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 14:55:19

Project Information:

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

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 71.89m² **Plot Reference:** Site Reference : Hermitage Lane Plot 5

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))

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

Dwelling Carbon Dioxide Emission Rate (DER) 12.10 kg/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 43.0 kWh/m²

OK 2 Fabric U-values

Element Average

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

Roof (no roof)

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 3.00 (design value)

OK Maximum 10.0

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

programmer and at least two room thermostats

Hot water controls: No cylinder thermostat

No cylinder

OK

Regulations Compliance Report

7 Low energy lights		
7 Low energy lights	400.007	
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 East	11.2m²	
Ventilation rate:	4.00	
10 Key features		
Air permeablility	3.0 m³/m²h	
Floors U-value	0.12 W/m ² K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

		اعدا	r Details:						
Assessor Name:	Zahid Ashraf	030	Strom	o Nium	bor		STDO	001082	
Software Name:	Stroma FSAP 2012	2	Softwa					on: 1.0.5.9	
		Proper	ty Address:	Plot 5					
Address :									
Overall dwelling dime	ensions:				A I I .	tarle ((a a)) / - l	
Ground floor		A	rea(m²) 71.89	(1a) x		ight(m) 2.5	(2a) =	Volume(m³	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)	 + (1n) ☐		(4)]` ''	170.72	
Dwelling volume	a, ((, a), (, a), (, a), (, a)		71.00)+(3c)+(3c	d)+(3e)+	.(3n) =	470.70	7(5)
				(54) (55)	, , (00) , (00	.,, (33),	.(0)	179.72	(5)
2. Ventilation rate:		condary	other		total			m³ per hou	r
Number of chimneys	heating he	eating +	0	7 - F	0	X 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0	Ј <u>Г</u>	0	x 2	20 =	0	(6b)
Number of intermittent fa				J	0	x	10 =	0	(7a)
Number of passive vents				L	0	x	10 =	0	(7b)
Number of flueless gas f				L	0	x	40 =	<u> </u>	(7c)
Number of flueless gas fi	1103			L				0	(70)
							Air ch	anges per ho	our
Infiltration due to chimne	ys, flues and fans = (6a))+(6b)+(7a)+(7b)+(7c) =		0		÷ (5) =	0	(8)
	peen carried out or is intended	l, proceed to (17	7), 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]XU.1 =	0	(11)
	resent, use the value corresp	onding to the gr	eater wall are	a (after					` ′
deducting areas of opening	ngs); if equal user 0.35 floor, enter 0.2 (unseale	d) or 0.1 (se	aled) else	enter ()			i	0	(12)
If no draught lobby, en	,	a) or o.1 (30	aica), cisc	Critci 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	12) + (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 ad	been done or a	degree air pe	meability	is being u	sed		2	(19)
Shelter factor	,u		(20) = 1 -	0.075 x (1	19)] =			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	l 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	5 0.92	1	1.08	1.12	1.18		
			•		•	•	•	•	

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	: (21a) x	(22a)m					
0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15]	
Calculate effect		•	rate for t	he appli	cable ca	se	•	•	•	•	•	-	
If mechanica			andiv N (2	3h) - (23a	a) v Emy (4	aguation (N5N othe	rwica (23h	n) = (23a)			0.5	(23a
If balanced with		•	•	, ,	,			•	i) = (23a)			0.5	(23b
		-	-	_					Ol- \	005) [4 (00-)	79.05	(23c
a) If balance (24a)m= 0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	2D)M + (0.24	0.25	0.25) ÷ 100]]	(24a
` '		<u> </u>	<u> </u>			<u> </u>	1				0.23	_	(240
b) If balance (24b)m= 0		o 0	o nulation	0 WILLIOUT	0		0 (24)	0	0	0	0	1	(24b
	<u> </u>	<u> </u>	<u> </u>		<u> </u>			<u> </u>				_	(2.12
c) If whole h if (22b)n				•	•				5 x (23h	n)			
(24c)m = 0	0	0	0	0	0	0	0	0	0	0	0	1	(240
d) If natural	L ventilatio	n or wh	ole hous	e nositiv	ve input	L ventilatio	on from l	l loft	<u>!</u>	<u> </u>	<u> </u>	_	
if (22b)n					•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d
Effective air	change	rate - er	nter (24a	or (24b	o) or (24	c) or (24	ld) in box	x (25)	-	-	-		
(25)m= 0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25		(25)
3. Heat losse	s and he	at loss i	naramet	or.									
ELEMENT	Gros		Openin		Net Ar	ea	U-val	ue	ΑXU		k-valu	e	ΑΧk
	area	-	m		A ,r		W/m2		(W/	K)	kJ/m²-		kJ/K
Doors					2	X	1.4	=	2.8				(26)
Windows					11.20	5 x1	/[1/(1.4)+	0.04] =	14.86				(27)
Floor					71.88	8 X	0.12	=	8.6265	6 6		\neg \vdash	(28)
Walls Type1	69.9)2	11.2		58.72	<u>x</u>	0.15	<u> </u>	8.81				(29)
Walls Type2	22.3	3	2		20.33	3 x	0.14	Ħ =i	2.86	₹ i		= =	(29)
Total area of e	lements	, m²			164.1	4							(31)
* for windows and	roof wind	ows, use e	effective wi	ndow U-va			g formula 1	!/[(1/U-valu	ue)+0.04] á	as given in	paragrapi	h 3.2	
** include the area				ls and par	titions								
Fabric heat los	ss, W/K =	= S (A x	U)				(26)(30)) + (32) =				37.95	(33)
Heat capacity	,	,						((28).	(30) + (32	2) + (32a).	(32e) =	9014.3	2 (34)
Thermal mass	•	•		•					tive Value			100	(35)
For design assess can be used instead				construct	ion are no	t known pi	recisely the	e indicative	e values of	TMP in Ta	able 1f		
Thermal bridge				usina Ar	pendix I	<						12.65	(36)
if details of therma	,	,		• .	•	•						12.00	(00)
								(33) +	(36) =			50.61	(37)
	at 1033												
Total fabric hea		alculated	monthly	/				(38)m	$=0.33\times($	25)m x (5))	_	
Total fabric he		alculated Mar	monthly	/ May	Jun	Jul	Aug	(38)m Sep	= 0.33 × (25)m x (5)	Dec]	
Total fabric hea	at loss ca	i			Jun 13.4	Jul 13.4	Aug 13.21	1	1		1]	(38)
Total fabric heaventilation heaventilation	Feb	Mar 15.48	Apr	May	-	-		Sep 13.77	Oct	Nov 14.72	Dec]	(38)
Total fabric heaventilation heaventi	Feb	Mar 15.48	Apr	May	-	-		Sep 13.77	Oct 14.34	Nov 14.72	Dec]	(38)

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.92	0.92	0.92	0.91	0.9	0.89	0.89	0.89	0.9	0.9	0.91	0.91		
						ı	l		Average =	Sum(40) ₁	12 /12=	0.91	(40)
Number of day	·	nth (Tab	le 1a)					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	ting ene	rgy requi	rement:								kWh/ye	ar:	
Assumed occi if TFA > 13. if TFA £ 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		29		(42)
Annual average Reduce the annu- not more that 125	al average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		3.28		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage								· '					
(44)m= 102.6	98.87	95.14	91.41	87.68	83.95	83.95	87.68	91.41	95.14	98.87	102.6		
	ļ								Total = Su	m(44) ₁₁₂ =	-	1119.32	(44)
Energy content of	f hot water	used - cal	culated mo	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= 152.16	133.08	137.33	119.72	114.88	99.13	91.86	105.41	106.67	124.31	135.7	147.36		
If in atomton acus	water booti	na at naint	of upo (no	bot water	, ataragal	antar O in	haves (46		Total = Su	m(45) ₁₁₂ =	=	1467.61	(45)
If instantaneous v	1		,	1	, , , , , , , , , , , , , , , , , , ,		, ,	, , , I	ī	ı			(15)
(46)m= 22.82 Water storage	19.96	20.6	17.96	17.23	14.87	13.78	15.81	16	18.65	20.35	22.1		(46)
Storage volum) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	•					_							` '
Otherwise if n	_			-			, ,	ers) ente	er '0' in ((47)			
Water storage													
a) If manufac				or is kno	wn (kWł	n/day):					0		(48)
Temperature f											0		(49)
Energy lost fro		•					(48) x (49)) =		1	10		(50)
b) If manufact Hot water stor			-								02		(51)
If community h	•			0 2 (1111)	1,11ti 0, de	•97				0.	.02		(01)
Volume factor	_									1.	.03		(52)
Temperature f	factor fro	m Table	2b							0	.6		(53)
Energy lost fro	om watei	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	1.	03		(54)
Enter (50) or	(54) in (55)								1.	.03		(55)
Water storage	loss cal	culated f	or each	month			((56)m = ((55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хH	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	<u>-</u> -							0		(58)
Primary circuit	`	,			59)m = ((58) ÷ 36	65 × (41)	m					
(modified by	y factor f	rom Tab	le H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Cambilasa a	الم مغمل بمام	for oosb		(C4)	(00) . 20	CF (44)	\						
Combi loss c	alculated	or each	montn (61)m =	(60) ÷ 30	05 × (41))m 0	0	0	0	0	1	(61)
		<u> </u>					ļ	ļ	<u> </u>	ļ		(F0)m + (61)m	(01)
(62)m= 207.44	-	192.6	173.22	170.16	152.63	147.14	160.69	160.16	179.59	189.19	202.64	(59)m + (61)m	(62)
Solar DHW inpu						<u> </u>						l	(02)
(add addition									ii continuu	ion to wate	er rieatiriy)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from	water hea	Ll ter				ļ		ļ			!	ı	
(64)m= 207.44		192.6	173.22	170.16	152.63	147.14	160.69	160.16	179.59	189.19	202.64		
	ı					!	Out	put from w	ater heate	r (annual)₁	12	2118.45	(64)
Heat gains fr	om water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)r	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	 .]	
(65)m= 94.81	1	89.88	82.6	82.42	75.76	74.76	79.27	78.26	85.56	87.91	93.22	ĺ	(65)
include (57	')m in calc	culation o	of (65)m	only if c	vlinder i	s in the o	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]	
(66)m= 114.55	5 114.55	114.55	114.55	114.55	114.55	114.55	114.55	114.55	114.55	114.55	114.55		(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equati	ion L9 o	r L9a), a	lso see	Table 5	•	•	•		
(67)m= 18.85	16.75	13.62	10.31	7.71	6.51	7.03	9.14	12.27	15.58	18.18	19.38		(67)
Appliances g	ains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5		•	•	
(68)m= 201.66	203.76	198.48	187.26	173.08	159.77	150.87	148.77	154.05	165.27	179.45	192.76		(68)
Cooking gair	ns (calcula	ted in Ap	pendix	L, equat	ion L15	or L15a)	, also s	ee Table	5	•	•		
(69)m= 34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46		(69)
Pumps and f	ans gains	(Table 5	ia)										
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses e.g. 6	evaporatio	n (negat	ive valu	es) (Tab	le 5)		=		-	-	-		
(71)m= -91.6 ²	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64		(71)
Water heatin	g gains (T	able 5)				-	-		-	-	-		
(72)m= 127.44	125.28	120.81	114.73	110.78	105.22	100.49	106.55	108.7	114.99	122.1	125.29		(72)
Total interna	al gains =	:		-	(66))m + (67)m	+ (68)m	+ (69)m +	(70)m + (7	'1)m + (72))m		
(73)m= 405.32	2 403.15	390.28	369.66	348.94	328.86	315.76	321.83	332.38	353.21	377.09	394.8		(73)
6. Solar gai	ns:												
Solar gains are		•	flux from	Table 6a			tions to c	onvert to th	ne applical		tion.		
Orientation:	Access F Table 6d	actor	Area m²		Flu	ıx ble 6a	_	g_ Fable 6b	т	FF able 6c		Gains	
•					ı a	ole da	. –	able ob	_ '	able 60		(W)	7
Southeast 0.9x		X	11.	.2	X 3	36.79	X	0.63	x	0.7	=	126	(77)
Southeast 0.9x		X	11.			62.67	X	0.63	x	0.7	=	214.62	(77)
Southeast 0.9x		X	11.	.2	X 8	35.75	X	0.63	x	0.7	=	293.65	(77)
Southeast 0.9x		X	11.		x 1	06.25	×	0.63	X	0.7	=	363.85	(77)
Southeast 0.9x	0.77	X	11.	.2	x 1	19.01	X	0.63	X	0.7	=	407.54	(77)

Southeast 0.9x	0.77	X	11.	.2	X	118.15] x [0.63	x	0.7	=	404.59	(77)
Southeast 0.9x	0.77	X	11.	.2	X	113.91] x [0.63	x [0.7	=	390.07	(77)
Southeast 0.9x	0.77	X	11.	.2	X	104.39] x [0.63	x	0.7	=	357.47	(77)
Southeast 0.9x	0.77	X	11.	.2	x	92.85] x [0.63	x [0.7	=	317.96	(77)
Southeast 0.9x	0.77	X	11.	.2	x	69.27] x [0.63	x	0.7	=	237.2	(77)
Southeast 0.9x	0.77	X	11.	2	x	44.07	x	0.63	x	0.7	=	150.91	(77)
Southeast 0.9x	0.77	X	11.	.2	x	31.49	×	0.63	x	0.7	=	107.83	(77)
Solar gains in	watts, ca	lculated	for eacl	n month	_	-	(83)m	= Sum(74)m	(82)m				
(83)m= 126	214.62	293.65	363.85	407.54	404.59	390.07	357.4	17 317.96	237.2	150.91	107.83		(83)
Total gains –	internal a	nd solar	(84)m =	(73)m ·	+ (83)m	, watts						•	
(84)m= 531.32	617.77	683.93	733.51	756.47	733.45	705.83	679.	3 650.34	590.41	528.01	502.63		(84)
7. Mean inte	rnal temp	erature	(heating	season)								
Temperature	during h	eating p	eriods ir	the livi	ng area	from Tal	ble 9,	Th1 (°C)				21	(85)
Utilisation fa	ctor for ga	ains for I	iving are	ea, h1,m	(see T	able 9a)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
(86)m= 0.94	0.91	0.86	0.78	0.66	0.51	0.38	0.41	0.6	0.8	0.91	0.95		(86)
Mean interna	al tempera	ature in	living are	ea T1 (fo	ollow st	eps 3 to 7	7 in Ta	able 9c)		•	•	•	
(87)m= 19.35	19.64	20	20.41	20.72	20.91	20.97	20.9		20.45	19.84	19.3		(87)
Temperature	during h	ooting n	oriode ir	roct of	dwollin	a from Ta	abla 0	Th2 (°C)	ļ	1			
(88)m= 20.15	20.15	20.15	20.16	20.16	20.18	20.18	20.1		20.16	20.16	20.16		(88)
, ,					<u> </u>		<u> </u>	20.17	20.10	20.10	20.10		()
Utilisation fa	 				·	1	T 			Ι		Ī	(00)
(89)m= 0.93	0.9	0.84	0.75	0.62	0.46	0.32	0.35	0.54	0.77	0.9	0.94		(89)
Mean interna	al tempera	ature in	the rest	of dwelli	ng T2 (follow ste	eps 3	to 7 in Tab	le 9c)		ı	Ī	
(90)m= 17.94	18.35	18.86	19.44	19.85	20.09	20.16	20.1		19.51	18.65	17.87		(90)
									fLA = Livii	ng area ÷ (4) =	0.46	(91)
Mean_interna	al tempera	ature (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1 -	- fLA) × T2					
(92)m= 18.59	18.94	19.39	19.89	20.25	20.47	20.53	20.5	3 20.4	19.94	19.2	18.53		(92)
Apply adjust	ment to th	ne mean	internal	temper	ature fr	1	4e, v	vhere appr	opriate			•	
(93)m= 18.59	18.94	19.39	19.89	20.25	20.47	20.53	20.5	3 20.4	19.94	19.2	18.53		(93)
8. Space hea													
Set Ti to the the utilisation					ned at s	tep 11 of	Table	9b, so tha	at Ti,m=	(76)m an	d re-calc	culate	
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
Utilisation fa			•	iviay	Juli	1 Jul	<u> </u>	g Ocp	1 000	1 1101	Dec		
(94)m= 0.91	0.88	0.83	0.74	0.63	0.48	0.35	0.37	7 0.56	0.76	0.88	0.92		(94)
Useful gains	,hmGm,	W = (94	1)m x (84	4)m	l	_!	<u> </u>			!	ļ		
(95)m= 485.99	, 	565.14	545.27	474.84	350.6	244.76	254.4	15 363.67	450.58	463.97	464.52		(95)
Monthly ave	rage exte	rnal tem	perature	from Ta	able 8				<u>•</u>				
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rat	e for mea	an intern	al tempe	erature,	Lm , W	=[(39)m	x [(93)m– (96)m]			•	
(97)m= 949.86	930.35	851.61	715.67	555.46	375.55	251.62	263.2	28 405.73	606.61	790.28	941.55		(97)
Space heating	ng require	ment fo	r each n	nonth, k	Wh/mor	1 = 0.02	24 x [(97)m – (95	5)m] x (4	·1)m	1	1	
(98)m= 345.12	260.52	213.13	122.69	59.98	0	0	0	0	116.08	234.94	354.91		

