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 14:53:41

Project Information:

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

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 63.82m² Plot Reference: Site Reference : Hermitage Lane Plot 45

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))

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

Dwelling Carbon Dioxide Emission Rate (DER) 12.97 kg/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 43.6 kWh/m²

OK

2 Fabric U-values

Element Average Highest External wall 0.14 (max. 0.30) 0.15 (max. 0.70) OK Floor (no floor) Roof 0.10 (max. 0.20) OK 0.10 (max. 0.35)

1.40 (max. 3.30)

2a Thermal bridging

Openings

Thermal bridging calculated from linear thermal transmittances for each junction

1.40 (max. 2.00)

3 Air permeability

Air permeability at 50 pascals 3.00 (design value)

OK Maximum 10.0

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

programmer and at least two room thermostats

Hot water controls: No cylinder thermostat

No cylinder

OK

OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK
8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	0.91	
Maximum	1.5	OK
MVHR efficiency:	93%	
Minimum	70%	OK
9 Summertime temperature		
Overheating risk (Thames valley):	Slight	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: South West	1.7m²	
Windows facing: North West	6.1m²	
Ventilation rate:	4.00	
10 Key features		
Air permeablility	3.0 m ³ /m²h	
Roofs U-value	0.1 W/m²K	
External Walls U-value	0.13 W/m²K	
Community heating, heat from boilers – mains gas	0.10 W/IIITK	
Photovoltaic array		
i notovoitale array		

		هءا ا	r Details:						
Assessor Name:	Zahid Ashraf	030	Strom	a Nium	bor		STDO	001082	
Software Name:	Stroma FSAP 2012	2	Softwa	on: 1.0.5.9					
		Proper	ty Address:	Plot 45					
Address :									
Overall dwelling dime	ensions:				A I I .	last (Cost)) / - l	
Ground floor		A	rea(m²) 63.82	(1a) x		ight(m) 2.5	(2a) =	Volume(m³	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)	 + (1n) ☐		(4)]` ''	100.00	
Dwelling volume	a) · (· a) · (· a) · (· a) · (· a)	(,	03.02)+(3c)+(3c	d)+(3e)+	.(3n) =	150.56	(5)
				(54) (55)	, , (00) , (00	., (66)	.(0)	159.56	(5)
2. Ventilation rate:		condary	other		total			m³ per hou	r
Number of chimneys	heating he	eating +	0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0 +	0]	0	x 2	20 =	0	(6b)
Number of intermittent fa				J L	0	x	10 =	0	(7a)
Number of passive vents				L	0	x	10 =	0	(7b)
Number of flueless gas fi				F	0	x 4	40 =	0	(7c)
realiser of fluciess gas in				L	0			0	(/'C)
							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	d, 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)
	.25 for steel or timber fr	ame or 0.35	for masonr	y constr	uction	[(0)]	1]XO.1 =	0	(11)
	resent, use the value corresp	onding to the gr	eater wall are	a (after					` ′
deducting areas of openia	ngs); if equal user 0.35 floor, enter 0.2 (unseale	nd) or 0.1 (se	aled) else	enter ()				0	(12)
If no draught lobby, en	•	0.1 (30	aica), cisc	Critici o				0	(13)
• •	s and doors draught str	ipped					-	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 cubi	•	•	•	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	been done or a	degree air pe	meability	is being u	sed		2	(19)
Shelter factor	,		(20) = 1 -	0.075 x (1	19)] =			0.78	(20)
Infiltration rate incorporate	ting shelter factor		(21) = (18)	x (20) =				0.12	(21)
Infiltration rate modified f	or monthly wind speed								
Jan Feb	Mar Apr May	Jun Ju	l Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	eed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2.	2)m ÷ 4								
	1.23 1.1 1.08	0.95 0.95	0.92	1	1.08	1.12	1.18		
			•		•	•	•	•	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calculate effect If mechanication		•	ate for t	пе арріі	саріе са	se						0.5	(23a)
If exhaust air h	eat pump	using Appe	endix N, (2	3b) = (23a	ı) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0.5	(23b)
If balanced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				79.05	(23c)
a) If balance	ed mech	anical ve	ntilation	with hea	at recove	ery (MVI	HR) (24a	n)m = (22	2b)m + (23b) × [1 – (23c)	÷ 100]	_
(24a)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24		(24a)
b) If balance	ed mech	anical ve	ntilation	without	heat rec	covery (N	/IV) (24b)m = (22	2b)m + (23b)		_	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h if (22b)n				•	-				.5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural if (22b)n									0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air	change	rate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)				,	
(25)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24		(25)
3. Heat losse	s and he	eat loss p	paramete	er:									
ELEMENT	Gros		Openin		Net Ar		U-val		AXU		k-value		X k
Danie	area	(m²)	m	l ²	A ,r		W/m2	K — r	(W/	K)	kJ/m²-l	K kJ	
Doors					2	×	1.4	= [2.8	╡			(26)
Windows Type					1.696	_	/[1/(1.4)+	L	2.25	_			(27)
Windows Type					6.097	′ x¹	/[1/(1.4)+	0.04] = [8.08	ᆗ ,			(27)
Walls Type1	20.3	_	7.79	_	12.58	3 ×	0.15	=	1.89	ᆜ !			(29)
Walls Type2	28.	_	2	_	26.8	×	0.14	=	3.79	ᆜ !			(29)
Walls Type3	18.1		0	_	18.13	=	0.13	=	2.4	ᆜ !			(29)
Roof	63.8		0		63.82	_	0.1	=	6.38				(30)
Total area of e					131.1		. (15/4/11) 0.047			. 0.0	(31)
* for windows and ** include the area						ated using	tormula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragrapr	1 3.2	
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				27.59	(33)
Heat capacity	Cm = S((Axk)						((28)	(30) + (32	2) + (32a).	(32e) =	1379.58	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	kJ/m²K			Indica	tive Value	: Low		100	(35)
For design assess can be used inste				construct	ion are not	t known pr	ecisely the	indicative	e values of	TMP in Ta	able 1f		
Thermal bridge	es : S (L	x Y) cal	culated ı	using Ap	pendix ł	<						13.69	(36)
if details of therma Total fabric he		are not kn	own (36) =	= 0.05 x (3	1)			(33) +	(36) =			41.28	(37)
Ventilation hea	at loss ca	alculated	monthly	/				(38)m	= 0.33 × ((25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 13.32	13.17	13.01	12.25	12.1	11.33	11.33	11.18	11.64	12.1	12.4	12.71		(38)
Heat transfer of	coefficie	nt, W/K						(39)m	= (37) + (38)m		_	
(39)m= 54.59	54.44	54.29	53.52	53.37	52.61	52.61	52.45	52.91	53.37	53.68	53.98		_
								,	Average =	Sum(39) ₁	12 /12=	53.49	(39)

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.86	0.85	0.85	0.84	0.84	0.82	0.82	0.82	0.83	0.84	0.84	0.85		
		!							Average =	Sum(40) ₁	12 /12=	0.84	(40)
Number of day	<u> </u>	<u> </u>	le 1a)		<u> </u>			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	irement:								kWh/ye	ear:	
Assumed occurring TFA > 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	TFA -13		09		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the a	lwelling is	designed i			se target o		.19		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i								1 225		1			
(44)m= 97	93.48	89.95	86.42	82.89	79.37	79.37	82.89	86.42	89.95	93.48	97		
. ,	!	!				<u> </u>	ļ		I Total = Su	M(44) ₁₁₂ =		1058.22	(44)
Energy content of	f hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 143.85	125.82	129.83	113.19	108.61	93.72	86.85	99.66	100.85	117.53	128.29	139.31		
									Total = Su	m(45) ₁₁₂ =		1387.5	(45)
If instantaneous v	vater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	to (61)					
(46)m= 21.58	18.87	19.47	16.98	16.29	14.06	13.03	14.95	15.13	17.63	19.24	20.9		(46)
Water storage Storage volum		\ includir	na anv sa	alar or M	WHRS	etorana	within es	ama vas	امء		0		(47)
If community h	,					•		airio voo	001		0		(47)
Otherwise if no	-			-			, ,	ers) ente	er '0' in ((47)			
Water storage			`					,	`	,			
a) If manufact	turer's d	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro		•					(48) x (49)) =		1	10		(50)
b) If manufact			-										
Hot water stor If community h	-			e 2 (KVV	n/litre/da	ay)				0.	02		(51)
Volume factor	•		011 4.3							1	03		(52)
Temperature f			2b							-	.6		(53)
Energy lost fro				ear			(47) x (51)) x (52) x (53) =		03		(54)
Enter (50) or		_	,,					, , , ,	,		03		(55)
Water storage	loss cal	culated t	for each	month			((56)m = ((55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain												ix H	()
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
	<u> </u>				1 00.00	1 02.01	1 02.01	1 50.00	1 02.01				, ,
Primary circuit	`	,			E0\	(EQ) + QC	SE /44\				0		(58)
Primary circuit (modified by				,	•	` '	, ,		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)
(00)111- 20.20	21.01	20.20	22.01	20.20	22.01	20.20	20.20	22.01	20.20	22.01	20.20		(00)

