hot									
central heating pump:							30		(230c
boiler with a fan-assisted flue							45		(230e
Total electricity for the above, kWh/year			sum	of (230a).	(230g) =		ا ن	75	(231)
Electricity for lighting				(====)	(===3)		[ [		(232)
, , ,	راه دا د	alia a rasi	oro CLID				L	241.42	(232)
12a. CO2 emissions – Individual heating system	is inclu	aing mi	CTO-CHP						
		<b>ergy</b> h/year			Emiss kg CO	<b>ion fac</b> 2/kWh	tor	Emission kg CO2/ye	
Space heating (main system 1)	(211	) x			0.2		= [	565.4	(261)

Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	441.98 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1007.38 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	125.3 (268)
Total CO2, kg/year	sum	of (265)(271) =	1171.6 (272)

TER = 23.15 (273)