	Total per year (kWh/year) = Sum(98) _{15,912} =	1707.38	(98)
Space heating requirement in kWh/m²/year		23.75	(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 (Table		0	(301)
Fraction of space heat from community system 1 – (301) =	·	1	(302)
The community scheme may obtain heat from several sources. The procedure allows	L s for CHP and up to four other heat sources; th	e latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See A Fraction of heat from Community boilers	Appendix C. Г	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		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating	L	kWh/yea	
Annual space heating requirement	ſ	1707.38	7
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1792.75	(307a)
Efficiency of secondary/supplementary heating system in % (from Ta	able 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating	Г		_ ¬
Annual water heating requirement	L	2118.45	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2224.37	(310a)
Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] =	40.17	(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	249.41	(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) =	249.41	(331)
Energy for lighting (calculated in Appendix L)		332.99	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-724.55	(333)
Electricity generated by wind turbine (Appendix M) (negative quantit	y)	0	(334)
12b. CO2 Emissions – Community heating scheme			
	Energy Emission factor E 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 =	923.08	(367)
Electrical energy for heat distribution [(313)	0.52 =	20.85	(372)

Total CO2 associated with community systems	(363)(366) + (368)(372	2) =	943.93	(373)
CO2 associated with space heating (secondary)	(309) x	0 =	0	(374)
CO2 associated with water from immersion heater or instanta	neous heater (312) x	0.22	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		943.93	(376)
CO2 associated with electricity for pumps and fans within dw	elling (331)) x	0.52	129.44	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	172.82	(379)
Energy saving/generation technologies (333) to (334) as applitem 1	icable	0.52 x 0.01 =	-376.04	(380)
Total CO2, kg/year sum of (376)(382) =			870.15	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =			12.1	(384)
El rating (section 14)			90.02	(385)

SAP 2012 Overheating Assessment

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

Dwelling type: Flat Located in: **England** Region: Thames valley

Cross ventilation possible: No **Number of storeys:**

Front of dwelling faces: North West

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)

Summer ventilation heat loss coefficient: (P1) 237.23

Transmission heat loss coefficient: 50.6

Summer heat loss coefficient: 287.84 (P2)

Overhangs:

Overhangs:

Orientation: Ratio: **Z_overhangs:**

South East (SE) 0 1

Orientation: Z blinds: Solar access: Overhangs: Z summer: 0.9 (P8)

South East (SE) 0.9 1 1

Orientation FF **Shading** Area Flux Gains g_{-}

119.92 0.9 479.99 South East (SE) 0.9 x11.2 0.63 0.7 **Total** 479.99 (P3/P4)

Internal gains:

June July **August** 456.8 448.31 Internal gains 440.1 960.68 920.1 (P5) Total summer gains 896.08 Summer gain/loss ratio 3.34 3.2 3.11 (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 20.64 22.4 22.21

Likelihood of high internal temperature Slight Medium Medium

Assessment of likelihood of high internal temperature: Medium

		Llea	r Details:						
Access at Name.	Zahid Ashraf	USE		a Mirros	b a v .		CTDO	001002	
Assessor Name: Software Name:	Stroma FSAP 2012)	Stroma Softwa					001082 on: 1.0.5.9	
			ty Address:						
Address :									
1. Overall dwelling dime	ensions:								
Ground floor		A	rea(m²) 71.89	(1a) x		ight(m) 2.5	(2a) =	Volume(m ³	(3a)
	a) . (1b) . (1a) . (1d) . (1a)	(1p)				2.5	(2a) –	179.72	(Ja)
Total floor area TFA = (1	a)+(10)+(10)+(10)+(10)	+(111)	71.89	(4)) . (2-) . (2-	4) . (2 -) .	(2-)		_
Dwelling volume				(3a)+(3b))+(3C)+(3C	d)+(3e)+	.(3h) =	179.72	(5)
2. Ventilation rate:	main se	condary	other		total			m³ per hou	ır
Number of chimneys	heating	eating		1 ₌ [40 =		_
•			0]	0		20 =	0	(6a)
Number of open flues		0 +	0	」 ⁻	0			0	(6b)
Number of intermittent fa				L	3		10 =	30	(7a)
Number of passive vents				Ļ	0		10 =	0	(7b)
Number of flueless gas fi	ires				0	X 4	40 =	0	(7c)
							Air ch	anges per ho	our
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	Г	30		÷ (5) =	0.17	(8)
If a pressurisation test has b	peen carried out or is intended	d, proceed to (17	7), otherwise o	ontinue fr			` ′		`` <i>`</i>
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration	05 for stool on timb or fr	0.05	.			[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber fr resent, use the value corresp			•	uction			0	(11)
deducting areas of opening	ngs); if equal user 0.35								
•	floor, enter 0.2 (unseale	ed) or 0.1 (sea	aled), else	enter 0				0	(12)
If no draught lobby, en								0	(13)
· ·	s and doors draught str	ipped	0.05 10.0	(4.4)4	001			0	(14)
Window infiltration			0.25 - [0.2		_	. (45)		0	(15)
Infiltration rate	.50		(8) + (10)					0	(16)
•	q50, expressed in cubi	•	•	•	etre of e	envelope	area	3	(17)
If based on air permeabil	es if a pressurisation test has				is heina u	sad		0.32	(18)
Number of sides sheltere		been done or a	acgree an per	meability	is being a	300	1	2	(19)
Shelter factor			(20) = 1 -	0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporate	ting shelter factor		(21) = (18)	x (20) =				0.27	(21)
Infiltration rate modified f	or monthly wind speed						'		
Jan Feb	Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2.	2)m ∸ 4								
<u> </u>	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		
<u> </u>						-		ı	

Calculate effective air change rate for the applicable case If mechanical ventilation:	
If mechanical ventilation: If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)), otherwise (23b) = (23a) If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) (24c)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 d) If natural ventilation or whole house positive input ventilation from loft if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² × 0.5] (24d)m = 0.56 0.56 0.55 0.54 0.54 0.54 0.53 0.53 0.53 0.54 0.54 0.55 0.55 Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) (25)m = 0.56 0.56 0.55 0.54 0.54 0.54 0.53 0.53 0.53 0.54 0.54 0.55 0.55 3. Heat losses and heat loss parameter: ELEMENT Gross Openings area (m²) m² Net Area U-value A X U (W/K) kJ/m²-K kJ/K Doors 2 1 1.4 = 2.8 Windows 11.205 x1/1/(1.4)+0.04] = 14.86 Floor 71.888 x 0.12 = 8.62656	(23b) (23c) (24a) (24b) (24c) (24d) (25)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m=0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m=0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) (24c)m=0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 d) If natural ventilation or whole house positive input ventilation from loft if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² × 0.5] (24d)m=0.56 0.56 0.55 0.54 0.54 0.53 0.53 0.53 0.53 0.54 0.54 0.55 0.55 Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) (25)m=0.56 0.56 0.56 0.55 0.54 0.54 0.53 0.53 0.53 0.53 0.54 0.54 0.55 0.55 3. Heat losses and heat loss parameter: ELEMENT Gross Openings Net Area U-value A X U k-value A X U k-value A X M/m² W/m²K (W/K) kJ/m²-K kJ/K Doors 2 2 x 1.4 = 2.8 Windows 11.205 x1/1/(1.4) + 0.04] = 14.86 Floor 71.888 x 0.12 = 8.62656	(23b) (23c) (24a) (24b) (24c) (24d) (25)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 - (23c) ÷ 100] (24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24a) (24b) (24c) (24d) (25)
a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100] (24a)m = 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24a) (24b) (24c) (24d) (25)
(24a)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24b) (24c) (24d) (25)
b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b) (24b)m = 0	(24b) (24c) (24d) (25)
(24b)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24c) (24d) (25)
c) If whole house extract ventilation or positive input ventilation from outside if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) (24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24c) (24d) (25)
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b) (24c)m=	(24d) (25)
(24c)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	(24d) (25)
d) If natural ventilation or whole house positive input ventilation from loft if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5] (24d)m= 0.56	(24d) (25)
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5] (24d)m= 0.56	(25) k
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25) (25)m= 0.56	(25) k
(25)m= 0.56	k
3. Heat losses and heat loss parameter: ELEMENT Gross Openings area (m²) m² Net Area A ,m² U-value W/m2K (W/K) kJ/m²-K kJ/K Doors 2 x 1.4 = 2.8 Windows 11.205 x1/[1/(1.4)+0.04] = 14.86 Floor 71.888 x 0.12 = 8.62656	k
ELEMENT Gross area (m²) Openings m² Net Area A ,m² U-value W/m2K A X U (W/K) k-value kJ/m²-K A X I (W/K) Doors 2 x 1.4 = 2.8 Windows 11.205 $x^{1/[1/(1.4) + 0.04]}$ = 14.86 Floor 71.888 x 0.12 = 8.62656	
ELEMENT Gross area (m²) Openings m² Net Area A ,m² U-value W/m2K A X U (W/K) k-value kJ/m²-K A X I (W/K) Doors 2 x 1.4 = 2.8 Windows 11.205 $x^{1/[1/(1.4) + 0.04]} = 14.86$ Floor 71.888 x 0.12 = 8.62656	
area (m²) $m²$ A ,m² W/m2K (W/K) kJ/m²-K kJ/K Doors	
Windows	
Floor 71.888 x 0.12 = 8.62656	(26)
71130	(27)
	(28)
Walls Type1 69.92 11.2 58.72 x 0.15 = 8.81	(29)
Walls Type2 22.33 2 20.33 x 0.14 = 2.86	(29)
Total area of elements, m ²	(31)
* for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2	` '
** include the areas on both sides of internal walls and partitions	_
Fabric heat loss, W/K = S (A x U) $(26)(30) + (32) = 37.95$	(33)
Heat capacity $Cm = S(A \times k)$ $((28)(30) + (32) + (32a)(32e) = 9014.32$	(34)
Thermal mass parameter (TMP = Cm \div TFA) in kJ/m ² K Indicative Value: Low 100	(35)
For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.	
The arread besidence of College VO and evaluate advantage Annound in M	(36)
if details of thermal bridging are not known (36) = 0.05 x (31)	(30)
Total fabric heat loss $(33) + (36) = 50.61$	(37)
Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$	ı
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(38)m= 33.15 33.02 32.88 32.26 32.14 31.6 31.6 31.5 31.81 32.14 32.38 32.62	(38)
Heat transfer coefficient, W/K (39)m = (37) + (38)m	
(39)m= 83.76 83.62 83.49 82.86 82.75 82.2 82.1 82.41 82.75 82.98 83.23	
Average = Sum(39) ₁₁₂ /12= 82.86	_