Combi loss cald	sulated t	for each	month ((61)m –	(60) ·	365 v (41)m						
(61)m= 0	0	0	0	0 0	00) +	0	0	0	0	Ιο	0	1	(61)
Total heat requi		-									<u> </u>	[.(50)m + (61)m	(- /
	175.74	185.11	166.68	163.88	147.2		154.93		172.8	181.78	194.59]	(62)
Solar DHW input ca						_				1		J	(-)
(add additional									· continua	non to wat	or riodiirig)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(63)
Output from wa	ter heat	ter						Į.	<u>!</u>	1	<u> </u>	J	
· —	175.74	185.11	166.68	163.88	147.2	1 142.12	154.93	154.34	172.8	181.78	194.59]	
LL	!			l .			Ou	tput from w	ater heate	er (annual)	112	2038.34	(64)
Heat gains from	water	heating,	kWh/m	onth 0.2	5 ′ [0.8	35 × (45)m	n + (61)	m] + 0.8 x	k [(46)m	+ (57)m	+ (59)m]	-
(65)m= 92.05	81.78	87.39	80.43	80.33	73.96		77.36	76.33	83.3	85.45	90.54]	(65)
include (57)m	n in calc	ulation o	of (65)m	only if c	ylinde	r is in the	dwelling	or hot w	ater is f	rom com	munity h	neating	
5. Internal gai					•						•		
Metabolic gains	,												
Jan	Feb	Mar	Apr	May	Jur	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m= 104.37	104.37	104.37	104.37	104.37	104.3	7 104.37	104.37	104.37	104.37	104.37	104.37	1	(66)
Lighting gains (calculat	ed in Ap	pendix	L, equat	on L9	or L9a), a	ılso see	Table 5				•	
(67)m= 17.99	15.98	12.99	9.84	7.35	6.21	6.71	8.72	11.7	14.86	17.34	18.49]	(67)
Appliances gain	ns (calcı	ulated in	Append	dix L, eq	uation	L13 or L1	3a), als	o see Ta	ble 5	•		•	
(68)m= 182.48	184.37	179.6	169.44	156.62	144.5	6 136.51	134.62	139.39	149.55	162.37	174.42]	(68)
Cooking gains (calcula	ted in A	pendix	L, equat	ion L1	5 or L15a), also s	ee Table	5	!		•	
(69)m= 33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44]	(69)
Pumps and fans	s gains	(Table 5	Ба)			•	•	•	•	•	•	•	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(70)
Losses e.g. eva	poratio	n (negat	ive valu	es) (Tab	le 5)	•		•	•	•		•	
(71)m= -83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5]	(71)
Water heating g	gains (T	able 5)						•	•	•		•	
(72)m= 123.73	121.69	117.46	111.71	107.98	102.7	2 98.25	103.97	106.01	111.96	118.68	121.7]	(72)
Total internal g	gains =				(66)m + (67)n	n + (68)m	+ (69)m +	(70)m + (7	71)m + (72))m	•	
(73)m= 378.5	376.35	364.36	345.3	326.26	307.8	295.78	301.62	311.41	330.68	352.71	368.92]	(73)
6. Solar gains:						•			•	•			
Solar gains are ca	alculated u	using sola	r flux from	Table 6a	and ass	ociated equa	ations to o	onvert to th	ne applica	ble orienta	tion.		
Orientation: Ac		actor	Area			lux		g_ 	-	FF		Gains	
	able 6d		m²		!	able 6a	_	Table 6b	_ '	able 6c		(W)	_
Southwest _{0.9x}	0.77	X	1.	7	X	36.79		0.63	X	0.7	=	19.07	(79)
Southwest _{0.9x}	0.77	X	1.	7	X	62.67		0.63	X	0.7	=	32.48	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	85.75] [0.63	x	0.7	=	44.45	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	106.25		0.63	x	0.7	=	55.07	(79)
Southwest _{0.9x}	0.77	X	1.	7	X	119.01		0.63	X	0.7	=	61.69	(79)

		_							_				_
Southwest _{0.9x}	0.77	X	1.	7	x	118.15]	0.63	X	0.7	=	61.24	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	113.91		0.63	X	0.7	=	59.04	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	104.39		0.63	X	0.7	=	54.11	(79)
Southwest _{0.9x}	0.77	X	1.	7	X	92.85]	0.63	X	0.7	=	48.13	(79)
Southwest _{0.9x}	0.77	x	1.	7	x	69.27]	0.63	x	0.7	=	35.9	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	44.07		0.63	X	0.7		22.84	(79)
Southwest _{0.9x}	0.77	x	1.	7	x	31.49		0.63	x	0.7	=	16.32	(79)
Northwest _{0.9x}	0.77	x	6.	1	x	11.28	x	0.63	X	0.7	=	21.02	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	22.97	x	0.63	X	0.7	=	42.79	(81)
Northwest 0.9x	0.77	x	6.	1	x	41.38	x	0.63	x	0.7	=	77.1	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	67.96	x	0.63	X	0.7	=	126.62	(81)
Northwest _{0.9x}	0.77	×	6.	1	x	91.35	x	0.63	x	0.7	=	170.21	(81)
Northwest _{0.9x}	0.77	×	6.	1	x	97.38	x	0.63	x	0.7	=	181.46	(81)
Northwest _{0.9x}	0.77	×	6.	1	x	91.1	x	0.63	x	0.7		169.75	(81)
Northwest _{0.9x}	0.77	×	6.	1	x	72.63	x	0.63	x	0.7		135.33	(81)
Northwest 0.9x	0.77	×	6.	1	х	50.42	x	0.63	x	0.7	=	93.95	(81)
Northwest 0.9x	0.77	×	6.	1	x	28.07	х	0.63	x	0.7	=	52.3	(81)
Northwest _{0.9x}	0.77	×	6.	1	x	14.2	x	0.63	х	0.7	=	26.45	(81)
Northwest 0.9x	0.77	×	6.	1	x	9.21	x	0.63	x	0.7	<u> </u>	17.17	(81)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m													
(83)m= 40.09	75.28 12	21.55	181.7	231.89	242.7	228.79	189	.43 142.08	88.2	49.3	33.49		(83)
Total gains – i	nternal and	solar	(84)m =	= (73)m	+ (83)r	n , watts		<u> </u>				•	
(84)m= 418.6	451.63 48	35.91	526.99	558.15	550.5	524.57	491	.06 453.49	418.88	3 402	402.41		(84)
7. Mean inter	nal tempera	ature	(heating	season	1)								
Temperature	during hea	ting p	eriods ir	n the livi	ng are	a from Ta	ble 9,	, Th1 (°C)				21	(85)
Utilisation fac	ctor for gain	s for I	iving are	ea, h1,m	(see	Γable 9a)							_
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug Sep	Oct	Nov	Dec		
(86)m= 0.95	0.94	0.9	0.83	0.72	0.56	0.42	0.4	0.68	0.86	0.93	0.96		(86)
Mean interna	ıl temperatu	re in l	living are	ea T1 (fo	ollow s	teps 3 to	7 in T	able 9c)					
(87)m= 19.4	19.59 1	9.91	20.35	20.7	20.9	20.97	20.9	96 20.81	20.38	19.83	19.37		(87)
Temperature	during hea	tina p	eriods ir	n rest of	dwellir	na from Ta	able 9	9. Th2 (°C)		-		•	
(88)m= 20.21		0.21	20.22	20.22	20.23	-	20.2	· · · ·	20.22	20.22	20.21		(88)
Utilisation fac	tor for gain	e for r	est of d	welling	h2 m (saa Tahla	02)						
(89)m= 0.95).89	0.81	0.68	0.5	0.36	0.4	4 0.62	0.83	0.92	0.95		(89)
` ′	<u>l</u>			<u> </u>				<u> </u>		1 0.02	0.00		, ,
Mean interna	ıl temperatu	re in t		19.88	ing 12 20.14	<u>` </u>	eps 3	to 7 in Tabl		10.60	18.01		(90)
	10 22 1	o 70						.2 20.04	19.47	18.69	10.01		(30)
(90)m= 18.05	18.32 1	8.79	19.4	19.00	20.14	20.21	1 20.		IA = Ii	ing area ∸ (ļ	0.51	(01)
(90)m= 18.05	<u> </u>	ļ		l	!		Į.	f	LA = Liv	ving area ÷ (ļ	0.51	(91)
(90)m= 18.05 Mean interna	l temperatu	re (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1	– fLA) × T2			4) =	0.51	
(90)m= 18.05	ıl temperatu	re (fo 9.36	r the wh	ole dwe	elling) =	fLA × T1	+ (1	fLA) × T2 59 20.43	19.93	19.27	ļ	0.51	(91)