Heat loss para	meter (l	-II P) \///	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.17	1.16	1.16	1.15	1.15	1.14	1.14	1.14	1.15	1.15	1.15	1.16		
(10)										Sum(40) ₁ .		1.15	(40)
Number of day	s in mo	nth (Tabl	le 1a)							J ann(10)1		0	(\ ' ' '
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
										!			
4. Water heat	ina ono	rav, roaui	romont:								kWh/ye	or:	
4. Walei neal	ing ene	igy requi	rement.								KVVII/ye	di.	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		29		(42)
Annual averag Reduce the annua not more that 125	al average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		.28		(43)
			- ,				_	_	_		- 1		
Jan	Feb	Mar	Apr	May	Jun	Jul Table 10 V	Aug	Sep	Oct	Nov	Dec		
Hot water usage in							, ,		1				
(44)m= 102.6	98.87	95.14	91.41	87.68	83.95	83.95	87.68	91.41	95.14	98.87	102.6		_
Energy content of	hot water	used - cal	culated mo	onthly = 4 .	190 x Vd,r	n x nm x D	0Tm / 3600			m(44) ₁₁₂ = ables 1b, 1		1119.32	(44)
(45)m= 152.16	133.08	137.33	119.72	114.88	99.13	91.86	105.41	106.67	124.31	135.7	147.36		
									Total = Su	m(45) ₁₁₂ =	=	1467.61	(45)
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46 ₎) to (61)			•		
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage						-		-					
Storage volum	` ′					•		ame ves	sel		0		(47)
If community h	•			•			` '	` .	(0): (· 4 ¬ \			
Otherwise if no Water storage		not wate	er (tnis in	iciudes i	nstantar	neous co	illod idmi	ers) ente	er o'in ((47)			
a) If manufact		eclared l	oss facto	or is kno	wn (k\/\/ł	n/day).					0		(48)
Temperature fa				51 10 Ki10	**** (1.000)	"day).					0		(49)
Energy lost fro				ar			(48) x (49)	١ _					, ,
b) If manufact		_	-		or is not		(40) X (49)	, =			0		(50)
Hot water stora			-								0		(51)
If community h	eating s	see section	on 4.3										
Volume factor											0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro	m watei	r storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or ((54) in (5	55)									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nnual) fro	m Table	3							0		(58)
Primary circuit	•	•			59)m = ((58) ÷ 36	55 × (41)	m					
(modified by	factor f	rom Tabl	le H5 if t	here is s	olar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss ca	alculated	for each	month ((61)m =	(60) ÷ :	365 x (41)m							
(61)m= 0	0	0	0	0	0	0) 0		0	0	0	0	1	(61)
	uired for	water h	Leating ca	alculated	l for ea	ch month	(62)ı	— m =	0.85 × (′45)m +		(57)m +	ו - (59)m + (61)m	
(62)m= 129.34	·	116.73	101.77	97.65	84.26	78.08	89.	_	90.67	105.67	115.34	125.25]	(62)
Solar DHW input	calculated	using App	endix G oı	· Appendix	H (nega	tive quantity	y) (ent	er '0'	if no sola	r contribu	tion to wate	er heating)) T	
(add additiona														
(63)m= 0	0	0	0	0	0	0	0		0	0	0	0]	(63)
Output from v	vater hea	ter									•	•	-	
(64)m= 129.34	113.12	116.73	101.77	97.65	84.26	78.08	89.	6	90.67	105.67	115.34	125.25]	
	-		=			-		Outp	out from wa	ater heate	er (annual)	112	1247.47	(64)
Heat gains fro	om water	heating,	kWh/m	onth 0.2	5 ′ [0.8	5 × (45)m	+ (6	1)m	n] + 0.8 x	((46)m	+ (57)m	+ (59)m	າ]	
(65)m= 32.33	28.28	29.18	25.44	24.41	21.07	19.52	22.	4	22.67	26.42	28.84	31.31]	(65)
include (57	m in cal	culation (of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	- neating	
5. Internal g	ains (see	e Table 5	and 5a):										
Metabolic gai	ns (Table	e 5), Wat	ts											
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec]	
(66)m= 114.55	114.55	114.55	114.55	114.55	114.55	114.55	114.	.55	114.55	114.55	114.55	114.55]	(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9	or L9a), a	lso s	ee 7	Table 5					
(67)m= 18.85	16.75	13.62	10.31	7.71	6.51	7.03	9.1	4	12.27	15.58	18.18	19.38]	(67)
Appliances ga	ains (calc	ulated in	Append	dix L, eq	uation l	_13 or L1	3a), a	also	see Tal	ble 5		_	-	
(68)m= 201.66	203.76	198.48	187.26	173.08	159.77	150.87	148.	.77	154.05	165.27	179.45	192.76]	(68)
Cooking gains	s (calcula	ted in A	ppendix	L, equat	ion L15	or L15a), als	o se	e Table	5	•	•	-	
(69)m= 34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.4	46	34.46	34.46	34.46	34.46]	(69)
Pumps and fa	ns 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= -91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.	64	-91.64	-91.64	-91.64	-91.64]	(71)
Water heating	g gains (T	able 5)	-			-						-	-	
(72)m= 43.46	42.08	39.22	35.34	32.81	29.26	26.24	30.	11	31.48	35.51	40.05	42.09]	(72)
Total interna	l gains =				(6)	6)m + (67)m	n + (68	3)m +	- (69)m + ((70)m + (7	71)m + (72))m	-	
(73)m= 321.34	319.95	308.69	290.27	270.97	252.9	241.5	245.	.39	255.16	273.72	295.04	311.6]	(73)
6. Solar gain	is:													
Solar gains are	calculated	using sola	r flux from	Table 6a	and asso	ciated equa	tions t	to co	nvert to th	e applica		tion.		
Orientation:			Area m²			ux able 6a		т	g_ able 6b	т	FF able 6c		Gains	
	Table 6d					able ba		1	able ob	_ '	able oc		(W)	,
Southeast 0.9x		X	11	.2	X	36.79	X		0.63	×	0.7	=	126	<u> </u> (77)
Southeast 0.9x	•	X	11	.2	X	62.67	X		0.63	×	0.7	=	214.62	(77)
Southeast 0.9x	•	X	11	.2	X	85.75	X		0.63	x	0.7	=	293.65	(77)
Southeast 0.9x		X	11	.2	x	106.25	X		0.63	x	0.7	=	363.85	(77)
Southeast 0.9x	0.77	X	11	.2	X	119.01	X		0.63	X	0.7	=	407.54	(77)

Southeast _{0.9x}	0.77	11	.2	x	118.15	X		0.63	x	0.7	=	404.59	(77)
Southeast _{0.9x}	0.77	11	.2	x	113.91	X		0.63	x	0.7	=	390.07	(77)
Southeast 0.9x	0.77	11	.2	x	104.39	X		0.63	x	0.7	=	357.47	(77)
Southeast _{0.9x}	0.77	11	.2	X	92.85	X		0.63	x	0.7	=	317.96	(77)
Southeast 0.9x	0.77	11	.2	x	69.27	X		0.63	x	0.7	=	237.2	(77)
Southeast _{0.9x}	0.77	11	.2	x	44.07	X		0.63	x	0.7	=	150.91	(77)
Southeast 0.9x	0.77	11	.2	x	31.49	X		0.63	x	0.7	=	107.83	(77)
Solar gains in wat	ts, calculate	d for eac	h month	,		(83)m	n = S	um(74)m .	(82)m			•	
` '	4.62 293.65	363.85	407.54	404.		357	7.47	317.96	237.2	150.91	107.83		(83)
Total gains – inter		, ` 	` 	`							ı	1	<i>(</i>)
(84)m= 447.34 53	4.57 602.34	654.12	678.51	657.	49 631.57	602	2.86	573.12	510.92	445.95	419.43		(84)
7. Mean internal	temperature	(heating	season)									
Temperature dur	ing heating	periods i	n the livi	ng ar	ea from Tal	ble 9	, Th	1 (°C)				21	(85)
Utilisation factor	for gains for	living are	ea, h1,m	(see	Table 9a)							•	
Jan I	eb Mar	Apr	May	Ju	ın Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 0.96 0	94 0.91	0.85	0.77	0.6	4 0.51	0.5	54	0.72	0.88	0.95	0.97		(86)
Mean internal ter	nperature in	living ar	ea T1 (fo	ollow	steps 3 to 7	7 in T	Γable	e 9c)					
(87)m= 18.61 18	.92 19.36	19.9	20.38	20.7	74 20.9	20.	.87	20.61	19.98	19.19	18.54		(87)
Temperature dur	ing heating	periods i	n rest of	dwel	ling from Ta	able 9	9. TI	h2 (°C)		-	•	•	
·	.95 19.95	19.96	19.96	19.9	-	19.		19.96	19.96	19.96	19.95		(88)
Utilisation factor	for gains for	rost of d	welling	h2 m	(soo Table	. 02)							
	93 0.9	0.83	0.73	0.5	<u>` </u>	0.4	45	0.66	0.85	0.94	0.96		(89)
` '		<u> </u>		<u> </u>									, ,
Mean internal ter (90)m= 17.77 18	nperature in	19.03	19.48	ng 12	`	eps 3		7 IN Tabl	e 9c) 19.12	18.35	17.71		(90)
(30)111 17.77	10.51	19.03	13.40	13.	0 19.92	13.	.91			ng area ÷ (4	<u> </u>	0.46	(91)
										·9 ··· · · · · (,	0.40	(01)
Mean internal ter	 `	1	1		-	T				T		Ī	(00)
` ′	.46 18.9	19.43	19.9	20.2		20.		20.12	19.51	18.73	18.09		(92)
Apply adjustmen (93)m= 18.15 18	1 to the mea	n interna 19.43	19.9	20.2		20.		20.12	19.51	18.73	18.09		(93)
8. Space heating			19.9	20.2	20.37	20.	.33	20.12	19.51	10.73	18.09		(33)
Set Ti to the mea	·		re obtair	ad a	t stan 11 of	Tahl	ام Ok	n en tha	t Ti m-/	76)m an	d re-calc	rulata	
the utilisation fac				icu a	i step 11 oi	Tab	10 31	J, 30 iiia	11,111—(10)III ali	u ie-caic	Julate	
Jan I	eb Mar	Apr	May	Ju	ın Jul	А	ug	Sep	Oct	Nov	Dec		
Utilisation factor	for gains, hr	n:			•								
(94)m= 0.95 0	92 0.88	0.82	0.72	0.5	9 0.45	0.4	48	0.67	0.84	0.92	0.95		(94)
Useful gains, hm	Gm , W = (9	94)m x (8	4)m									•	
` ′	1.44 530.26	534.57	490.4	386.		291	1.36	383.68	428.83	411.72	399.76		(95)
Monthly average		-i	1									1	<i>(</i>)
` ′	.9 6.5	8.9	11.7	14.		16		14.1	10.6	7.1	4.2		(96)
Heat loss rate fo								·	ī —	005.07	4450.44	1	(07)
(97)m= 1160.38 113			678.24	462.			1.36	496.14	737.4	965.27	1156.11		(97)
Space heating re (98)m= 548.42 43	quirement f	or each r	139.75	/Vh/m 0		1	<u>((97)</u>)m – (95 0)MJ X (4 229.58	1)m 398.56	562.73		
(30)111- 340.42 43	1.70 375.75	L 243.4	138.73					U U	223.00	1 390.30	502.13		

Total per year (kWh/year) = Sum(98)												08)15,912 =	2929.94	(98)
Space	e heating	g require	ement in	kWh/m²	/year								40.76	(99)
8c. Sp	pace co	oling red	quiremer	nt										
Calcu	lated for	r June, c	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 2	5°C inter	nal temp	erature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	772.69	608.29	623.96	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.76	0.82	0.8	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = ((100)m x	(101)m									
(102)m=	0	0	0	0	0	586.29	499.96	500.91	0	0	0	0		(102)
Gains	(solar g	gains ca	lculated	for appli	cable we	eather re	gion, se	e Table	10)		•	•		
(103)m=	0	0	0	0	0	853.74	821.77	789.69	0	0	0	0		(103)
						lwelling,	continu	ous (kW	h = 0.0	24 x [(10	03)m – (102)m]:	x (41)m	
` ı		zero if (104)m <	3 × (98)m									
(104)m=	0	0	0	0	0	192.56	239.43	214.86	0	0	0	0		_
										= Sum('	=	646.85	(104)
	I fraction			_					f C =	cooled	area ÷ (4	4) =	1	(105)
ı		<u> </u>	able 10b					г					İ	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		_
_									Total	l = Sum((104)	=	0	(106)
· .			1			× (105)		1					İ	
(107)m=	0	0	0	0	0	48.14	59.86	53.71	0	0	0	0		_
									Total	= Sum(107)	=	161.71	(107)
Space	cooling	requirer	ment in k	:Wh/m²/y	/ear				(107)	÷ (4) =			2.25	(108)
8f. Fab	ric Ener	gy Effici	iency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabrio	Energy	/ Efficier	псу						(99)	+ (108) =	=		43.01	(109)

SAP Input

Property Details: Plot 5

Address:

Located in: England Region: Thames valley

UPRN:

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

Assessment type: New dwelling design stage

Transaction type:

Tenure type:

Related party disclosure:

Thermal Mass Parameter:

New dwelling
Unknown

No related party
Indicative Value Low

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

PCDF Version: 466

Property description:

Dwelling type: Flat

Detachment:

Year Completed: 2020

Floor Location: Floor area:

Storey height:

Floor 0 71.888 m² 2.5 m

Living area: 33.063 m² (fraction 0.46)

Front of dwelling faces: North West

Opening types:

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

NW Manufacturer Solid

SE Manufacturer Windows double-glazed Yes

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

Name: Type-Name: Location: Orient: Width: Height: NW Corridor Wall North West 0 0

SE External Wall South East 0 0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Element	<u>ts</u>						
External Wall	69.922	11.2	58.72	0.15	0	False	N/A
Corridor Wall	22.329	2	20.33	0.15	0.43	False	N/A
Ground Floor	71.888			0.12			N/A
Indones Flances							

Internal Elements
Party Elements

Thermal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0771

Length	Psi-value		
5.93	0.293	E2	Other lintels (including other steel lintels)
17.7	0.048	E4	Jamb
31.271	0.154	E5	Ground floor (normal)

SAP Input

22.791	0.067	E7	Party floor between dwellings (in blocks of flats)
14.75	0.087	E16	Corner (normal)
8.31	0.155	E21	Exposed floor (inverted)
5.9	-0.081	E17	Corner (inverted internal area greater than external area)
5.9	0.108	E25	Staggered party wall between dwellings
6.193	0.16	P1	Ground floor
6.193	0	P3	Intermediate floor between dwellings (in blocks of flats)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery

Number of wet rooms: Kitchen + 1

Ductwork: Insulation, rigid

Approved Installation Scheme: True

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

Main heating system

Main heating system: Community heating schemes

Heat source: Community boilers

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

Central heating pump: 2013 or later

Design flow temperature: Unknown

Boiler interlock: Yes

Main heating Control:

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

thermostats

Control code: 2312

Secondary heating system:

Secondary heating system: None

Water heating

Water heating: From main heating system

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

Others:

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

Low energy lights: 100%

Terrain type: Low rise urban / suburban

EPC language: English Wind turbine: No

Photovoltaics: Photovoltaic 1

Installed Peak power: 0.88 Tilt of collector: 30°

Overshading: None or very little Collector Orientation: South West

Assess Zero Carbon Home: No

		Us <u>er</u> l	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa					0001082 on: 1.0.5.9	
		Property	Address	: Plot 5					
Address :									
1. Overall dwelling dime	ensions:	_							
Ground floor		_	ea(m²)	1(40) 4	Av. He		_	Volume(m ³	<u>`</u>
	\ \(\lambda \)			(1a) x		2.5	(2a) =	179.72	(3a)
	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	71.89	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	179.72	(5)
2. Ventilation rate:								2	
	main seconda heating heating		other		total			m³ per hou	ır
Number of chimneys	0 + 0	+ [0	=	0)	40 =	0	(6a)
Number of open flues	0 + 0	+	0	=	0	>	20 =	0	(6b)
Number of intermittent fa	ins				3	,	(10 =	30	(7a)
Number of passive vents	;			F	0	,	10 =	0	(7b)
Number of flueless gas fi	ires			L F	0	,	40 =	0	(7c)
				L					(, o)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+$	(7a)+(7b)+	·(7c) =	Γ	30		÷ (5) =	0.17	(8)
	peen carried out or is intended, proce	ed to (17),	otherwise of	continue fi	rom (9) to	(16)			
Number of storeys in the Additional infiltration	he dwelling (ns)					1/0	N 41-0 4	0	(9)
	.25 for steel or timber frame of	vr 0 35 fc	or mason	rv coneti	ruction	[(8	9)-1]x0.1 =	0	(10)
	resent, use the value corresponding			•	dollon			0	(11)
deducting areas of openii									_
·	floor, enter 0.2 (unsealed) or	J.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	s and doors draught stripped							0	(13)
Window infiltration	s and doors draught stripped		0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (12) + (13) -	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic meti	es per h	our per s	quare m	etre of e	envelop	e area	5	(17)
If based on air permeabil	lity value, then $(18) = [(17) \div 20]$ -	(8), otherv	vise (18) =	(16)				0.42	(18)
	es if a pressurisation test has been de	one or a de	egree air pe	ermeability	is being u	sed			_
Number of sides sheltere Shelter factor	ed .		(20) = 1 -	[0.075 x (19)] =			0.85	(19) (20)
Infiltration rate incorporat	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		ı	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7]	
W. J. F. (22.)	0)	1	1	•	•	•	1	1	
Wind Factor (22a)m = (2.20) m 	1 0 05	0.00	1 4	4.00	1 40	1 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	

djusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42]	
Calculate effe If mechanic		_	rate for t	he appli	cable ca	se	-	-	-	-		-	
If exhaust air h			endix N. (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) . othe	rwise (23b) = (23a)			0	(2:
If balanced with									, (===,			0	(2:
a) If balance		•	•	J		`		,	2h\m + (23h) ~ [·	1 _ (23c)		(2.
24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
b) If balance	d mech:	anical ve	entilation	without	heat red	overv (N	/\\/) (24h	l = (22)	2b)m + (23h)		1	·
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24
c) If whole h			ntilation of then (24)		•				.5 × (23b)	ı	J	
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(2
d) If natural					•				<u>I</u>	<u>I</u>	!	1	
		<u> </u>	m = (22k)				 `					1	
24d)m= 0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	J	(24
Effective air			- ` 	<u> </u>	``	<u> </u>	r	`		1	ī	1	
25)m= 0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59]	(2
3. Heat losse	s and he	eat loss	paramete	er:									
LEMENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/l	K)	k-value kJ/m²·	-	A X k kJ/K
oors					2	х	1	= [2				(2
Vindows					11.20	5 x1.	/[1/(1.4)+	0.04] =	14.86				(2
loor					71.88	8 X	0.13		9.3454	4			(2
Valls Type1	69.9	92	11.2	!	58.72	2 x	0.18	<u> </u>	10.57	T i		7 F	(2
Valls Type2	22.3	33	2		20.33	x	0.18	<u> </u>	3.66	Ŧ i		7 F	(2
otal area of e	lements	, m²			164.1	4							(3
for windows and include the area					alue calcul		formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragrapl	h 3.2	`
abric heat los	ss, W/K :	= S (A x	U)	·			(26)(30)) + (32) =				40.43	3 (3
eat capacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	9014.	32 (3
hermal mass	parame	ter (TMF	o = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(3
or design assess an be used inste				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
hermal bridg	es : S (L	x Y) cal	culated (using Ap	pendix l	<						12.09	(3
details of therma		are not kn	iown (36) =	= 0.05 x (3	1)								
otal fabric he	at loss							(33) +	(36) =			52.5°	1 (3
entilation hea	at loss ca	alculated	l monthly	/			1	(38)m	= 0.33 × (25)m x (5))	,	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
35.71 35.71	35.47	35.24	34.16	33.96	33.01	33.01	32.84	33.38	33.96	34.37	34.8]	(3
leat transfer of	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
ical lialisici (
89)m= 88.22	87.99	87.76	86.67	86.47	85.53	85.53	85.35	85.89	86.47	86.88	87.31		

Heat loss para	ımeter (l	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.23	1.22	1.22	1.21	1.2	1.19	1.19	1.19	1.19	1.2	1.21	1.21		
					ı	ı	ı	,	Average =	Sum(40) ₁	12 /12=	1.21	(40)
Number of day	1	nth (Tab	le 1a)	1				ı	1				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	o(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13.		29		(42)
Annual average Reduce the annual not more that 125	, al average	hot water	usage by	5% if the α	lwelling is	designed t	` ,		se target o		.61		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i	n litres pe	r day for ea			ctor from	Table 1c x			ļ.	!			
(44)m= 97.47	93.93	90.39	86.84	83.3	79.75	79.75	83.3	86.84	90.39	93.93	97.47		
		•			!	!	!			m(44) ₁₁₂ =		1063.36	(44)
Energy content of	hot water	used - cal	culated m	onthly = 4.	190 x Vd,ı	n x nm x C	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 144.55	126.43	130.46	113.74	109.13	94.17	87.27	100.14	101.34	118.1	128.91	139.99		_
If instantaneous w	vater heati	na at noint	of use (no	n hot water	r storage)	enter∩in	hoves (46		Total = Su	m(45) ₁₁₂ =	-	1394.23	(45)
									l	Ι ,			(46)
(46)m= 0 Water storage	loss:	0	0	0	0	0	0	0	0	0	0		(46)
Storage volum) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	neating a	and no ta	nk in dw	velling, e	nter 110	litres in	(47)						
Otherwise if no	o stored	hot wate	er (this in	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
Water storage					(1.3.4.(1	<i>,</i> , , ,							
a) If manufact				or is kno	wn (kWl	n/day):					0		(48)
Temperature f											0		(49)
Energy lost from b) If manufact		_	-		or io not		(48) x (49)) =			0		(50)
Hot water stor			-								0		(51)
If community h	•			•		,					<u> </u>		` '
Volume factor	from Ta	ble 2a									0		(52)
Temperature f	actor fro	m Table	2b								0		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or	` , `	,									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = ((55) × (41)	m	_			
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit	,	•			59)m =	(58) ÷ 36	65 × (41)	m					
(modified by	factor f	rom Tab	le H5 if t	here is s	solar wa	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m														
(61)m= 0	0	0	0	0	0	0) 0)	0	0	0	0]	(61)
	uired for	water h	eating ca	alculated	l for ea	 ch month	(62)	 m =	0.85 × (′45)m +	(46)m +	(57)m +	י - (59)m + (61)m	
(62)m= 122.87	`	110.89	96.68	92.76	80.05	74.18	85.		86.14	100.38	109.58	118.99	1	(62)
Solar DHW input	calculated	using App	endix G o	r Appendix	: H (nega	tive quantity	y) (ent	er '0	if no sola	r contribu	tion to wate	er heating))	
(add addition	al lines if	FGHRS	and/or \	WWHRS	applie	s, see Ap	pend	lix C	3)					
(63)m= 0	0	0	0	0	0	0	0)	0	0	0	0]	(63)
Output from v	vater hea	ter	-		-								_	
(64)m= 122.87	107.46	110.89	96.68	92.76	80.05	74.18	85.	12	86.14	100.38	109.58	118.99		_
								Outp	out from wa	ater heate	er (annual)	l12	1185.09	(64)
Heat gains fro	om water	heating,	kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	ı + (6	1)m] + 0.8 x	([(46)m	+ (57)m	+ (59)m	<u>]</u>]	
(65)m= 30.72	26.87	27.72	24.17	23.19	20.01	18.54	21.:	28	21.53	25.1	27.39	29.75		(65)
include (57)m in cald	culation of	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal g	jains (see	Table 5	and 5a):										
Metabolic gai	ns (Table	e 5), Wat	ts											
Jan	Feb	Mar	Apr	May	Jun	Jul	A	ug	Sep	Oct	Nov	Dec]	
(66)m= 114.55	114.55	114.55	114.55	114.55	114.55	114.55	114	.55	114.55	114.55	114.55	114.55]	(66)
Lighting gains	s (calcula	ted in Ap	pendix	L, equat	ion L9	or L9a), a	ılso s	ee -	Table 5				_	
(67)m= 18.85	16.75	13.62	10.31	7.71	6.51	7.03	9.1	4	12.27	15.58	18.18	19.38]	(67)
Appliances ga	ains (calc	ulated in	Append	dix L, eq	uation	L13 or L1	3a), a	also	see Tal	ble 5		-	_	
(68)m= 201.66	203.76	198.48	187.26	173.08	159.77	150.87	148	.77	154.05	165.27	179.45	192.76]	(68)
Cooking gain	s (calcula	ted in A	ppendix	L, equa	ion L1	or L15a), als	o se	e Table	5			-	
(69)m= 34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.	46	34.46	34.46	34.46	34.46	1	(69)
Pumps and fa	ans gains	(Table 5	 ба)										-	
(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= -91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.	.64	-91.64	-91.64	-91.64	-91.64]	(71)
Water heating	g gains (T	able 5)	-	-	-						-	-	_	
(72)m= 41.29	39.98	37.26	33.57	31.17	27.79	24.92	28.	.6	29.91	33.73	38.05	39.98]	(72)
Total interna	l gains =				(6	6)m + (67)n	n + (68	3)m +	- (69)m + ((70)m + (7	71)m + (72))m	-	
(73)m= 319.17	317.85	306.73	288.5	269.33	251.43	240.19	243	.88	253.59	271.95	293.04	309.49]	(73)
6. Solar gair	ns:													
Solar gains are	calculated	using sola	r flux from	Table 6a	and asso	ciated equa	ations	to co	nvert to th	e applica		tion.		
Orientation:			Area			ux able 6a		_	g_ able 6b	-	FF		Gains	
	Table 6d		m²			able ba	, ,		able ob	_ '	able 6c		(W)	_
Southeast 0.9x		X	11	.2	x	36.79	X		0.63	x	0.7	=	126	(77)
Southeast 0.9x	•	X	11	.2	x	62.67	X		0.63	x	0.7	=	214.62	(77)
Southeast 0.9x		X	11	.2	x	85.75	X		0.63	x	0.7	=	293.65	(77)
Southeast 0.9x		Х	11	.2	x	106.25	X	<u> </u>	0.63	x	0.7	=	363.85	(77)
Southeast 0.9x	0.77	X	11	.2	X	119.01	X		0.63	X	0.7	=	407.54	(77)

Southeast 0.9x	0.77	X	11.2	x	118.15	X		0.63	x	0.7	=	404.59	(77)
Southeast _{0.9x}	0.77	х	11.2	x	113.91	X		0.63	x	0.7	=	390.07	(77)
Southeast 0.9x	0.77	Х	11.2	x	104.39	X		0.63	x	0.7	=	357.47	(77)
Southeast 0.9x	0.77	х	11.2	x	92.85	X		0.63	x	0.7	=	317.96	(77)
Southeast 0.9x	0.77	х	11.2	x	69.27	x		0.63	x	0.7	=	237.2	(77)
Southeast 0.9x	0.77	х	11.2	x	44.07	x		0.63	_ x [0.7	=	150.91	(77)
Southeast 0.9x	0.77	х	11.2	x	31.49	x		0.63	_ x [0.7	=	107.83	(77)
													_
Solar gains in w	atts, calcula	ted for e	ach month	1		(83)m	n = Si	um(74)m .	(82)m				
(83)m= 126	214.62 293.6	363.8	5 407.54	404	4.59 390.07	357	'.47	317.96	237.2	150.91	107.83		(83)
Total gains – int	ernal and so	lar (84)r	n = (73)m	+ (83	3)m , watts								
(84)m= 445.17	532.47 600.3	88 652.3	5 676.87	656	6.03 630.26	601	.36	571.55	509.15	443.95	417.32		(84)
7. Mean interna	al temperatu	re (heati	ng seasor	n)									
Temperature d	uring heating	g periods	in the liv	ing a	rea from Tal	ble 9	, Th	1 (°C)				21	(85)
Utilisation facto	or for gains fo	or living	area, h1,n	ı (se	e Table 9a)								
Jan	Feb Ma	$\overline{}$		Ť	un Jul	Α	ug	Sep	Oct	Nov	Dec		
(86)m= 1	0.99 0.99	0.96	0.89	0.	75 0.58	0.6	62	0.84	0.97	0.99	1		(86)
Mean internal t	emperature	in livina	area T1 (f	ســــــ	stans 3 to	7 in T	I						
(87)m= 19.67	19.86 20.1	-		$\overline{}$.93 20.98	20.		20.86	20.48	20.01	19.64		(87)
					!								. ,
Temperature d	19.9 19.9			T		T			10.02	19.91	10.01		(88)
(88)m= 19.9	19.9	19.9	19.92	19	.93 19.93	19.	93	19.92	19.92	19.91	19.91		(00)
Utilisation facto		or rest of	dwelling,	h2,n	<u> </u>	9a)				,	ı	l	
(89)m= 1	0.99 0.98	0.94	0.85	0.0	65 0.45	0.4	19	0.77	0.96	0.99	1		(89)
Mean internal t	emperature	in the re	st of dwel	ling T	Γ2 (follow ste	eps 3	8 to 7	7 in Tabl	e 9c)				
(90)m= 18.7	18.88 19.1	5 19.48	19.74	19	.89 19.92	19.	92	19.85	19.51	19.04	18.68		(90)
								f	LA = Livir	ig area ÷ (4	4) =	0.46	(91)
Mean internal t	emperature	(for the	whole dwe	elling) = fLA × T1	+ (1	– fL	.A) × T2					
(92)m= 19.15	19.33 19.59	`			.37 20.41	20.		20.31	19.95	19.49	19.12		(92)
Apply adjustme	ent to the me	an inter	nal tempe	rature	e from Table	4e,	whe	ere appro	priate			l	
(93)m= 19.15	19.33 19.59	9 19.93	3 20.2	20	.37 20.41	20.	41	20.31	19.95	19.49	19.12		(93)
8. Space heati	ng requireme	ent											
Set Ti to the m				ned a	at step 11 of	Tabl	le 9t	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the utilisation fa		 	1	1 .	<u> </u>				_	T	I _		
Jan	Feb Ma		· May	J	un Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation facto			1 0.06	0.	7 0.51	T 0.5	1	0.0	0.06	0.00	4		(94)
(0.1)				0.	.7 0.51	0.5	00	0.8	0.96	0.99	1		(34)
Useful gains, h (95)m= 443.46	527.59 587.3	` 	` 	156	5.06 319.58	332	12	457.24	487.71	440.31	416.13		(95)
Monthly average						1 332	72	407.24	407.71	440.01	410.13		(00)
(96)m= 4.3	4.9 6.5	- i	11.7		1.6 16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate						<u> </u>				<u> </u>			• •
(97)m= 1309.79 1				1	3.38 325.97	342	_	533.51	808.7	1076.31	1302.72		(97)
Space heating	requirement	for each	month, k	Wh/r	month = 0.02	24 x [—— [(97))m – (95)m] x (4	1)m			
· -	498.63 417.9	-		т —	0 0	0		0	238.82	457.92	659.62		
<u> </u>	ļ.		-	-	-	-						l	

Total per year (kWh/year) = Sum(98) _{15,9}												8)15,912 =	3275.38	(98)
Space	e heating	g require	ement in	kWh/m²	² /year								45.56	(99)
8c. Sp	oace 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 I	oss rate	Lm (ca	lculated	using 2	5°C inter			and exte	ernal ten	nperatur	e from T	able 10)	ı	
(100)m=	0	0	0	0	0	803.97	632.92	648.69	0	0	0	0		(100)
Utilisa	tion fac	tor for lo	ss hm										ı	
(101)m=	0	0	0	0	0	0.85	0.92	0.9	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = (100)m x	(101)m								ı	
(102)m=	0	0	0	0	0	686.22	581.01	583.97	0	0	0	0		(102)
Gains	(solar g	ains cal	culated	for appli	cable we	eather re	gion, se	e Table	10)				1	
(103)m=	0	0	0	0	0	852.28	820.46	788.19	0	0	0	0		(103)
•	_					lwelling,	continu	ous (kW	h = 0.02	24 x [(10	03)m – (102)m] :	x (41)m	
` ı		zero ii (104)m <	3 × (98		110.56	170.15	151.04	0	0	0	0		
(104)m=	0	0	U	0	0	119.56	178.15	151.94	0 T = 1 = 1					7,,,,,
Cooloo	I fraction									= Sum(cooled a	,	=	449.66	(104)
			able 10b	١					10=	cooled	area - (²	+) =	1	(105)
(106)m=		0	0	0	0	0.25	0.25	0.25	0	0	0	0		
(100)										' = Sum((104)	=	0	(106)
Space	cooling	requiren	nent for	month =	(104)m	× (105)	× (106)r	n	, ota,	Jam	1606 17		•	
(107)m=	Ť	0	0	0	0	29.89	44.54	37.99	0	0	0	0		
1									Total	= Sum(107)	=	112.41	(107)
Space cooling requirement in kWh/m²/year $(107) \div (4) =$											1.56	(108)		
8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)														
Fabric Energy Efficiency (99) + (108) =												47.13	(109)	
Targe	et Fabrio	Energ	y Efficie	ency (TF	EE)								54.19	(109)