												1	
(93)m= 18.73	18.96	19.36	19.88	20.29	20.53	20.59	20.59	20.43	19.93	19.27	18.69		(93)
8. Space hea													
Set Ti to the the utilisation			•		ned at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fac	l		<u> </u>	iviay	Our	Oui	//ug	ОСР	001	1101	DCO		
(94)m= 0.93	0.91	0.88	0.8	0.68	0.52	0.39	0.43	0.64	0.82	0.91	0.94		(94)
Useful gains,	hmGm	, W = (9	4)m x (8	4)m									
(95)m= 390.04	412.53	426	422.72	381.28	288.35	203.55	210.4	289.49	345.16	364.43	377.43		(95)
Monthly aver	age exte	rnal tem	perature	from T	able 8								
(96)m= 4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate		i	· ·		ì		- ` 	– (96)m				ı	
(97)m= 787.89	765.31	698.01	587.71	458.47	311.79	210.15	219.55	334.97	497.96	653.04	782.43		(97)
Space heatin		1	ı							·			
(98)m= 296.01	237.07	202.38	118.79	57.43	0	0	0	0	113.69	207.8	301.32		7 (20)
							Tota	l per year	(kWh/yeaı) = Sum(9	8) _{15,912} =	1534.48	(98)
Space heatin	g require	ement in	kWh/m²	/year								24.04	(99)
9b. Energy red	quiremer	nts – Coi	mmunity	heating	scheme	!							
This part is us										unity sch	neme.		– ,
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none											0	(301)	
Fraction of spa	ace heat	from co	mmunity	system	1 – (30	1) =						1	(302)
The community so									up to four	other heat	sources; tl	he latter	
includes boilers, here		-			rom powe	r stations.	See Appei	ndix C.			i	1	(303a)
			-		. 11				(0	02) x (303	. I		╡`
Fraction of total	·			•			. 11	<i></i>	•	a) = 	1	(304a)	
Factor for conf				,	` ''		•	iting sys	tem			1	(305)
Distribution los	ss factor	(Table 1	12c) for o	commun	ity heatii	ng syste	m					1.05	(306)
Space heating	g											kWh/yea	<u>r</u>
Annual space	heating	requiren	nent									1534.48	
Space heat fro	m Com	munity b	oilers					(98) x (30	04a) x (30	5) x (306) :	=	1611.2	(307a)
Efficiency of se	econdar	y/supple	mentary	heating	system	in % (fro	om Table	4a or A	ppendix	E)		0	(308
Space heating	require	ment fro	m secon	dary/suլ	oplemen	tary sys	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water heating	1												
Annual water		equirem	ent									2038.34	\neg
If DHW from c											·		_
Water heat fro	m Comr	nunity bo	oilers					(64) x (30)3a) x (30	5) x (306) :	=	2140.25	(310a)
Electricity used for heat distribution 0								× [(307a).	(307e) +	(310a)((310e)] =	37.51	(313)
Cooling System	m Energ	y Efficie	ncy Rati	0								0	(314)
Space cooling	(if there	is a fixe	d coolin	g systen	n, if not e	enter 0)		= (107) ÷	(314) =			0	(315)
Electricity for p											ı		–
mechanical ve	ntilation	- baland	ed, extr	act or po	sitive in	out from	outside					221.43	(330a)

warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330	b) + (330g) =		221.43	(331)
Energy for lighting (calculated in Appendix L)				317.66	(332)
Electricity generated by PVs (Appendix M) (negative quantity	y)			-642.21	(333)
Electricity generated by wind turbine (Appendix M) (negative	e quantity)		Ī	0	(334)
12b. CO2 Emissions – Community heating scheme					
	Energy kWh/year	Emission facto		missions g CO2/year	
CO2 from other sources of space and water heating (not CH Efficiency of heat source 1 (%)	IP) using two fuels repeat (363) to	(366) for the second t	fuel	94	(367a)
CO2 associated with heat source 1 [(30)	7b)+(310b)] x 100 ÷ (367b) x	0.22	=	862.04	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	19.47	(372)
Total CO2 associated with community systems	(363)(366) + (368)(372	2)	=	881.51	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instant	aneous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			881.51	(376)
CO2 associated with electricity for pumps and fans within dw	velling (331)) x	0.52	=	114.92	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	164.87	(379)
Energy saving/generation technologies (333) to (334) as applitem 1	olicable	0.52 x 0.01	= [-333.31	(380)
Total CO2, kg/year sum of (376)(382) =				827.99	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =			Ē	12.97	(384)

El rating (section 14)

SAP 2012 Overheating Assessment

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

Property Details: Plot 45

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: No Number of storeys: 1

Front of dwelling faces: North East

Overshading: Average or unknown

Overhangs: None

Thermal mass parameter: Indicative Value Low

Night ventilation: False

Blinds, curtains, shutters:

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

Overheating Details:

Summer ventilation heat loss coefficient: 210.62 (P1)

Transmission heat loss coefficient: 41.3

Summer heat loss coefficient: 251.89 (P2)

Overhangs:

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

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

Solar shading:

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

Solar gains:

Orientation		Area	Flux	g _	FF	Shading	Gains
South West (SW)	0.9 x	1.7	119.92	0.63	0.7	0.9	72.65
North West (NW)	0.9 x	6.1	98.85	0.63	0.7	0.9	215.28
						Total	287.93 (P3/P4)

Internal gains.

	June	July	August	
Internal gains	425.36	410.13	418.06	
Total summer gains	734.03	698.06	661.95 (P5)	
Summer gain/loss ratio	2.91	2.77	2.63 (P6)	
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	1.3	1.3	1.3	
Threshold temperature	20.21	21.97	21.73 (P7)	
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