		اعدا	r Details:									
Assessor Name:	Zahid Ashraf	030	Strom	o Nium	bor		STDO	001082				
Software Name:	Stroma FSAP 2012	2	Softwa					on: 1.0.5.9				
		Proper	ty Address:	Plot 5								
Address :												
Overall dwelling dime	ensions:				A I I .	tarle ((a a)) / - l				
Ground floor		A	rea(m²) 71.89	(1a) x		ight(m) 2.5	(2a) =	Volume(m³	(3a)			
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)	 + (1n) ☐		(4)]` ''	170.72				
Dwelling volume	a, ((, a), (, a), (, a), (, a)		71.00)+(3c)+(3c	d)+(3e)+	.(3n) =	470.70	7(5)			
				(54) (55)	, , (00) , (00	.,, (33),	.(0)	179.72	(5)			
2. Ventilation rate:		condary	other		total			m³ per hou	r			
Number of chimneys	heating he	eating +	0	7 - F	0	X 4	40 =	0	(6a)			
Number of open flues	0 +	0 +	0	Ј <u>Г</u>	0	x 2	20 =	0	(6b)			
Number of intermittent fa				J	0	x	10 =	0	(7a)			
Number of passive vents				L	0	x	10 =	0	(7b)			
·				L		x	40 =	0	(7c)			
Number of flueless gas fi	Jumber of flueless gas fires 0 × 40 =											
							Air ch	anges per ho	our			
Infiltration due to chimne	ys, flues and fans = (6a))+(6b)+(7a)+(7b)+(7c) =		0		÷ (5) =	0	(8)			
	peen carried out or is intended	l, proceed to (17	7), 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]XU.1 =	0	(11)			
	resent, use the value corresp	onding to the gr	eater wall are	a (after					` ′			
deducting areas of opening	ngs); if equal user 0.35 floor, enter 0.2 (unseale	d) or 0.1 (se	aled) else	enter ()			i	0	(12)			
If no draught lobby, en	,	a) or o.1 (30	aica), cisc	Critci 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	12) + (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 ad	been done or a	degree air pe	meability	is being u	sed		2	(19)			
Shelter factor	,u		(20) = 1 -	0.075 x (1	19)] =			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	l 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	5 0.92	1	1.08	1.12	1.18					
			•		•	•	•	•				

0.16	ation rat	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15	1	
alculate effec			l -	-	i -	_	0.12	0.10	0.11	0.11	0.10	J 	
If mechanica												0.5	(2
If exhaust air he) = (23a)			0.5	(2
If balanced with		-	-	_								79.05	(2
a) If balance			.			<u> </u>	- 	í `	 		` ` ´	; ÷ 100]	
4a)m= 0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25]	(2
b) If balance			i				<u> </u>	i `	 	- 	ī	1	
lb)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(:
c) If whole h				•	•				F (22h	.\			
if (22b)n	0.5 ×	(23b), t	nen (240	(230) = (230)	o); otner	wise (24	C) = (220)	0) m + 0.	5 × (230	0	0	1	(
,										0		J	(4
d) If natural if (22b)n									0.5]				
ld)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(2
Effective air	change	rate - er	nter (24a	or (24k	o) or (24	c) or (24	d) in box	x (25)				,	
i)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	1	(:
Haatlaass		4			•		•	•	•		•	,	
. Heat losse	_				NI a t A a		11 -1		A 37 11				A 3/ I
EMENT	Gros area	_	Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/I	〈)	k-value kJ/m²-l		A X k kJ/K
ors		` ,			2	х	1.4	=	2.8	<u></u>			(
ndows					11.20		/[1/(1.4)+	0.04] =	14.86				(:
oor					71.88	8 x	0.12	: - -	8.62656				(:
alls Type1	69.9	12	11.2		58.72	=	0.15	<u>-</u>	8.81			-	(
alls Type2	22.3		2	=	20.33	=	0.14	<u>-</u>	2.86	ଟ ¦		러	`
tal area of e					164.1	=	0.14		2.00				\ (
or windows and			effective wi	ndow I I-va			ı formula 1	/[(1/Ll-valu	ıe)+0 041 a	ns aiven in	naragrant	h 32	(
nclude the area						atou uomg	, romaia 1	/[(1/ O Vaic	10/10.04/0	io givoii iii	paragrapi	7 0.2	
bric heat los	s, W/K :	= S (A x	U)				(26)(30)) + (32) =				37.95	(
at capacity	Cm = S(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	9014.32	2 (
ermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(
r design assess				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
n be used inste					ا دائد د د د	,							 ,
ermal bridge letails of therma	`	,		Ο.	•	`						12.65	(
tal fabric he		are not kn	OWII (30) =	= 0.03 X (3	(1)			(33) +	(36) =			50.61	
entilation hea		alculated	l monthly	/					= 0.33 × (25)m x (5))	30.01	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
3)m= 15.85	15.66	15.48	14.53	14.34	13.4	13.4	13.21	13.77	14.34	14.72	15.1	†	(
eat transfer o					!		!		= (37) + (37)	<u> </u>	!	1	,
at transler (OCITICIEI	ιι, νν/ Γ\						- ` ´	```		ı	1	
)m= 66.46	66.27	66.08	65.14	64.95	64	64	63.81	64.38	64.95	65.32	65.7		

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.92	0.92	0.92	0.91	0.9	0.89	0.89	0.89	0.9	0.9	0.91	0.91		
						l	l		Average =	Sum(40) ₁	12 /12=	0.91	(40)
Number of day	·	nth (Tab	le 1a)					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	ting ene	rgy requi	rement:								kWh/ye	ar:	
Assumed occi if TFA > 13. if TFA £ 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		29		(42)
Annual average Reduce the annu- not more that 125	al average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		3.28		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage								· '					
(44)m= 102.6	98.87	95.14	91.41	87.68	83.95	83.95	87.68	91.41	95.14	98.87	102.6		
	ļ								Total = Su	m(44) ₁₁₂ =	-	1119.32	(44)
Energy content of	f hot water	used - cal	culated mo	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= 152.16	133.08	137.33	119.72	114.88	99.13	91.86	105.41	106.67	124.31	135.7	147.36		
If in atomton acus	water booti	na at naint	of upo (no	bot water	, ataragal	antar O in	haves (46		Total = Su	m(45) ₁₁₂ =	=	1467.61	(45)
If instantaneous v	1		,	1	, , , , , , , , , , , , , , , , , , ,		, ,	, , , I	ī	ı			(15)
(46)m= 22.82 Water storage	19.96	20.6	17.96	17.23	14.87	13.78	15.81	16	18.65	20.35	22.1		(46)
Storage volum) includir	ig any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	•					_							` '
Otherwise if n	_			-			, ,	ers) ente	er '0' in ((47)			
Water storage													
a) If manufac				or is kno	wn (kWł	n/day):					0		(48)
Temperature f											0		(49)
Energy lost fro		•					(48) x (49)) =		1	10		(50)
b) If manufact Hot water stor			-								02		(51)
If community h	•			0 2 (1111)	1,11ti 0, de	•97				0.	.02		(01)
Volume factor	_									1.	.03		(52)
Temperature f	factor fro	m Table	2b							0	.6		(53)
Energy lost fro	om watei	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	1.	03		(54)
Enter (50) or	(54) in (55)								1.	.03		(55)
Water storage	loss cal	culated f	or each	month			((56)m = ((55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хH	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit	t loss (ar	nnual) fro	m Table	<u>-</u> -							0		(58)
Primary circuit	`	,			59)m = ((58) ÷ 36	65 × (41)	m					
(modified by	y factor f	rom Tab	le H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss (Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m													
(61)m= 0	0	0	0	0	00)	0),,, T)	0	0	0	0	1	(61)
	!			alculated	l for e	ach month						<u> </u>	J · (59)m + (61)m	` ,
(62)m= 207.4		192.6	173.22	170.16	152.		160		160.16	179.59	189.19	202.64	1	(62)
Solar DHW inpu		<u> </u>	endix G or		<u> </u>						1		<u></u>	` ,
(add addition												-: ····································		
(63)m= 0	0	0	0	0	0	0	j	_	0	0	0	0	7	(63)
Output from	water hea	ter	l				!						_	
(64)m= 207.4		192.6	173.22	170.16	152.	63 147.14	160	.69	160.16	179.59	189.19	202.64	1	
		ı	ı			!		Outp	out from w	ater heate	er (annual)	112	2118.45	(64)
Heat gains f	rom water	heating	kWh/m	onth 0.2	5 ′ [0.	85 × (45)m	n + (6	31)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	 n]	_
(65)m= 94.8°	84.19	89.88	82.6	82.42	75.7	6 74.76	79.	27	78.26	85.56	87.91	93.22	1	(65)
include (5	7)m in cald	culation	of (65)m	only if c	ylinde	er is in the	dwell	ling	or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	Table 5	and 5a):										
Metabolic gains (Table 5), Watts														
Jar	Feb	Mar	Apr	May	Ju	n Jul	А	ug	Sep	Oct	Nov	Dec]	
(66)m= 137.4	6 137.46	137.46	137.46	137.46	137.	137.46	137	.46	137.46	137.46	137.46	137.46]	(66)
Lighting gair	ns (calcula	ted in Ap	pendix	L, equat	ion L	or L9a), a	ılso s	ee -	Table 5					
(67)m= 47.14	41.87	34.05	25.78	19.27	16.2	7 17.58	22.	85	30.67	38.94	45.45	48.45]	(67)
Appliances (gains (calc	ulated ir	Append	dix L, eq	uatio	1 L13 or L1	3a),	also	see Ta	ble 5			_	
(68)m= 300.9	9 304.11	296.24	279.49	258.34	238.	46 225.18	222	.05	229.92	246.68	267.83	287.71]	(68)
Cooking gair	ns (calcula	ited in A	ppendix	L, equat	ion L	15 or L15a), als	o se	ee Table	5				
(69)m= 51.04	51.04	51.04	51.04	51.04	51.0	4 51.04	51.	04	51.04	51.04	51.04	51.04		(69)
Pumps and	fans gains	(Table s	5a)											
(70)m= 0	0	0	0	0	0	0	C)	0	0	0	0]	(70)
Losses e.g.	evaporatio	n (nega	tive valu	es) (Tab	le 5)									
(71)m= -91.6	4 -91.64	-91.64	-91.64	-91.64	-91.6	-91.64	-91	.64	-91.64	-91.64	-91.64	-91.64]	(71)
Water heating	ng gains (T	able 5)											_	
(72)m= 127.4	4 125.28	120.81	114.73	110.78	105.	22 100.49	106	.55	108.7	114.99	122.1	125.29]	(72)
Total intern	al gains =	:				(66)m + (67)n	n + (68	3)m +	+ (69)m +	(70)m + (7	71)m + (72))m	_	
(73)m= 572.4	2 568.12	547.96	516.85	485.24	456	8 440.1	448	.31	466.15	497.47	532.24	558.31		(73)
6. Solar ga	ns:													
Solar gains ar		•				•	ations	to co	onvert to th	ne applica		tion.		
Orientation:	Access F Table 6d		Area m²			Flux Table 6a		Т	g_ able 6b	Т	FF able 6c		Gains (W)	
Southeast 0.9					_		1 .,					_	. ,	1(77)
Southeast 0.9		X			x	36.79] X]		0.63		0.7	=	126	(77)
Southeast 0.9	<u> </u>	×			× _	62.67] ×] _v		0.63	×	0.7	╡ -	214.62	[(77)] ₍₇₇₎
Southeast 0.9	<u> </u>	×	11		× L	85.75] ×] _~		0.63	×	0.7	- -	293.65	
Southeast 0.9		x	11		x	106.25] X] ,,	\vdash	0.63	×	0.7	=	363.85](77)] ₍₇₇₎
Journed 51 (1,9)	0.77	X	11	.2	x	119.01	X		0.63	X	0.7	=	407.54	(77)

Southeast _{0.9x}	0.77	X	11.	.2	x	118	8.15	x		0.63	x	0.7	=	404.59	(77)
Southeast 0.9x	0.77	x	11.	.2	x	11:	3.91	x		0.63	x	0.7	=	390.07	(77)
Southeast _{0.9x}	0.77	X	11.	.2	x	10-	4.39	x		0.63	x	0.7		357.47	(77)
Southeast _{0.9x}	0.77	×	11.	.2	x	92	2.85	x		0.63	x	0.7	=	317.96	(77)
Southeast _{0.9x}	0.77	x	11.	.2	x	69	9.27	х		0.63	x	0.7		237.2	(77)
Southeast _{0.9x}	0.77	×	11.	.2	х	44	1.07	x		0.63	×	0.7	=	150.91	(77)
Southeast 0.9x	0.77	×	11.	.2	x [31	1.49	x		0.63		0.7	=	107.83	(77)
•								•							
Solar gains in	watts, ca	alculated	for eacl	n month				(83)m	n = Si	um(74)m .	(82)m				
(83)m= 126	214.62	293.65	363.85	407.54	40)4.59	390.07	357	.47	317.96	237.2	150.91	107.83		(83)
Total gains – i	internal a	and solar	(84)m =	(73)m	+ (8	33)m ,	watts					_			
(84)m= 698.42	782.74	841.61	880.7	892.78	86	31.39	830.17	805	.78	784.11	734.67	683.15	666.14		(84)
7. Mean inte	rnal temp	erature	(heating	season)										
Temperature						area fr	rom Tab	ole 9	, Th	1 (°C)				21	(85)
Utilisation fac	_	٠.			-					, ,					
Jan	Feb	Mar	Apr	May	È	Jun		А	ug	Sep	Oct	Nov	Dec		
(86)m= 0.89	0.85	0.8	0.71	0.59	0	.45	0.33	0.3	35	0.52	0.72	0.85	0.9		(86)
Mean interna	l temper	ature in	living ar	22 T1 /f/	مالم	w ston	oc 3 to 7	Tin T	I	2 0c)					
(87)m= 19.68	19.92	20.22	20.56	20.8		0.94	20.98	20.		20.9	20.6	20.11	19.64		(87)
` ′	<u> </u>				<u> </u>							1			, ,
Temperature	20.15	eating p	eriods ir 20.16		_	elling 1	20.18	20.		12 (°C) 20.17	20.16	20.16	20.16	Ī	(88)
(88)m= 20.15	20.15	20.15	20.16	20.16		0.18	20.18	20.	18	20.17	20.16	20.16	20.16		(00)
Utilisation fac						$\overline{}$		T				_		1	
(89)m= 0.88	0.84	0.78	0.68	0.55	(0.4	0.27	0.2	29	0.47	0.69	0.83	0.89		(89)
Mean interna	al temper	ature in	the rest	of dwell	ng	T2 (fo	llow ste	eps 3	to 7	7 in Tabl	e 9c)			-	
(90)m= 18.41	18.74	19.17	19.63	19.94	20	0.12	20.16	20.	16	20.07	19.7	19.02	18.35		(90)
										f	LA = Livi	ng area ÷ (4) =	0.46	(91)
Mean interna	al temper	ature (fo	r the wh	ole dwe	lling	g) = fL	.A × T1	+ (1	– fL	.A) × T2					
(92)m= 19	19.29	19.65	20.05	20.34	2	20.5	20.54	20.	54	20.45	20.12	19.52	18.94		(92)
Apply adjusti	ment to t	he mean	internal	temper	atur	re fron	n Table	4e,	whe	re appro	priate	•	•		
(93)m= 19	19.29	19.65	20.05	20.34	2	20.5	20.54	20.	54	20.45	20.12	19.52	18.94		(93)
8. Space hea	ating requ	uirement													
Set Ti to the					ed	at ste	p 11 of	Tabl	le 9b	o, so tha	t Ti,m=	(76)m an	d re-calc	culate	
the utilisation	1				Г	1	11			Con	0 0 0 1	Nev	Daa		
Jan Utilisation fac	Feb	Mar	Apr	May	<u> </u>	Jun	Jul	LA	ug	Sep	Oct	Nov	Dec		
(94)m= 0.86	0.82	0.76	0.68	0.56	0	0.42	0.3	0.3	32	0.49	0.68	0.81	0.87		(94)
Useful gains										00	0.00	1 0.01	1 0.0.		, ,
(95)m= 600.04		642.05	595.63	501.25	36	80.03	247.63	258	.24	380.38	502.99	555.28	580.06		(95)
Monthly aver			perature		ı— able	——∟ 9.8		<u> </u>				- !	Į		
(96)m= 4.3	4.9	6.5	8.9	11.7		4.6	16.6	16	.4	14.1	10.6	7.1	4.2		(96)
Heat loss rat	e for me	an intern	al tempe	erature,	Lm	, W =	[(39)m :	x [(9	3)m-	– (96)m]	1	1	I	
(97)m= 976.73	953.33	869.18	726.58	560.82	37	77.31	252.14	263	.97	408.97	618	811.34	968.57		(97)
Space heatir	ng require	ement fo	r each n	nonth, k	Wh/	month/	1 = 0.02	24 x	[(97))m – (95)m] x (4	11)m			
(98)m= 280.25	209.83	168.99	94.29	44.32		0	0	C)	0	85.57	184.36	289.05		
_															

Space heating requirement in kWh/m²/year 1356.66 188) 18.87 189			
### Space heating requirements from Secondary/Supplementary heating system Praction of space heat from community system 1 - (301) =		Total per year (kWh/year) = Sum(98)15,912 = 1356.66 (98)
This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) 0' if none 7 incommunity scheme mey obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and water heat from power stations. See Appendix C. Fraction of total space heat from Community boilers Fraction of total space heat from Community beating system Distribution loss factor (Table 12c) for community heating system Distribution loss factor (Table 12c) for community heating system Fraction of total space heating requirement Space heating requirement Space heating requirement Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) Space heating requirement from secondary/supplementary system (98) x (301) x 100 + (308) = Water heating Fraction of total space heating requirement Fraction of total space heating Fraction of total space heati	Space heating requirement in kWh/m²/year		18.87 (99)
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none			
The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources: the latter includes bollers, heat pumps, geothermal and waste heat from power stations. See Appendix C. Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a) Fraction of total space heat from Community boilers (302) x (303a) = 1 (305b) Fraction of total space heat from Community boilers (1.05 (306b) Fraction of total space heat from Community heating system (1.05 (306b) Fractor for control and charging method (Table 4c(3)) for community heating system (1.05 (306b) Fractor for control and charging method (Table 4c(3)) for community heating system (1.05 (306b) Fractor for control and charging method (Table 4c(3)) for community heating system (1.05 (306b) Fractor for control and charging method (Table 4c(3)) for community heating system (1.05 (306b) Fractor for control and charging method (Table 4c(3)) for community heating system (1.05 (306b) Fractor for control and charging method (Table 4c(3)) for community heating requirement (1.05 (307a) (305) x (306) (306) (306b) Fractor for control and charging method (Table 4c(3)) for community beating system in (606 (808) x (304) x (305) x (306)			
Fraction of heat from Community boilers 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 heating system 1 305 Distribution loss factor (Table 12c) for community heating system 1 305 Space heating 1 105 Space heating requirement 1 1356.66 Space heat from Community boilers (38) x (304a) x (305) x (306) = 1424.49 (307a) Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308) Space heating requirement from secondary/supplementary system (89) x (301) x (305) x (306) = 0 (309) Water heating 2 (18.45	Fraction of space heat from community system 1 – (301) =		1 (302
Fraction of heat from Community boilers (302) x (303a) = 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 heating system			ources; the latter
Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a) Factor for control and charging method (Table 4c(3)) for community heating system 1.05 (306) Distribution loss factor (Table 12c) for community heating system 1.05 (306) Space heating		tions. See Appendix C.	1 (303
Distribution loss factor (Table 12c) for community heating system 1.05 (308)	·	(302) x (303a	
Space heating KWhlyear Annual space heating requirement 1356.66 Space heat from Community boilers (98) x (304a) x (305) x (306) = 1424.49 (307a) Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308) Space heating requirement from secondary/supplementary system (98) x (301) x 100 + (308) = 0 (309) Water heating Annual water heating requirement 2118.45 2118.45 1 If DHW from community scheme: (64) x (303a) x (305) x (306) = 2224.37 (310a) Water heat from Community boilers (64) x (303a) x (305) x (306) = 2224.37 (310a) Electricity used for heat distribution 0.01 x (307a)(307e) + (310a)(310e) = 36.49 (31) Cooling System Energy Efficiency Ratio 0.01 x (314) 0.0314 (314) Space cooling (if there is a fixed cooling system, if not enter 0) = (107) + (314) = 0.0316 (330a) Electricity for pumps and fans within dwelling (Table 4f): 0.0330 (330a) (330a) (330a) (330a)	Factor for control and charging method (Table 4c(3)) for co	mmunity heating system	1 (305
Annual space heating requirement Space heat from Community boilers Space heat from Community boilers Space heating requirement from secondary/supplementary system in % (from Table 4a or Appendix E) Space heating requirement from secondary/supplementary system Space heating requirement from secondary/supplementary system Space heating requirement from secondary/supplementary system Space heating requirement rom secondary/supplementary system n % (from Table 4a or Appendix E) Space heating system fance Space heating from CHP Space heating system fance Space heating system fance Space heating from CHP Space heating from Space in the space of space in the sp	Distribution loss factor (Table 12c) for community heating s	system	1.05 (306
Space heat from Community boilers (98) x (304a) x (305) x (306) = 1424.49 (307a) Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308) Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309) Water heating Annual water heating requirement 2118.45 2118.45 1 If DHW from community scheme: Water heat from Community boilers (64) x (303a) x (305) x (306) = 2224.37 (310a) Electricity used for heat distribution 0.01 x [(307a)(307e) + (310a)(310e)] = 36.49 (313) Cooling System Energy Efficiency Ratio 0 (314) 0 (315) 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): 0 (330a) mechanical ventilation - balanced, extract or positive input from outside 249.41 (330a) warm air heating system fans 0 (330a) pump for solar water heating 0 (330a) Electricity generated by PVs (Appendix M) (negative qu	Space heating		kWh/year
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309) Water heating Annual water heating requirement If DHW from community scheme: Water heat from Community boilers (64) x (303a) x (305) x (306) = 2224.37 (310a) Electricity used for heat distribution 0.01 x [(307a)(307e) + (310a)(310e)] = 36.49 (313) Cooling System Energy Efficiency Ratio 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 outside warm air heating system fans 0 (330a) pump for solar water heating Total electricity for the above, kWh/year = (330a) + (330b) + (330g) = 249.41 (331) Energy for lighting (calculated in Appendix L) Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) 10b. Fuel costs – Community heating scheme Fuel kWh/year Fuel Price (Table 12) Fuel Cost E/year Space heating from CHP (307a) x 4.24 x 0.01 = 60.4 (340a)	Annual space heating requirement		1356.66
Space heating requirement from secondary/supplementary system Water heating Annual water heating requirement If DHW from community scheme: Water heat from Community boilers (64) × (303a) × (305) × (306) = 2224.37 (310a) Electricity used for heat distribution 0.01 × [(307a)(307e) + (310a)(310e)] = 36.49 (313) Cooling System Energy Efficiency Ratio 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 outside warm air heating system fans 0 (330b) pump for solar water heating Total electricity for the above, kWh/year = (330a) + (330b) + (330g) = 249.41 (331) Energy for lighting (calculated in Appendix L) Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) 0 (334) 10b. Fuel costs – Community heating scheme	Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1424.49 (307
Water heating Annual water heating requirement 2118.45 If DHW from community scheme: Water heat from Community boilers (64) x (303a) x (305) x (306) = 2224.37 (310a) Electricity used for heat distribution 0.01 x [(307a)(307e) + (310a)(310e)] = 36.49 (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 outside 249.41 (330a) warm air heating system fans 0 (330b) pump for solar water heating 0 (330a) pump for solar water heating 0 (330a) Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 249.41 (331) Electricity generated by PVs (Appendix M) (negative quantity) -724.55 (333) Electricity generated by wind turbine (Appendix M) (negative quantity) 0 (334) 10b. Fuel costs – Community heating scheme Fuel Price (Table 12) Fuel Cost £/year Space heating from CHP	Efficiency of secondary/supplementary heating system in %	6 (from Table 4a or Appendix E)	0 (308)
Annual water heating requirement If DHW from community scheme: Water heat from Community boilers Electricity used for heat distribution Cooling System Energy Efficiency Ratio Cooling System Energy Efficiency Ratio Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside warm air heating system fans Double of the above, kWh/year Electricity for the above, kWh/year Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) Fuel kWh/year Fuel kWh/year Space heating from CHP (307a) x Electricity (305) x (306) = (64) x (303a) x (305) x (306) = (2224.37 (310a) (310a) 2224.37 (310a) (310a) (314) 50 (314) 50 (315) Electricity (314) = 0 (315) Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside 249.41 (330a) (330a) 330a) Total electricity for the above, kWh/year =(330a) + (330b) + (330b) + (330g) = 249.41 (331) Electricity generated by PVs (Appendix M) (negative quantity) 7-724.55 (333) Electricity generated by wind turbine (Appendix M) (negative quantity) 0 (334) 10b. Fuel Cost £/year Space heating from CHP (307a) x 4.24 x 0.01 = 60.4 (340a)	Space heating requirement from secondary/supplementary	system (98) x (301) x 100 ÷ (308) =	0 (309
If DHW from community scheme: Water heat from Community boilers (64) × (303a) × (305) × (306) = 2224.37 (310a) Electricity used for heat distribution 0.01 × [(307a)(307e) + (310a)(310e)] = 36.49 (313) Cooling System Energy Efficiency Ratio 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 outside warm air heating system fans 0 (330a) pump for solar water heating Total electricity for the above, kWh/year = (330a) + (330b) + (330g) = 249.41 (331) Energy for lighting (calculated in Appendix L) Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) 10b. Fuel costs – Community heating scheme Fuel kWh/year Fuel Price (Table 12) Fuel Cost £/year Space heating from CHP (307a) × (4.24) × 0.01 = 60.4 (340a)			
Water heat from Community boilers (64) × (303a) × (305) × (306) = 2224.37 (310a) Electricity used for heat distribution 0.01 × [(307a)(307e) + (310a)(310e)] = 36.49 (313) Cooling System Energy Efficiency Ratio Cooling System Energy Efficiency Ratio 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 outside warm air heating system fans 0 (330b) pump for solar water heating Total electricity for the above, kWh/year = (330a) + (330b) + (330g) = 249.41 (331) Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) 10b. Fuel costs – Community heating scheme Fuel kWh/year Fuel Price (Table 12) Space heating from CHP (307a) × 4.24 × 0.01 = 60.4 (340a)	• .		2118.45
Cooling System Energy Efficiency Ratio 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 outside warm air heating system fans pump for solar water heating Total electricity for the above, kWh/year = (330a) + (330b) + (330g) = 249.41 (331) Energy for lighting (calculated in Appendix L) Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) 10b. Fuel costs – Community heating scheme Fuel kWh/year Fuel Price (Table 12) Fuel Cost £/year Space heating from CHP (307a) x 4.24 x 0.01 = 60.4 (340a)	•	(64) x (303a) x (305) x (306) =	2224.37 (310
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 outside warm air heating system fans pump for solar water heating Total electricity for the above, kWh/year = (330a) + (330b) + (330g) = 249.41 (331) Energy for lighting (calculated in Appendix L) Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) Tob. Fuel costs – Community heating scheme Fuel kWh/year Fuel Price (Table 12) Fuel Cost £/year Space heating from CHP (307a) x 4.24 x 0.01 = 60.4 (340a)	Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(3	(313 (313 (313 (313 (313 (313 (313 (313
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside warm air heating system fans pump for solar water heating Total electricity for the above, kWh/year Energy for lighting (calculated in Appendix L) Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) Tub. Fuel costs – Community heating scheme Fuel kWh/year Fuel Price (Table 12) Fuel Cost £/year Space heating from CHP Fuel Cost (Table 12) Fuel Cost (Table 12)	Cooling System Energy Efficiency Ratio		0 (314
mechanical ventilation - balanced, extract or positive input from outside warm air heating system fans 0 (330b) pump for solar water heating Total electricity for the above, kWh/year =(330a) + (330b) + (330b) + (330g) = Energy for lighting (calculated in Appendix L) Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) Tub. Fuel costs – Community heating scheme Fuel kWh/year Fuel Price (Table 12) Space heating from CHP (307a) x 4.24 x 0.01 = 60.4 (340a)	Space cooling (if there is a fixed cooling system, if not enter	er 0) = (107) ÷ (314) =	0 (315
pump for solar water heating Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 249.41 (331) Energy for lighting (calculated in Appendix L) Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) 10b. Fuel costs – Community heating scheme Fuel kWh/year Fuel Price (Table 12) Space heating from CHP (307a) x Fuel Cost £/year Fuel Cost £/year	, , ,	from outside	249.41 (330
Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 249.41 (331) Energy for lighting (calculated in Appendix L) 332.99 (332) Electricity generated by PVs (Appendix M) (negative quantity) -724.55 (333) Electricity generated by wind turbine (Appendix M) (negative quantity) 0 (334) 10b. Fuel costs – Community heating scheme Fuel kWh/year (Table 12) £/year Space heating from CHP (307a) x 4.24 x 0.01 = 60.4 (340a)	warm air heating system fans		0 (330
Energy for lighting (calculated in Appendix L) Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) To (332) Electricity generated by wind turbine (Appendix M) (negative quantity) To (334) 10b. Fuel costs – Community heating scheme Fuel kWh/year Fuel Price (Table 12) E/year Space heating from CHP Fuel Cost £/year Fuel Cost £/year	pump for solar water heating		0 (330
Electricity generated by PVs (Appendix M) (negative quantity) Electricity generated by wind turbine (Appendix M) (negative quantity) O (334) 10b. Fuel costs – Community heating scheme Fuel kWh/year (Table 12) Space heating from CHP (307a) x Fuel Price (Table 12) £/year 60.4 (340a)	Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	249.41 (331
Electricity generated by wind turbine (Appendix M) (negative quantity) 10b. Fuel costs – Community heating scheme Fuel kWh/year (Table 12) Space heating from CHP (307a) x Fuel Price (Table 12) £/year 60.4 (340a)	Energy for lighting (calculated in Appendix L)		332.99 (332
Fuel Fuel Price Fuel Cost & Wh/year (Table 12) Space heating from CHP (307a) x 4.24 x 0.01 = 60.4 (340a)	Electricity generated by PVs (Appendix M) (negative quant	ity)	-724.55 (333
Fuel Fuel Price Fuel Cost kWh/year (Table 12) £/year Space heating from CHP (307a) \times 4.24 \times 0.01 = 60.4 (340a)	Electricity generated by wind turbine (Appendix M) (negative	ve quantity)	0 (334
kWh/year (Table 12) £/year Space heating from CHP (307a) \times 4.24 \times 0.01 = 60.4 (340a)	10b. Fuel costs – Community heating scheme		
4.24			
Water heating from CHP $(310a) \times 4.24 \times 0.01 = 94.31 (342a)$	Space heating from CHP (307a)	x 4.24 x	0.01 = 60.4 (340
	Water heating from CHP (310a)	x 4.24 x	0.01 = 94.31 (342