User Details:	
Assessor Name: Zahid Ashraf Stroma Number: STRO001 Software Name: Stroma FSAP 2012 Software Version: 1	
Property Address: Plot 45 Address:	
1. Overall dwelling dimensions:	
Š	olume(m³)
Ground floor 63.82 (1a) x 2.5 (2a) =	159.56 (3a)
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 63.82 (4)	
Dwelling volume $(3a)+(3b)+(3c)+(3d)+(3e)+(3n) =$	159.56 (5)
2. Ventilation rate:	
main secondary other total m heating heating	³ per hour
Number of chimneys $0 + 0 + 0 = 0 \times 40 =$	0 (6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 =$	0 (6b)
Number of intermittent fans 2 x 10 =	20 (7a)
Number of passive vents 0 x 10 =	0 (7b)
Number of flueless gas fires 0 x 40 =	0 (7c)
Air chang	es per hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7c)=$ 20 $\div (5) =$	0.13 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns)	0 (9)
Additional infiltration [(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction	0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35	
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0	0 (12)
If no draught lobby, enter 0.05, else enter 0	0 (13)
Percentage of windows and doors draught stripped	0 (14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] =$	0 (15)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) =$	0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area	3 (17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used	0.28 (18)
Number of sides sheltered	3 (19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.78 (20)
Infiltration rate incorporating shelter factor (21) = (18) x (20) =	0.21 (21)
Infiltration rate modified for monthly wind speed	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Monthly average wind speed from Table 7	
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7	
Mind Foster (22a) (22) (22)	
Wind Factor $(22a)m = (22)m \div 4$	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25		
Calculate effe		-	rate for t	he appli	cable ca	se							
If mechanic			om alive NL (O	ah) (00-	· \		\) (00-)			0	(23
If exhaust air h) = (23a)			0	(23
If balanced with		-	-	_								0	(23
a) If balance	i							ŕ	 	- 	' '	÷ 100] I	(24
(24a)m= 0	0		0	0	0	0	0	0	0	0	0		(24
b) If balance	i				i	 	<u> </u>	i i	· ·	· ·		I	(24)
(24b)m= 0	0	0	0	0		0	0	0	0	0	0		(24)
c) If whole h					•		on from c c) = (22k		5 v (23h	<i>\</i>)			
$\frac{11(220)1}{(24c)m=0}$	0.5 7	0	0	0	0	0	0	0	0	0	0		(24
d) If natural			·										
,				•			0.5 + [(2		0.5]				
(24d)m= 0.54	0.54	0.53	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53		(240
Effective air	change	rate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)	•	•	•	•	
(25)m= 0.54	0.54	0.53	0.53	0.53	0.52	0.52	0.52	0.52	0.53	0.53	0.53		(25)
2 Heat lease	o ond be	est logo r	oromot	0.51			•						
3. Heat losse					Net Ar	00	U-valı	10	AXU		k-value	` /	λΧk
ELEMENT	Gros area		Openin m		A,r		W/m2		(W/	K)	kJ/m²-l		J/K
Doors					2	X	1.4		2.8				(26)
Windows Type	e 1				1.696	x1	/[1/(1.4)+	0.04] =	2.25	Ħ			(27)
Windows Type	2				6.097		/[1/(1.4)+	0.04] =	8.08	=			(27)
Walls Type1	20.3	18	7.79		12.58		0.15		1.89	=			(29)
Walls Type2	28.8		2		26.8		0.14	-	3.79	=		7	(29)
Walls Type3	18.1	_	0	=	18.13	=	0.13	╡ :	2.4	=			(29)
Roof	63.8	=		=	63.82	=	0.13	╡ [6.38	믁 ¦			(30)
Total area of e						_	0.1		0.30	[``
* for windows and		•	effective wi	ndow H-vs	131.1		r formula 1	/[(1/ ₋ \/2	ارم ۱۸۵ مرام	e aiven in	naragrant	. 2 2	(31)
** include the area						ateu using	i Torritula 1	/[(16)+0.0+j c	is given in	paragrapi	1 3.2	
Fabric heat los	ss, W/K :	= S (A x	U)				(26)(30)	+ (32) =				27.59	(33)
Heat capacity	Cm = S((Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	1379.58	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35)
For design asses				construct	ion are no	t known pi	ecisely the	indicative	values of	TMP in T	able 1f		
can be used inste					ا دائلہ میں ا	,							<u> </u>
Thermal bridg	•	,			•	`						13.69	(36)
if details of therma Total fabric he		are not kn	OWII (30) =	= 0.05 X (3	1)			(33) +	(36) =			41.28	(37)
Ventilation hea		alculated	l monthly	/					= 0.33 × (25)m x (5)	41.20	(0.
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 28.28	28.2	28.13	27.78	27.71	27.41	27.41	27.35	27.53	27.71	27.84	27.98		(38)
Heat transfer	<u> </u>				I	<u> </u>	!	<u> </u>	= (37) + (<u> </u>	Į.	I	
i ioai iiaiisibi (it, VV/IX						(33)111	- (01) + (00/111			
(39)m= 69.55	69.48	69.4	69.05	68.99	68.68	68.68	68.63	68.8	68.99	69.12	69.26		

Heat loss para	meter (l	HLP). W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.09	1.09	1.09	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.09		
` /						<u> </u>	<u> </u>		L Average =	Sum(40) ₁ .	12 /12=	1.08	(40)
Number of day	s in mo	nth (Tabl	e 1a)							, ,			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing one	rav regui	romont:								kWh/ye	aar:	
4. Water Heat	ing ene	igy requi	rement.								KVVII/ye	tai.	
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		09		(42)
Annual averag Reduce the annua not more that 125	ıl average	hot water	usage by	5% if the a	lwelling is	designed t			se target o		.19	ı	(43)
			- '		lot and co	·	1	1		ı		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	l	
Hot water usage in	n litres pei	day for ea	cn montn	Va,m = ta	ctor from	able 1c x	(43)					ı	
(44)m= 97	93.48	89.95	86.42	82.89	79.37	79.37	82.89	86.42	89.95	93.48	97		_
Energy content of	hot water	used - cal	culated ma	onthly – 1	100 v Vd r	n v nm v Γ	Tm / 3600			m(44) ₁₁₂ =		1058.22	(44)
(45)m= 143.85	125.82	129.83	113.19	108.61	93.72	86.85	99.66	100.85	117.53	128.29	139.31		— (45)
If instantaneous w	ater heati	na at noint	of use (no	hot water	· storage)	enter () in	hoves (46		Total = Su	m(45) ₁₁₂ =	=	1387.5	(45)
						1				T .			(40)
(46)m= 0 Water storage	0	0	0	0	0	0	0	0	0	0	0	I	(46)
Storage volum		includin	a anv sa	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community h	` '					Ū					<u> </u>		()
Otherwise if no	-			•			' '	ers) ente	er '0' in <i>(</i>	(47)			
Water storage			(-					, ,		,			
a) If manufact	urer's d	eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature fa	actor fro	m Table	2b								0		(49)
Energy lost fro	m watei	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
b) If manufact		_	-		or is not	known:							()
Hot water stora	_			e 2 (kWl	h/litre/da	ay)					0		(51)
If community h	•		on 4.3									1	
Volume factor			O.								0		(52)
Temperature fa											0	l •	(53)
Energy lost fro		•	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (,									0	I	(55)
Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)ı	m 				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nual) fro	m Table	e 3							0	J	(58)
Primary circuit				•	•	. ,	, ,						
(modified by	factor f	rom Tabl	e H5 if t	here is s	olar wat	ter heatii	ng and a	cylinde	r thermo	stat)		1	
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss calculated	for each	month (61)m =	(60) <u>+</u> 3	65 v (41)m						
(61)m= 0 0	0	0	0	00) . 0	00 × (+1)) o	T 0	0	0	0	1	(61)
Total heat required for	water he	eating ca	alculated	l for eac	h month			<u> </u>	<u> </u>	ļ] · (59)m + (61)m	, ,
(62)m= 122.28 106.94	110.36	96.21	92.32	79.66	73.82	84.71	<u> </u>	99.9	109.05	118.42]	(62)
Solar DHW input calculated	using App	endix G or	Appendix	L H (negati	ive quantity	/) (enter	'0' if no sola	r contribu	tion to wate	er heating)	1	
(add additional lines if										0,		
(63)m= 0 0	0	0	0	0	0	0	0	0	0	0]	(63)
Output from water hea	ater				!	•	•			!	•	
(64)m= 122.28 106.94	110.36	96.21	92.32	79.66	73.82	84.71	85.72	99.9	109.05	118.42]	
				<u> </u>		0	utput from w	ater heate	er (annual)	112	1179.37	(64)
Heat gains from water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61	m] + 0.8 x	([(46)m	+ (57)m	+ (59)m	n]	
(65)m= 30.57 26.74	27.59	24.05	23.08	19.92	18.45	21.18	21.43	24.97	27.26	29.6]	(65)
include (57)m in cal	culation o	of (65)m	only if c	ylinder i	s in the	dwellin	g or hot w	ater is f	rom com	munity h	neating	
5. Internal gains (se	e Table 5	and 5a):									
Metabolic gains (Table	e 5). Wat	s										
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m= 104.37 104.37	104.37	104.37	104.37	104.37	104.37	104.3	7 104.37	104.37	104.37	104.37	1	(66)
Lighting gains (calcula	ited in Ap	pendix l	L, equat	ion L9 o	r L9a), a	lso se	e Table 5				•	
(67)m= 17.99 15.98	12.99	9.84	7.35	6.21	6.71	8.72	11.7	14.86	17.34	18.49]	(67)
Appliances gains (calc	culated in	Append	dix L, eq	uation L	13 or L1	3a), al	so see Ta	ble 5		•	•	
(68)m= 182.48 184.37	179.6	169.44	156.62	144.56	136.51	134.6	2 139.39	149.55	162.37	174.42]	(68)
Cooking gains (calcula	ated in Ap	pendix	L, equat	ion L15	or L15a), also	see Table	5		-	•	
(69)m= 33.44 33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44]	(69)
Pumps and fans gains	(Table 5	ia)			-		-			-	-	
(70)m= 0 0	0	0	0	0	0	0	0	0	0	0]	(70)
Losses e.g. evaporation	on (negat	ive valu	es) (Tab	le 5)							-	
(71)m= -83.5 -83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5]	(71)
Water heating gains (Table 5)										_	
(72)m= 41.09 39.79	37.08	33.41	31.02	27.66	24.8	28.46	29.76	33.57	37.86	39.79]	(72)
Total internal gains :	=			(66)m + (67)m	n + (68)r	n + (69)m +	(70)m + (7	71)m + (72))m	_	
(73)m= 295.86 294.44	283.98	266.99	249.3	232.74	222.34	226.1	1 235.17	252.29	271.89	287.01]	(73)
6. Solar gains:												
Solar gains are calculated	•				•	itions to	convert to th	e applica		tion.		
Orientation: Access Table 6		Area m²		Flu Ta	ıx ble 6a		g_ Table 6b	т	FF able 6c		Gains (W)	
						, –						٦
Southwest 0.9x 0.77		1.7		-	36.79	ļ Ļ	0.63	_ ×	0.7	=	19.07	(79)
Southwest 0.9x 0.77		1.7			62.67	ļ Ļ	0.63	_ ×	0.7	_ =	32.48	(79)
Southwests a 0.77		1.7			35.75	! <u> </u>	0.63	_ ×	0.7	=	44.45	[(79)
Southwest 0.9x 0.77		1.7		-	06.25	ļ Ļ	0.63	_ ×	0.7	=	55.07	(79)
Southwest _{0.9x} 0.77	X	1.7	7	x 1	19.01	J L	0.63	X	0.7	=	61.69	(79)