		F	Fuel Price		
Pumps and fans	(331)	Ĺ	13.19 × 0.01 =	32.9	(349)
Energy for lighting	(332)		13.19 x 0.01 =	43.92	(350)
Additional standing charges (Table 12)				120	(351)
Energy saving/generation technologies					
Total energy cost	= (340a)(342e) + (345)	(354) =		351.53	(355)
11b. SAP rating - Community heating	scheme				
Energy cost deflator (Table 12)				0.42	(356)
Energy cost factor (ECF)	[(355) x (356)] ÷ [(4) + 45.0	0] =		1.26	(357)
SAP rating (section12)				82.38	(358)
12b. CO2 Emissions – Community hea	ting scheme	Energy	Emission factor	r Emissions	
		kWh/year	kg CO2/kWh	kg CO2/year	
CO2 from other sources of space and v Efficiency of heat source 1 (%)			B) to (366) for the second fu	uel 94	(367a)
CO2 associated with heat source 1	[(307b))+(310b)] x 100 ÷ (367b)	x 0.22	= 838.46	(367)
Electrical energy for heat distribution		[(313) x	0.52	= 18.94	(372)
Total CO2 associated with community s	systems	(363)(366) + (368)	(372)	= 857.4	(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	ater heating	(373) + (374) + (375) =	=	857.4	(376)
CO2 associated with electricity for pum	ps and fans within dwe	elling (331)) x	0.52	= 129.44	(378)
CO2 associated with electricity for light	ng	(332))) x	0.52	172.82	(379)
Energy saving/generation technologies Item 1	(333) to (334) as appli	cable	0.52 x 0.01 =	-376.04	(380)
Total CO2, kg/year	sum of (376)(382) =			783.62	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			10.9	(384)
El rating (section 14)				91.02	(385)
13b. Primary Energy – Community hea	ting scheme	F	During	D. F	
		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 Ch If there is CHP us	HP) ing two fuels repeat (363	B) to (366) for the second fu	uel 94	(367a)
Energy associated with heat source 1	[(30 7 b])+(310b)] x 100 ÷ (367b)	x 1.22	= 4735.75	(367)
Electrical energy for heat distribution		[(313) x		= 112.02	(372)
Total Energy associated with communit	y systems	(363)(366) + (368)	(372)	= 4847.77	(373)
if it is negative set (373) to zero (unle	ess specified otherwise,	, see C7 in Appendi	x C)	4847.77	(373)
Energy associated with space heating (secondary)	(309) x	0	= 0	(374)

Total Primary Energy, kWh/year sum of (37)	'6)(382) =			4411.35	(383)
Energy saving/generation technologies Item 1		3.07 × 0.01	= [-2224.36	(380)
Energy associated with electricity for lighting	(332))) x	3.07	=	1022.26	(379)
Energy associated with electricity for pumps and fans within	dwelling (331)) x	3.07	=	765.68	(378)
Energy associated with space cooling	(315) x	3.07	=	0	(377)
Total Energy associated with space and water heating	(373) + (374) + (375) =			4847.77	(376)
Energy associated with water from immersion heater or insta	antaneous heater(312) x	1.22	=	0	(375)

		l Iser I	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa					0001082 on: 1.0.5.9	
Address :	F	Property	Address	Plot 5					
1. Overall dwelling dime	ensions:								
3		Are	a(m²)		Av. He	ight(m)		Volume(m	³)
Ground floor		-	71.89	(1a) x	2	2.5	(2a) =	179.72	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	71.89	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	179.72	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys	0 + 0	+ [0	=	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	<u> </u>	0	Ī - Ē	0	x 2	20 =	0	(6b)
Number of intermittent fa	ns			, <u> </u>	3	x ′	10 =	30	(7a)
Number of passive vents	· · · · · · · · · · · · · · · · · · ·			F	0	x ²	10 =	0	(7b)
Number of flueless gas fi	res			_ [0	X 4	40 =	0	(7c)
-				L					
							Air ch	nanges per ho	our
•	ys, flues and fans = $(6a)+(6b)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6a)+(6b)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a$			[30		÷ (5) =	0.17	(8)
Number of storeys in the	peen carried out or is intended, procee he dwelling (ns)	ed to (17),	otnerwise (continue tr	om (9) to ((16)		0	(9)
Additional infiltration	ino direning (rie)					[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r masoni	y constr	uction			0	(11)
if both types of wall are pa deducting areas of openia	resent, use the value corresponding t	o the grea	ter wall are	a (after					
,	floor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
Percentage of windows	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	. ,	-			0	(15)
Infiltration rate			(8) + (10)					0	(16)
•	q50, expressed in cubic metro lity value, then $(18) = [(17) \div 20] + (18)$	•	•	•	etre of e	envelope	area	5	(17)
· ·	es if a pressurisation test has been do				is being u	sed		0.42	(18)
Number of sides sheltere			,	,	J			2	(19)
Shelter factor			(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorporat	•		(21) = (18) x (20) =				0.35	(21)
Infiltration rate modified f	- 1 	1	1 .		T _	T	I _	1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	 	1 00	1 0.7		1 40	1 45	1.7	1	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = $(22a)$ m = $(22a)$ m = $(22a)$ m = $(22a)$ m	2)m ÷ 4							_	
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltra	ation rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m						
0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.42]		
Calculate effect		•	rate for t	he appli	cable ca	se	•	•	•	•	•	<u>.</u>		٦,,,,
If mechanica If exhaust air he			andiv N. (2	2h) _ (22c) Em. (auation (VEVV otho	muiaa (22h) - (220))	(23a
If balanced with) = (23a))	(23b
		-	-	_					21.)	001.)	4 (00))	(23c
a) If balance	d mecha 0	anicai ve			at recove	- ` ` 	, ``	ŕ	 	23b) × [``) ÷ 100]]		(24a
			0	0	<u> </u>	0	0	0	0		0]		(24a
b) If balance	a mecna	anicai ve	ntilation	without	neat red	overy (r	0 (240	$\int_{0}^{\infty} \int_{0}^{\infty} dx = (22)$	2b)m + (. 0		0	1		(24b
` ′					<u> </u>					0]		(240
c) If whole ho if (22b)m				•	•				5 v (23h)				
(24c)m = 0	0.5 %	0	0	0	0	0	0	0	0	0	0	1		(240
d) If natural v						<u> </u>						J		•
if (22b)m				•	•				0.5]					
(24d)m= 0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59]		(24d
Effective air	change	rate - er	iter (24a) or (24k	o) or (24	c) or (24	d) in box	x (25)			•	_		
(25)m= 0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59]		(25)
2 Heat leases	مط امدید	ot loop i		o. W.								_		
3. Heat losses	and ne	·			Net Ar	00	U-valı	110	AXU		k-value	^	ΑX	/ lz
ELEMENT	area	_	Openin m		A,r		W/m2		(W/I	K)	kJ/m ² ·		kJ/l	
Doors					2	х	1		2	$\dot{\Box}$				(26)
Windows					11.20	5 x1	/[1/(1.4)+	0.04] =	14.86	=				(27)
Floor					71.88	8 X	0.13		9.3454	<u></u>		п г		(28)
Walls Type1	69.9	2	11.2	,	58.72	=	0.18	<u>-</u>	10.57	북 ;		╡╘		(29)
Walls Type2	22.3		2		20.33	=	0.18	<u>-</u>	3.66	륵 ;		=](29)
Total area of el						=	0.10		3.00	[_
* for windows and		,	iffective wi	ndow I I-vs	164.1		ı formula 1	/[(1/ ₋ valı	د 0.41 مداها	as aiven in	naragrani	h 3 2		(31)
** include the area						atoa aomg	, rormaia r	/[(10)10.04] 0	io givori iii	paragrapi	7 0.2		
Fabric heat los	s, W/K =	= S (A x	U)				(26)(30)) + (32) =				40	.43	(33)
Heat capacity (Cm = S(Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	901	4.32	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		25	 50	(35)
For design assess	ments wh	ere the de	tails of the	construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in T	able 1f	-		_
can be used instea						_								_
Thermal bridge	•	•			•	<						12	09	(36)
if details of therma Total fabric hea		are not kn	own (36) =	= 0.05 x (3	11)			(33) +	(36) =				<u></u>	(37)
		alculatos	l monthly					, ,		25\m v (5)	\	52	51	<u> </u>
Ventilation hea					lun	list	۸۰۰۰		= 0.33 × (i	1		
(38)m= 35.71	Feb 35.47	Mar 35.24	Apr 34.16	33.96	Jun 33.01	Jul 33.01	Aug 32.84	Sep 33.38	Oct 33.96	Nov 34.37	Dec 34.8	1		(38)
` '			UT. 10	55.50	1 00.01	00.01	02.04		<u> </u>	<u> </u>] 34.0	J		(55)
Heat transfer c			00.5=		0	0	0-5-		= (37) + (37)			1		
(39)m= 88.22	87.99	87.76	86.67	86.47	85.53	85.53	85.35	85.89	86.47	86.88	87.31	00	67	7(20)
								•	Average =	oum(39)₁	12 / 12=	86	10	(39)

Heat loss para	meter (l	HLP). W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.23	1.22	1.22	1.21	1.2	1.19	1.19	1.19	1.19	1.2	1.21	1.21		
(10)										Sum(40) ₁ .		1.21	(40)
Number of day	s in mo	nth (Tabl	le 1a)						go	J			(- /
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
` /						<u> </u>							
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occur if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	ΓFA -13.		29		(42)
Annual averag Reduce the annua									se target o		.61		(43)
not more that 125	litres per	person per	day (all w	ater use, l	hot and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	n litres per	day for ea	ch month	Vd,m = fa	ctor from T	Table 1c x	(43)			•			
(44)m= 97.47	93.93	90.39	86.84	83.3	79.75	79.75	83.3	86.84	90.39	93.93	97.47		
								_	Γotal = Su	m(44) ₁₁₂ =	=	1063.36	(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	m x nm x E	0Tm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 144.55	126.43	130.46	113.74	109.13	94.17	87.27	100.14	101.34	118.1	128.91	139.99		
						•		_	Γotal = Su	m(45) ₁₁₂ =	=	1394.23	(45)
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46)) to (61)			•		
(46)m= 21.68	18.96	19.57	17.06	16.37	14.13	13.09	15.02	15.2	17.71	19.34	21		(46)
Water storage				•	•	•							
Storage volum	e (litres)	includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	•			•			` '						
Otherwise if no		hot wate	er (this in	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage				!	(1-) (//	. /-1							(45)
a) If manufact				or is kno	wn (kvvr	n/day):				1.	39		(48)
Temperature fa										0.	54		(49)
Energy lost fro		_	-				(48) x (49)) =		0.	75		(50)
b) If manufactHot water stora			-										(E4)
If community h	-			C Z (KVV	ii/iiti e/ua	iy <i>)</i>					0		(51)
Volume factor	_		311 4.0								0		(52)
Temperature fa			2b							—	0		(53)
Energy lost fro				-ar			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (_	, 10 VIII/ y 0	Jui			(, (0.)	,	,		75		(55)
Water storage	, ,	,	or each	month			((56)m = (55) × (41)ı	m	<u> </u>			()
					00.50	i	,, , ,	, , ,			00.00		(FC)
(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	Sv 11	(56)
If cylinder contains	deulcale	u solai siol	rage, (57)	11 = (56)111	x [(50) – (п i i)] ÷ (э	o), eise (s	7)111 = (56)	m where (<u>г</u>	m Append	IX II	
(57)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Primary circuit	loss (ar	nual) fro	m Table	e 3							0		(58)
Primary circuit	•	•			59)m = ((58) ÷ 36	65 × (41)	m					
(modified by	factor f	rom Tabl	le H5 if t	here is s	solar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combiles of	ombi loss calculated for each month (61)m = (60) \div 365 \times (41)m												
(61)m= 0	liculated 0	for each	montn ((61)m =	(60) ÷ 30	05 × (41))m 0	T 0	0	0	0	1	(61)
				<u> </u>			<u> </u>		<u> </u>		ļ	[(50)m + (61)m	(01)
(62)m= 191.15		177.05	158.83	155.73	139.27	133.86	146.73		164.69	174	186.59	(59)m + (61)m]	(62)
Solar DHW input	<u> </u>	L		<u> </u>				_]	(02)
(add additiona									ii continbu	ion to wat	or ricating)		
(63)m= 0	0	0	0	0	0	0	0		0	0	0]	(63)
Output from w	ıater hea	ter		<u>I</u>							<u> </u>	ı	
(64)m= 191.15		177.05	158.83	155.73	139.27	133.86	146.73	146.43	164.69	174	186.59]	
	1	<u> </u>		<u>!</u>		!	Οι	itput from w	ater heate	r (annual)	112	1942.85	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	m] + 0.8 x	x [(46)m	+ (57)m	+ (59)m		-
(65)m= 85.34	75.71	80.65	73.89	73.56	67.39	66.29	70.57	69.77	76.54	78.94	83.82]	(65)
include (57)	m in cal	culation (of (65)m	only if c	ylinder i	s in the	dwelling	g or hot w	ater is f	rom com	munity h	neating	
5. Internal g	ains (see	e Table 5	and 5a):	-								
Metabolic gair	ns (Table	5). Wat	ts	,									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 114.55	114.55	114.55	114.55	114.55	114.55	114.55	114.55	114.55	114.55	114.55	114.55		(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5		-	-	-	
(67)m= 18.85	16.75	13.62	10.31	7.71	6.51	7.03	9.14	12.27	15.58	18.18	19.38		(67)
Appliances ga	ains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	so see Ta	ble 5	-	_	-	
(68)m= 201.66	203.76	198.48	187.26	173.08	159.77	150.87	148.77	154.05	165.27	179.45	192.76		(68)
Cooking gains	s (calcula	ited in A	ppendix	L, equat	ion L15	or L15a	, also	see Table	5	-	-		
(69)m= 34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46		(69)
Pumps and fa	ıns gains	(Table 5	āa)									_	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)							_	
(71)m= -91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64	-91.64		(71)
Water heating	gains (T	able 5)										_	
(72)m= 114.7	112.66	108.41	102.63	98.88	93.59	89.1	94.86	96.9	102.88	109.63	112.67		(72)
Total interna	l gains =	:			(66))m + (67)m	n + (68)m	n + (69)m +	(70)m + (7	'1)m + (72))m	_	
(73)m= 395.59	393.52	380.87	360.56	340.03	320.23	307.37	313.14	323.58	344.1	367.63	385.18		(73)
6. Solar gain													
Solar gains are		•				•	tions to		ne applical		tion.		
Orientation:	Access F Table 6d		Area m²		Flu Tal	ıx ble 6a		g_ Table 6b	Т	FF able 6c		Gains (W)	
Southeast 0.9x											_	. ,	7,77
Southeast 0.9x	0.77	X	11			36.79	X	0.63	×	0.7	=	126	(77)
Southeast 0.9x	0.77	×	11			52.67		0.63		0.7	=	214.62	(77)
Southeast 0.9x	0.77	X	11			35.75		0.63		0.7	=	293.65	(77)
Southeast 0.9x	0.77	X	11		-	06.25		0.63	×	0.7		363.85	(77)
Journeast (),9x	0.77	X	11	.2	x 1	19.01	X	0.63	x	0.7	=	407.54	(77)