<u>-</u>		_							_				_
Southwest _{0.9x}	0.77	X	1.	7	X	118.15]	0.63	X	0.7	=	61.24	(79)
Southwest _{0.9x}	0.77	X	1.	7	X	113.91]	0.63	X	0.7	=	59.04	(79)
Southwest _{0.9x}	0.77	X	1.	7	X	104.39		0.63	X	0.7	=	54.11	(79)
Southwest _{0.9x}	0.77	X	1.	7	X	92.85]	0.63	X	0.7	=	48.13	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	69.27]	0.63	×	0.7	=	35.9	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	44.07		0.63	x	0.7	=	22.84	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	31.49		0.63	x	0.7	=	16.32	(79)
Northwest _{0.9x}	0.77	×	6.	1	x	11.28	x	0.63	x	0.7		21.02	(81)
Northwest _{0.9x}	0.77	X	6.	1	x	22.97	x	0.63	x	0.7	=	42.79	(81)
Northwest 0.9x	0.77	X	6.	1	x	41.38	x	0.63	×	0.7	=	77.1	(81)
Northwest _{0.9x}	0.77	×	6.	1	x	67.96	х	0.63	×	0.7	=	126.62	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	91.35	х	0.63	x	0.7	=	170.21	(81)
Northwest 0.9x	0.77	x	6.	1	x	97.38	х	0.63	×	0.7	=	181.46	(81)
Northwest 0.9x	0.77	x	6.	1	x	91.1	х	0.63	x	0.7		169.75	(81)
Northwest 0.9x	0.77	×	6.	1	х	72.63	х	0.63	×	0.7	=	135.33	(81)
Northwest 0.9x	0.77	= x	6.	1	x	50.42	x	0.63	×	0.7		93.95	(81)
Northwest 0.9x	0.77	x	6.	1	x	28.07	х	0.63	x	0.7	=	52.3	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	14.2	х	0.63	x	0.7	=	26.45	(81)
Northwest 0.9x	0.77	X	6.	1	x	9.21	х	0.63	×	0.7	-	17.17	(81)
Solar gains in						1 000 70	`	I = Sum(74)m.			00.40	1	(02)
(83)m= 40.09 Total gains – i	<u> </u>	1.55	181.7	231.89	242.7 + (83)m	228.79	189	.43 142.08	88.2	49.3	33.49		(83)
(84)m= 335.96		5.53	448.69	481.19	475.44		415	.55 377.25	340.49	9 321.18	320.5]	(84)
` '					l	401.10	110	.00 077.20	040.4	021:10	020.0		(0.)
7. Mean inter	•		`		<i>'</i>	, -		TI 4 (00)					7,
Temperature	•	•			•		bie 9,	Th1 (°C)				21	(85)
Utilisation fac					` 		Ι ,		0.1	l NI-		1	
Jan		Mar	Apr	May	Jun	Jul	 	ug Sep	Oct	+	Dec		(86)
(86)m= 0.97	L	.95	0.9	0.83	0.7	0.57	0.6	<u> </u>	0.93	0.97	0.98		(00)
Mean interna	 	T		· `	1	i –	т —			-		1	(07)
(87)m= 18.62	18.82 19	9.22	19.77	20.3	20.7	20.88	20.	84 20.51	19.85	19.14	18.57		(87)
Temperature	during heat	ing p	eriods ir	rest of	dwellin	g from Ta	able 9	9, Th2 (°C)				•	
(88)m= 20.01	20.01 20	0.01	20.02	20.02	20.02	20.02	20.	02 20.02	20.02	20.01	20.01		(88)
Utilisation fac	ctor for gains	s for r	est of d	welling,	h2,m (s	see Table	9a)						
(89)m= 0.97	0.96 0	.94	0.89	0.79	0.64	0.47	0.5	0.76	0.91	0.96	0.97		(89)
Mean interna	l temperatui	re in t	he rest	of dwelli	ing T2	follow ste	eps 3	to 7 in Tabl	e 9c)				
(90)m= 17.82	 	3.42	18.96	19.46	19.82	19.96	19.		19.04	18.34	17.77		(90)
					•	-		f	LA = Liv	ving area ÷ (4) =	0.51	(91)
Mean interna	Ltemneratu	re (fo	r the wh	ole dwe	llina) –	fl A 🗴 T1	+ (1	– fl A) y T2					
Mean interna (92)m= 18.22	 	re (fo	r the wh	ole dwe	lling) =	fLA × T1	+ (1		19.45	18.74	18.17]	(92)
	18.43 18	3.82	19.37	19.89	20.26	20.42	20.	39 20.1			18.17]	(92)

(93)m=	18.22	18.43	18.82	19.37	19.89	20.26	20.42	20.39	20.1	19.45	18.74	18.17		(93)
` '			uirement		10.00	20.20	20.42	20.00	20.1	10.40	10.74	10.17		(==)
					re ohtair	ned at ste	en 11 of	Tahla Oh	so tha	t Ti m-(76)m an	d re-calc	ulate	
				using Ta		ieu at st	ер 11 ог	Table 31), 30 tria	t 11,111—(r O)III air	u re-caic	uiate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac		ains, hm	•	,		Į.		•					
(94)m=	0.96	0.95	0.93	0.87	0.79	0.65	0.52	0.57	0.76	0.9	0.95	0.97		(94)
Usefu	ıl gains,	hmGm .	W = (94)	1)m x (84	4)m		!	!				<u> </u>		
(95)m=	323.1	351.09	375.24	392.39	378.3	311.1	233.52	235.9	287.78	305.6	304.62	309.55		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8	ļ	ļ						
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for mea	an intern	al tempe	erature,	Lm,W=	=[(39)m :	x [(93)m-	– (96)m	1				
(97)m=	968.23	939.79	855.19	722.78	564.7	388.96	262.57	274.05	412.56	610.41	804.65	967.7		(97)
Space	e heating	g require	ement fo	r each n	nonth, k	Wh/mont	th = 0.02	24 x [(97)	m – (95)m] x (4	1)m			
(98)m=	479.97	395.61	357.08	237.88	138.68	0	0	0	0	226.78	360.02	489.66		
								Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	2685.69	(98)
Space	, hootin	a roquir	omont in	kWh/m²	2/voor					` ,	,	,	40.00	(99)
	·	•			7уваі							l	42.08	(99)
8c. Sp	pace co	oling rec	luiremer	nt										
Calcu				August.			1			_				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1		<u> </u>						and exte				r i		(100)
(100)m=	0	0	0	0	0	645.63	508.26	521.57	0	0	0	0		(100)
ĺ		tor for lo										- 1		(151)
(101)m=		0	0	0	0	0.72	0.79	0.76	0	0	0	0		(101)
				(100)m x	<u> </u>									
(102)m=	0	0	0	0	0	467.79	401.97	396	0	0	0	0		(102)
								e Table						
(103)m=		0	0	0	0	633.98	604.1	563.96	0	0	0	0		(103)
						dwelling,	continue	ous (kW	h) = 0.02	24 x [(10	03)m – (102)m] x	k (41)m	
,	04)m to	2ero II (3 × (98)	0	119.66	150.38	124.97	0	0	0			
(104)m=	U	U	0	0	U	119.66	150.36	124.97	0 T-1-1	0	0	0		7(101)
Coolog	I fractior	,								= Sum(104) area ÷ (4	=	395.01	(104) (105)
			able 10b)					10=	cooled	aiea - (²	+) =	1	(103)
(106)m=		0	0	0	0	0.25	0.25	0.25	0	0	0	0		
(100)	Ů	ŭ		ŭ	Ů	0.20	0.20	0.20		' = Sum(=	0	(106)
Space	cooling	requirer	ment for	month =	(104)m	× (105)	× (106)r	m	rotar	= <i>Gam</i> (I MT)	_		(100)
(107)m=	Ť	0	0	0	0	29.91	37.6	31.24	0	0	0	0		
(- /		-					<u> </u>	<u> </u>	Total	= Sum(=	98.75	(107)
Cnass	ممانمم	roguiron	nantin l	\	/00F					`	160081)	_		4
•		•		:Wh/m²/y					` ′	÷ (4) =			1.55	(108)
				alculated	only un	der spec	cial cond	litions, se		· ·				
Fabrio	Energy	/ Efficier	псу						(99) -	+ (108) =	=		43.63	(109)

SAP Input

Property Details: Plot 45

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 63.823 m² 2.5 m

Living area: 32.253 m² (fraction 0.505)

Front of dwelling faces: North East

Opening types:

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

NE Manufacturer Solid SW Manufacturer Windows double-glazed Yes

SW Manufacturer Windows double-glazed Yes
NW Manufacturer Windows double-glazed Yes

Name:	Gap:	Frame Factor	: g-value:	U-value:	Area:	No. of Openings:
NE	mm	0	0	1.4	2	1
SW	16mm or more	0.7	0.63	1.4	1.696	1

 SW
 16mm or more
 0.7
 0.63
 1.4
 1.696
 1

 NW
 16mm or more
 0.7
 0.63
 1.4
 6.097
 1

Width: Type-Name: Location: Orient: Height: Name: Corridor Wall North East NF 0 **External Wall** South West SW 0 0 NW **External Wall** North West 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	20.377	7.79	12.58	0.15	0	False	N/A
Corridor Wall	28.802	2	26.8	0.15	0.4	False	N/A
Stairwell Wall	18.126	0	18.13	0.15	0.9	False	N/A
Flat Roof	63.823	0	63.82	0.1	0		N/A
Internal Flement	c						

<u>Internal Elements</u> <u>Party Elements</u>

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1044

Length Psi-value

4.56 0.289 E2 Other lintels (including other steel lintels)

SAP Input

	12.469	0.047	E4	Jamb
	25.397	0.061	E7	Party floor between dwellings (in blocks of flats)
	7.95	0.074	E16	Corner (normal)
	10.6	-0.077	E17	Corner (inverted internal area greater than external area)
	5.3	0.096	E25	Staggered party wall between dwellings
[Approved]	5.3	0.06	E18	Party wall between dwellings
[Approved]	0.9	0.04	E3	Sill
	17.708	0.08	E14	Flat roof
	7.689	0.56	E15	Flat roof with parapet
	16.145	0	P3	Intermediate floor between dwellings (in blocks of flats)
	16.145	0.24	P4	Roof (insulation at ceiling level)

Yes (As designed) Pressure test:

Balanced with heat recovery Ventilation:

Number of wet rooms: Kitchen + 1

Ductwork: Insulation, rigid

Approved Installation Scheme: True

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

Community heating schemes Main heating system:

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

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

thermostats

Control code: 2312

Secondary heating system: None

From main heating system Water heating:

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

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

100% Low energy lights:

Terrain type: Low rise urban / suburban

English EPC language: No Wind turbine:

Photovoltaics: Photovoltaic 1

> Installed Peak power: 0.78 Tilt of collector: 30°

SAP Input

Overshading: None or very little Collector Orientation: South West

Assess Zero Carbon Home:

Nο

		User_l	Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa					0001082 on: 1.0.5.9	
		Property	Address						
Address :									
1. Overall dwelling dime	ensions:								
One word floor		_	ea(m²)	1,, ,	Av. He	• • •	_	Volume(m ³	<u>`</u>
Ground floor			63.82	(1a) x	2	2.5	(2a) =	159.56	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	63.82	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	159.56	(5)
2. Ventilation rate:									
	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	Ī = [0	×	20 =	0	(6b)
Number of intermittent fa	ins				2	<u> </u>	10 =	20	(7a)
Number of passive vents	;			F	0	<u> </u>	10 =	0	(7b)
Number of flueless gas fi	ires			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	20		÷ (5) =	0.13	(8)
	peen carried out or is intended, proce	ed to (17),	otherwise (continue fi	rom (9) to	(16)			_
Number of storeys in the Additional infiltration	he dwelling (ns)					1/0)) 41 ₂ O 4	0	(9)
	.25 for steel or timber frame of	or 0 35 fc	nr masoni	rv consti	ruction	[(8	9)-1]x0.1 =	0	(10)
	resent, use the value corresponding			•	dellon			0	(11)
deducting areas of openii		24/	1) 1						_
·	floor, enter 0.2 (unsealed) or t	J.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	s and doors draught stripped							0	(13)
Window infiltration	o 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 metr	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)				0.38	(18)
	es if a pressurisation test has been de	one or a de	egree air pe	rmeability	is being u	sed			
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0.075 x (19)] =			0.78	(19) (20)
Infiltration rate incorporat	ting shelter factor		(21) = (18	3) x (20) =	,-			0.78	(21)
Infiltration rate modified f	•							0.20	(= : /
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind sp	peed from Table 7	•	•	•	•		•	•	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind Factor (22a)m = (2	2)m : 4							=	
Wind Factor $(22a)m = (22a)m = 1.27$ 1.25	2)m ÷ 4 1.23	0.95	0.92	1	1.08	1.12	1.18	1	
(220)1117 1.21 1.20	1.20 1.11 1.00 0.95	1 0.00	1 0.02	<u> </u>	L	1.12	10	J	

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.37 Calculate effec	0.36	0.36	0.32	0.31 he appli	0.28	0.28	0.27	0.29	0.31	0.33	0.34		
If mechanica		-	ato for t	пс арри	oabic ca	00						0	(23a)
If exhaust air he	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	wise (23b) = (23a)			0	(23b)
If balanced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				0	(23c)
a) If balance	d mech	anical ve	ntilation	with he	at recove	ery (MVI	HR) (24a)m = (22	2b)m + (23b) × [1 – (23c)	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balance	d mech	anical ve	ntilation	without	heat rec	covery (N	ЛV) (24b)m = (22	2b)m + (23b)	•	•	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h if (22b)n				•	-				5 × (23b)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural if (22b)n									0.5]				
(24d)m = 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(24d)
Effective air	change	rate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	(25)			-		
(25)m= 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25)
3. Heat losse	s and he	eat loss p	paramete	er:									
ELEMENT	Gros		Openin		Net Ar		U-valı		AXU		k-value		λXk
_	area	(m²)	m	l ²	A ,r	m²	W/m2	K .	(W/I	<) 	kJ/m²-l	< k	J/K
Doors					2	X	1	= [2	닠			(26)
Windows Type					1.696	_	/[1/(1.4)+	L	2.25	ᆜ			(27)
Windows Type	2				6.097	χ1,	/[1/(1.4)+	0.04] = [8.08	亅 ,			(27)
Walls Type1	20.3	38	7.79		12.58	3 X	0.18	=	2.27	닠 !		_	(29)
Walls Type2	28.	_	2	_	26.8	X	0.18	=	4.82	닠 !		_	(29)
Walls Type3	18.1	3	0	_	18.13	3 X	0.18	=	3.26	<u> </u>		_	(29)
Roof	63.8		0		63.82	2 x	0.13	=	8.3				(30)
Total area of e					131.1								(31)
* for windows and ** include the area						ated using	formula 1	/[(1/U-valu	ie)+0.04] a	is given in	paragraph	3.2	
Fabric heat los							(26)(30)	+ (32) =				30.98	(33)
Heat capacity	Cm = S((A x k)						((28)	.(30) + (32	2) + (32a).	(32e) =	1379.58	(34)
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Medium		250	(35)
For design assess can be used instead				construct	ion are not	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Thermal bridge	es : S (L	x Y) cal	culated ı	using Ap	pendix ł	<						10.73	(36)
if details of therma Total fabric he		are not kn	own (36) =	= 0.05 x (3	1)			(33) +	(36) =			41.71	(37)
Ventilation hea	at loss ca	alculated	l monthly	/				(38)m	= 0.33 × (25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 29.95	29.81	29.67	29.02	28.9	28.34	28.34	28.23	28.55	28.9	29.15	29.4		(38)
Heat transfer of	coefficie	nt, W/K						(39)m	= (37) + (37)	38)m		-	
(39)m= 71.66	71.52	71.38	70.73	70.61	70.05	70.05	69.95	70.27	70.61	70.86	71.12		
									Average =	Sum(39) ₁	12 /12=	70.73	(39)