Southeast 0.9x	0.77 ×	11	.2	x	118.15	X		0.63	x [0.7	=	404.59	(77)
Southeast 0.9x	0.77 ×	11	.2	x	113.91	X		0.63	x [0.7	=	390.07	(77)
Southeast 0.9x	0.77 ×	11	.2	x	104.39	X		0.63	x	0.7	=	357.47	(77)
Southeast 0.9x	0.77 ×	11	.2	x	92.85	X		0.63	x	0.7	=	317.96	(77)
Southeast 0.9x	0.77 ×	11	.2	x	69.27	X		0.63	x	0.7	=	237.2	(77)
Southeast 0.9x	0.77 ×	11	.2	x	44.07	X		0.63	x	0.7	=	150.91	(77)
Southeast 0.9x	0.77 ×	11	.2	x	31.49	X		0.63	x [0.7	=	107.83	(77)
Solar gains in wat	s, calculate	d for eac	h month	,	1	(83)m	n = S	um(74)m .	(82)m	,		1	
` '	1.62 293.65	363.85	407.54	404.5		357	7.47	317.96	237.2	150.91	107.83		(83)
Total gains – inter		·	<u>` </u>	·	-	1	1			1		Ī	(0.4)
(84)m= 521.58 60	3.14 674.52	724.41	747.57	724.8	2 697.44	670).61	641.54	581.3	518.54	493		(84)
7. Mean internal	emperature	(heating	season)									
Temperature dur	ng heating	periods i	n the livi	ng are	a from Ta	ble 9	, Th	1 (°C)				21	(85)
Utilisation factor	or gains for	living are	ea, h1,m	(see	Table 9a)					,		1	
Jan F	eb Mar	Apr	May	Jur	ı Jul	A	ug	Sep	Oct	Nov	Dec		
(86)m= 1 0.	99 0.98	0.94	0.86	0.7	0.53	0.5	57	0.8	0.95	0.99	1		(86)
Mean internal ter	nperature in	living ar	ea T1 (fo	ollow s	teps 3 to	7 in T	Γable	e 9c)		_			
(87)m= 19.77 19	.95 20.21	20.53	20.79	20.95	20.99	20.	.98	20.89	20.55	20.1	19.74		(87)
Temperature dur	ng heating	periods i	n rest of	dwelli	ng from Ta	able 9	9, TI	h2 (°C)					
(88)m= 19.9 19	0.9 19.9	19.92	19.92	19.93	19.93	19.	.93	19.92	19.92	19.91	19.91		(88)
Utilisation factor	or gains for	rest of d	wellina	h2 m (see Table	9a)				•		I	
	99 0.97	0.92	0.81	0.6	0.41	0.4	44	0.71	0.93	0.99	1	İ	(89)
Mean internal ter	noratura in	the rest	of dwall	ing T2	/follow st	one 3	2 to 7	Tin Tahl	0.00)			l .	
	.54 18.92	19.37	19.71	19.89	<u>`</u>	19.		19.84	19.42	18.77	18.24		(90)
` /		1	<u> </u>	<u> </u>		<u> </u>		f	LA = Livii	_l ng area ÷ (₄	1) =	0.46	(91)
Many intornal tor		41	منتاء مامد	II:\	fl A T4	. (4	£I	۸\ T O					
Mean internal ter (92)m= 18.97 19	19 19.51	19.9	20.21	20.38		+ (1		20.33	19.94	19.39	18.93	1	(92)
Apply adjustmen		1	<u> </u>	<u> </u>						19.59	10.93		(02)
· · · · · · · · · · · · · · · · · · · 	.19 19.51	19.9	20.21	20.38		20.		20.33	19.94	19.39	18.93		(93)
8. Space heating													
Set Ti to the mea	·		re obtair	ned at	step 11 of	f Tabl	le 9b	o, so tha	t Ti,m=	(76)m an	d re-calc	culate	
the utilisation fac								,	, 	` <i>'</i>		•	
	eb Mar	Apr	May	Jur	ı Jul	A	ug	Sep	Oct	Nov	Dec		
Utilisation factor			1	1				· ·				I	
` '	98 0.97	0.92	0.82	0.64	0.46	0.	.5	0.75	0.93	0.98	0.99		(94)
Useful gains, hm	``	1 ` ` ` 	 	107.4	4 004.00	Loop		470.00	540.50	T 540.00	400.00	1	(OE)
` '	3.26 651.27	666.81	614.78	467.1	4 321.92	336	0.05	478.98	542.58	510.26	489.98		(95)
Monthly average (96)m= 4.3 4	9 6.5	8.9	11.7	14.6	16.6	16	34	14.1	10.6	7.1	4.2	1	(96)
Heat loss rate for		<u> </u>								1 ""	7.4		(30)
(97)m= 1293.83 125			735.78	494.1		342		534.77	807.7	1067.35	1286.2		(97)
Space heating re										.1)m		1	
· 	2.86 364.94	206.47	90.03	0	0	(- 	0	197.25	401.1	592.39		
												1	

Space heating requirement in kWh/m²/year a. Energy requirements — Individual heating systems including micro-CHP) Space heating: Space heat from space heat from secondary/supplementary system Fraction of space heat from main system 1 (204) = (202) × (1 - (203)) =													_
3. Energy requirements — Individual heating systems including micro-CHP) Space heating: Fraction of space heat from secondary/supplementary system Fraction of space heat from main system 1 (204) = (202) × [1 - (203)] = 1 (205) = (206) × [100] × [100							Tota	l per year	(kWh/yeaı	r) = Sum(9	98) _{15,912} =	2872.65	(98)
Space Neating Fraction of space Neat from secondary/supplementary system	Space heating requirem	nent in	kWh/m²	/year								39.96	(99)
Fraction of space heat from secondary/supplementary system Fraction of space heat from main system(s) Fraction of total heating from main system 1 (202) = 1 - (201) =	9a. Energy requirements	– Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Fraction of space heat from main system (s) Fraction of total heating from main system 1 (202) = 1 - (201) =	Space heating:	fram a		/aunnla	monton	, avatam							7(204)
Color Colo	·				mentary	•	(202) – 1	(201) -					= ' '
Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Space heating requirement (calculated above) 577.6 442.86 364.94 206.47 90.03 0 0 0 0 197.25 401.1 592.39 211)m = {[(98)m x (204)] } x 100 ÷ (206) [177.6 473.65 390.31 220.83 96.28 0 0 0 0 0 210.96 428.99 633.67 Total (kWhyear) =Sum(211)_{.x.mg*} 3072.35 (211) Space heating fuel (secondary), kWh/month ([(98)m x (201)] } x 100 ÷ (208) [15]m 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	·		-	. ,			` '	, ,	(202)1 -				╡` ′
Efficiency of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec KWh/year Space heating requirement (calculated above) 577.6	_	•	-				(204) = (2	02) x [1 –	(203)] =				╡` ′
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec KWh/year	•					- 0/							╡` ′
Space heating requirement (calculated above) 577.6					-			1					
S77.6						Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
211 m = {	· -					0	0	n	197 25	401.1	592 39		
Space heating fuel (secondary), kWh/month Space heating fuel (secondary), kWh/month Space heating fuel (secondary), kWh/month Space heating fuel (secondary), kWh/month Space heating fuel (secondary), kWh/month Space heating fuel (secondary), kWh/month Space heating fuel (secondary), kWh/month Space heating fuel (secondary), kWh/month Space heating fuel (secondary), kWh/month Space heating fuel (secondary), kWh/month Space heating fuel (secondary), kWh/month Space heating fuel used							U		107.20	1 401.1	002.00		(244)
Total (kWh/year) = Sum(211), see_ v= 3072.35 (211)	· · · · · · · · · · · · · · · · · · ·				0	0	0	0	210.96	428.99	633.57		(211)
												3072.35	(211)
	Space heating fuel (sec	ondar	y), kWh/	month									
Total (kWh/year) = Sum(215) Laveep 0 (215)	,											-	
Vater heating Putput from water heater (calculated above) 191.15 168.51 177.05 158.83 155.73 139.27 133.86 146.73 146.43 164.69 174 186.59	(215)m= 0 0	0	0	0	0	0	_			_			
Authority from water heater (calculated above) 191.15							Tota	I (kWh/yea	ar) =Sum(2	215) _{15,101}	2=	0	(215)
191.15 168.51 177.05 158.83 155.73 139.27 133.86 146.73 146.43 164.69 174 186.59	Water heating	, ,											
(216) (217) (217) (217) (217) (217) (217) (219) (217) (219	· — — — —				139.27	133.86	146.73	146.43	164.69	174	186.59		
217) m			.00.00	.000		100.00			1 .000		1.00.00	79.8	(216)
219 m = (64 m x 100 ÷ (217)m 218.25 193.08 204.21 185.73 186.7 174.52 167.75 183.88 183.49 193.08 200.07 212.79 218.25 193.08 204.21 185.73 186.7 174.52 167.75 183.88 183.49 193.08 200.07 212.79 210.00 212.79 2303.56 (219) 2303.56 (85.51	83.41	79.8	79.8	79.8	79.8	85.3	86.97	87.68		(217)
218.25 193.08 204.21 185.73 186.7 174.52 167.75 183.88 183.49 193.08 200.07 212.79	Fuel for water heating, k	Wh/mc	onth									l	
Total = Sum(219a),12 = 2303.56 (219) kmnual totals kWh/year space heating fuel used, main system 1 3072.35 Vater heating fuel used 2303.56 Electricity for pumps, fans and electric keep-hot central heating pump: 30 (230c) boiler with a fan-assisted flue 45 (230c) fotal electricity for the above, kWh/year sum of (230a)(230g) = 75 (231) Electricity for lighting 332.99 (232) 12a. CO2 emissions – Individual heating systems including micro-CHP Energy Emission factor kg CO2/kWh kg CO2/year				100.7	474.50	107.75	100.00	400.40	T 400 00	000.07	040.70	İ	
Annual totals Space heating fuel used, main system 1 Water heating fuel used Selectricity for pumps, fans and electric keep-hot Scientral heating pump: Social electricity for the above, kWh/year Social electricity for the above, kWh/year Social electricity for lighting Social electricity for the above, kWh/year Social electricity for lighting Social ele	(219)m= 218.25 193.08 2	204.21	185.73	186.7	174.52	167.75				200.07	212.79	0000 50	7(040)
space heating fuel used, main system 1 Water heating fuel used Selectricity for pumps, fans and electric keep-hot central heating pump: Solid electricity for the above, kWh/year Selectricity for lighting	Annual totals						Tota	ii – Suiii(2		Mhhraa			` '
central heating pump: boiler with a fan-assisted flue otal electricity for the above, kWh/year sum of (230a)(230g) = flectricity for lighting 12a. CO2 emissions – Individual heating systems including micro-CHP The systems including micro-CHP Energy kWh/year Emission factor kg CO2/kWh kg CO2/kWh kg CO2/year		, main	system	1					K	vvii/yeai			<u>'</u>
central heating pump: boiler with a fan-assisted flue otal electricity for the above, kWh/year sum of (230a)(230g) = flectricity for lighting 12a. CO2 emissions – Individual heating systems including micro-CHP The systems including micro-CHP Energy kWh/year Emission factor kg CO2/kWh kg CO2/kWh kg CO2/year	Water heating fuel used											2303.56	Ħ
central heating pump: boiler with a fan-assisted flue fotal electricity for the above, kWh/year sum of (230a)(230g) = flectricity for lighting 12a. CO2 emissions – Individual heating systems including micro-CHP Energy kWh/year Energy kWh/year Energy kWh/year Kg CO2/kWh Kg CO2/year	_	s and	electric	keen-ho	t								
boiler with a fan-assisted flue otal electricity for the above, kWh/year electricity for lighting 12a. CO2 emissions – Individual heating systems including micro-CHP Energy kWh/year Energy kWh/year Energy kWh/year Energy kWh/year Energy kWh/year Energy kWh/year Energy kWh/year Energy kWh/year Energy kWh/year Energy kWh/year Energy kWh/year Energy kWh/year Energy kg CO2/kWh kg CO2/year		o ana	0.001.10	noop no	•						- 00	l	(2200
Total electricity for the above, kWh/year sum of (230a)(230g) = 75 (231) Electricity for lighting 332.99 (232) 12a. CO2 emissions – Individual heating systems including micro-CHP Energy kWh/year kg CO2/kWh Emissions kg CO2/year	. .										30		
Electricity for lighting 12a. CO2 emissions – Individual heating systems including micro-CHP Energy Emission factor kg CO2/kWh Emissions kg CO2/year										(230e —			
12a. CO2 emissions – Individual heating systems including micro-CHP Energy Emission factor kg CO2/kWh kg CO2/year	I otal electricity for the above, kWh/year sum of (230a)(230g) =							75	(231)				
Energy Emission factor Emissions kWh/year kg CO2/kWh kg CO2/year	Electricity for lighting								332.99	(232)			
kWh/year kg CO2/kWh kg CO2/year	12a. CO2 emissions – I	ndivid	ual heati	ng syste	ems inclu	uding mi	cro-CHP)					
pace heating (main system 1) (211) \times 0.216 = 663.63 (261)													
1 0,210 1 1 000.00 1(201)	Space heating (main sys	item 1))		(21	1) x			0.2	16	=	663.63	(261)

Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	497.57 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1161.2 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	172.82 (268)
Total CO2, kg/year	sum	of (265)(271) =	1372.94 (272)

TER = 19.1 (273)