eat loss par	ameter (H	HLP), W	m²K					(40)m	= (39)m ÷	(4)			
0)m= 1.12	1.12	1.12	1.11	1.11	1.1	1.1	1.1	1.1	1.11	1.11	1.11		
umbar of de	wa in ma	oth (Tob	lo 1o\					,	Average =	Sum(40) ₁ .	12 /12=	1.11	(4
umber of da	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
1)m= 31	28	31	30	31	30	31	31	30	31	30	31		(4
´	ļ												
. Water hea	ating ene	rgy requi	irement:								kWh/yea	ar:	
aumad aa	unana.	NI.								_			,
sumed occ if TFA > 13	.9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13.		09		(4
if TFA £ 13	,	otor upoc	no in litro	o par da	\/d o	orogo –	(25 v NI)	. 26					
inual avera									se target o		.78		(4
t more that 12	5 litres per _l	person per	day (all w	ater use, l	not and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
t water usage	-					Table 1c x	· <i>'</i>						
)m= 92.15	88.8	85.45	82.1	78.75	75.4	75.4	78.75	82.1	85.45	88.8	92.15	1005.04	— ,
ergy content o	of hot water	used - cal	culated mo	onthly = 4 .	190 x Vd,r	n x nm x D	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1	<u> </u>	1005.31	(4
)m= 136.66	119.52	123.34	107.53	103.18	89.03	82.5	94.67	95.8	111.65	121.88	132.35		
<u> </u>	1								I Total = Su	m(45) ₁₁₂ =	:	1318.12	(4
nstantaneous	water heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)					
)m= 0	0	0	0	0	0	0	0	0	0	0	0		(•
ater storag orage volu		الماريطانم		olon on M	WHDC	otoro ao	within o		امما				,
community	, ,		•			_		airie ves	3 C I		150		(4
herwise if r	_			_			' '	ers) ente	er '0' in (47)			
ater storag			`					,	`	,			
If manufac	cturer's de	eclared l	oss facto	or is kno	wn (kWh	n/day):					0		(-
mperature	factor fro	m Table	2b								0		(4
ergy lost fr		_	-				(48) x (49)) =			0		(
If manufact water sto			-										
community	•			C Z (KVV)	ii/iiti c /ua	iy <i>)</i>					0		(
lume facto	_										0		(!
mperature	factor fro	m Table	2b								0		(
ergy lost fr	om water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(
nter (50) or	(54) in (5	55)									0		(
ater storag	e loss cal	culated f	for each	month			((56)m = (55) × (41)	m				
)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
ylinder contai	ns dedicate	d solar sto	rage, (57)ı	n = (56)m	x [(50) – (<u>I</u> H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendix	Ή	
)m= 0	0	0	0	0	0	0	0	0	0	0	0		(
	it loss (ar	nual) fro	m Table	. 2		•	•	•			0		(!
marv circii				, ,									- 1
mary circu mary circu	•	,			59)m = 1	(58) ± 36	65 × (41)	m			0		· ·
mary circu mary circu (modified b	it loss cal	culated t	for each	month (•	. ,	, ,		r thermo		<u> </u>		(

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$													
(61)m= 0	0	0	0	0	00) -	0) o	Το	T 0	T 0	0	1	(61)
				alculated	l for es	ch month					<u> </u>	J · (59)m + (61)m	, ,
(62)m= 116.16	-	104.84	91.4	87.7	75.68		80.47	81.43	94.9	103.59	112.5]	(62)
Solar DHW inpu		using App	L endix G oı	Appendix	H (nega	tive quantit	y) (enter	U'o' if no sola	r contribu	tion to wate	L er heating)	1	
(add addition											0,		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from	water hea	ter				•		•	•	•	!		
(64)m= 116.16	6 101.6	104.84	91.4	87.7	75.68	70.13	80.47	81.43	94.9	103.59	112.5	1	
	•					•	Οι	tput from w	ater heate	er (annual)	112	1120.4	(64)
Heat gains fr	om water	heating,	kWh/m	onth 0.2	5 ′ [0.8	5 × (45)m	n + (61)	m] + 0.8 x	x [(46)m	+ (57)m	+ (59)m	ı]	
(65)m= 29.04	25.4	26.21	22.85	21.93	18.92	17.53	20.12	20.36	23.73	25.9	28.12		(65)
include (57	')m in cal	culation of	of (65)m	only if c	ylinde	is in the	dwellin	g or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	e Table 5	and 5a):									
Metabolic ga	ins (Table	e 5), Wat	ts										
Jan	T .	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 104.33	7 104.37	104.37	104.37	104.37	104.3	7 104.37	104.37	104.37	104.37	104.37	104.37		(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equat	ion L9	or L9a), a	lso see	Table 5			-	•	
(67)m= 17.99	15.98	12.99	9.84	7.35	6.21	6.71	8.72	11.7	14.86	17.34	18.49		(67)
Appliances g	ains (calc	ulated in	Append	dix L, eq	uation	L13 or L1	3a), als	so see Ta	ble 5		_	•	
(68)m= 182.48	3 184.37	179.6	169.44	156.62	144.56	136.51	134.62	139.39	149.55	162.37	174.42		(68)
Cooking gair	ıs (calcula	ited in Ap	ppendix	L, equat	ion L1	5 or L15a), also	see Table	5	-	-	•	
(69)m= 33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44		(69)
Pumps and f	ans gains	(Table 5	āa)									-	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(70)
Losses e.g. e	evaporatio	n (negat	tive valu	es) (Tab	le 5)								
(71)m= -83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5]	(71)
Water heatin	g gains (T	able 5)										_	
(72)m= 39.03	37.8	35.23	31.74	29.47	26.28	23.56	27.04	28.28	31.89	35.97	37.8		(72)
Total interna	al gains =				(6	66)m + (67)n	n + (68)m	+ (69)m +	(70)m + (7	71)m + (72))m	_	
(73)m= 293.8°	1 292.45	282.13	265.32	247.75	231.3	221.1	224.69	233.68	250.61	270	285.02		(73)
6. Solar gai													
Solar gains are		•					ations to	convert to th	ne applica		tion.		
Orientation:	Access F Table 6d		Area m²			lux able 6a		g_ Table 6b	Т	FF able 6c		Gains (W)	
Cauthurata					_		. –		—				1
Southwest _{0.9x}		X	1.	==	X	36.79	¦ ⊨	0.63		0.7	=	19.07	(79)
Southwest _{0.9x}		X	1.		×	62.67	ļ Ļ	0.63		0.7	=	32.48	(79)
Southwest _{0.9x}		X	1.	7	x	85.75	ļ Ļ	0.63	×	0.7	=	44.45	(79)
Southwest _{0.9x}		X	1.	7	x	106.25	ļĻ	0.63	x	0.7	=	55.07	(79)
Southwest _{0.9x}	0.77	X	1.	7	X	119.01		0.63	X	0.7	=	61.69	(79)

		_			_		_		_				_
Southwest _{0.9x}	0.77	X	1.	7	x	118.15	╛	0.63	X	0.7	=	61.24	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	113.91		0.63	X	0.7	=	59.04	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	104.39		0.63	X	0.7	=	54.11	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	92.85		0.63	X	0.7	=	48.13	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	69.27		0.63	X	0.7	=	35.9	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	44.07		0.63	X	0.7	=	22.84	(79)
Southwest _{0.9x}	0.77	x	1.	7	x	31.49		0.63	X	0.7	=	16.32	(79)
Northwest 0.9x	0.77	x	6.	1	x	11.28	X	0.63	x	0.7	=	21.02	(81)
Northwest 0.9x	0.77	x	6.	1	x	22.97	X	0.63	x	0.7	=	42.79	(81)
Northwest 0.9x	0.77	x	6.	1	x	41.38	X	0.63	x	0.7	=	77.1	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	67.96	X	0.63	x	0.7	=	126.62	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	91.35	X	0.63	x	0.7	=	170.21	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	97.38	X	0.63	×	0.7	=	181.46	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	91.1	X	0.63	×	0.7		169.75	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	72.63	X	0.63	x	0.7	-	135.33	(81)
Northwest 0.9x	0.77	×	6.	1	x	50.42	X	0.63	x	0.7	=	93.95	(81)
Northwest 0.9x	0.77	×	6.	1	x	28.07	X	0.63	x	0.7	=	52.3	(81)
Northwest 0.9x	0.77	x	6.	1	x	14.2	X	0.63	x	0.7	=	26.45	(81)
Northwest 0.9x	0.77	×	6.	1	x	9.21	j x	0.63	x	0.7		17.17	(81)
•							_						
Solar gains in	watts, calc	ulated	for eacl	h month			(83)m	n = Sum(74)m .	(82)m				
(83)m= 40.09	75.28 1	21.55	181.7	231.89	242.	7 228.79	189	.43 142.08	88.2	49.3	33.49		(83)
Total gains – i	nternal and	solar	(84)m =	= (73)m	+ (83)	m , watts							
(84)m= 333.9	367.73 4	03.68	447.02	479.64	474.0	06 449.89	414	.12 375.76	338.8	1 319.29	318.51		(84)
7. Mean inter	nal temper	ature	(heating	season)								
Temperature	during hea	ting p	eriods ir	the livi	ng are	a from Ta	ble 9	, Th1 (°C)				21	(85)
Utilisation fac	ctor for gain	s for I	iving are	ea, h1,m	(see	Table 9a)							
Jan	Feb	Mar	Apr	May	Ju	n Jul	Α	ug Sep	Oct	Nov	Dec		
(86)m= 1	1	1	0.98	0.94	0.8	0.65	0.7	72 0.92	0.99	1	1		(86)
Mean interna	l temperatu	ıre in l	iving are	ea T1 (fo	ollow	steps 3 to	7 in T	able 9c)					
(87)m= 19.72	19.84 2	0.06	20.38	20.69	20.9	1 20.98	20.	96 20.8	20.41	20.01	19.7		(87)
Temperature	during hea	tina p	eriods ir	rest of	dwell	na from Ta	able 9	9. Th2 (°C)		-		•	
(88)m= 19.98		9.99	19.99	20	20	<u> </u>	20		20	19.99	19.99		(88)
				م المد	h2 m	(see Table	02)	<u> </u>			<u>l</u>		
Litilication fac	star for agin	e for r	act of di			ISEE LADIE						_	(89)
Utilisation fac		- i			1	` i	T	59 0.88	0.98	1	1		(09)
(89)m= 1	1 (0.99	0.98	0.91	0.73	0.52	0.5		0.98	1	1		(69)
(89)m= 1 Mean interna	1 (0.99 ire in 1	0.98 the rest	0.91 of dwell	0.73	0.52	0.5 eps 3	to 7 in Tabl	e 9c)		<u> </u>	1	, ,
(89)m= 1	1 (0.99	0.98	0.91	0.73	0.52	0.5	to 7 in Tabl	e 9c) 19.51	19.11	18.8	0.54	(90)
(89)m= 1 Mean interna	1 (0.99 ire in 1	0.98 the rest	0.91 of dwell	0.73	0.52	0.5 eps 3	to 7 in Tabl	e 9c) 19.51		18.8	0.51	, ,
Mean internation (90)m= 18.81 Mean internation (90)m= 18.81	1 (l temperaturate) 18.93 1	0.99 Ire in 1 9.15 Ire (fo	0.98 the rest 19.48 r the wh	0.91 of dwell 19.77 ole dwe	0.73 ing T2 19.9	0.52 (follow sto 6 20 = fLA × T1	0.5 eps 3 19.	to 7 in Tabl 99 19.87 f - fLA) × T2	e 9c) 19.51 LA = Liv	19.11 ving area ÷ (·	18.8	0.51	(90)
(89)m= 1 Mean interna (90)m= 18.81	1 (1 (1 (1 (1 (1 (1 (1 (1 (1 (1 (1 (1 (1	0.99 ure in 1 9.15 ure (fo 9.61	0.98 the rest 19.48 r the wh	0.91 of dwell 19.77 ole dwe 20.24	0.73 ing T2 19.9 Illing)	0.52 (follow storage) 6 20 = fLA × T1 4 20.49	0.5 eps 3 19. + (1 20.	to 7 in Tabl 99 19.87 - fLA) × T2 48 20.34	e 9c) 19.51 LA = Liv	19.11 ving area ÷ (-	18.8	0.51	(90)

(93)m= 19	9.27	19.39	19.61	19.93	20.24	20.44	20.49	20.48	20.34	19.96	19.57	19.25		(93)
8. Space		na real	uirement											
Set Ti to		·			re obtair	ned at ste	en 11 of	Table 9	o so tha	t Ti m=(76)m an	d re-calc	ulate	
the utilis				•		iou ut ot	ор о.	. 45.5 0.	o, oo aa	()	. 0, a	a ro care	diato	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisatio	n facto	or for g	ains, hm	:									l	
(94)m=	1	1	0.99	0.98	0.92	0.77	0.59	0.66	0.9	0.98	1	1		(94)
Useful g	ains, h	nmGm ,	W = (94	4)m x (8	4)m		<u> </u>		<u>I</u>	<u>I</u>		<u> </u>		
(95)m= 33	33.32	366.56	400.62	436.01	440.07	365.68	264.43	271.5	336.7	333.56	318.23	318.08		(95)
Monthly	avera	ge exte	rnal tem	perature	from T	able 8	•		•	•	•	•	l.	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat los	s rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]			l	
(97)m= 1	073	1036.32	936.07	780.55	602.94	408.9	272.67	285.62	438.46	661.1	883.34	1070.6		(97)
Space h	eating	require	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97))m – (95)m] x (4	1)m		l	
(98)m= 55	50.32	450.08	398.38	248.07	121.17	0	0	0	0	243.69	406.88	559.87		
					I.	!		Tota	l per year	(kWh/year	·) = Sum(9	8) _{15,912} =	2978.46	(98)
Space h	eating	require	ement in	kWh/m²	2/vear								46.67	(99)
·		•			/ycai								40.07	
8c. Spac		Ĭ			_									
Calculate														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Heat los						t								(400)
(100)m=	0	0	0	0	0	658.47	518.37	531.59	0	0	0	0		(100)
Utilisatio					1	1	1	1	1	ı	ı	1	l	(404)
(101)m=	0	0	0	0	0	0.82	0.9	0.86	0	0	0	0		(101)
Useful lo							Г		Г	Г		Г	ı	
(102)m=	0	0	0	0	0	541.2	464.11	458.29	0	0	0	0		(102)
Gains (s	Ť		culated		cable w	1		1	10)	1		1	l	
(103)m=	0	0	0	0	0	632.6	602.86	562.54	0	0	0	0		(103)
Space co						dwelling,	continue	ous (kW	h) = 0.0	24 x [(10	03)m – (102)m] :	x (41)m	
set (104) (104)m=	0	0	0	0 × (90	0	65.81	103.23	77.56	0	0	0	0		
(104)111=	0	U	U	U		05.61	103.23	77.30	<u> </u>	!		<u> </u>	0.40.0	7(404)
Cooled fra	action									= Sum(าเมส) area ÷ (4	= 1) _	246.6	(104)
Intermitte		ctor (Ta	able 10h)					10=	JUUIEU	urca - (²	- ,, –	I	(100)
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
` /					ļ.			l	L Tota	L l = Sum((104)	 =	0	(106)
Space co	olina r	equirer	nent for	month =	: (104)m	× (105)	× (106)r	n	. 5.01	- Carri	-0 200 • /		•	
(107)m=	0	0	0	0	0	16.45	25.81	19.39	0	0	0	0		
					!	<u> </u>	<u> </u>	I	 Total	l = Sum(107)	=	61.65	(107)
Space co	olina r	equirer	nent in L	·\Λ/h/m2/	/ear) ÷ (4) =	, ,,,			(108)
·					•	dorene	sial aana	litiona	` '	` , ,			0.97	(100)
8f. Fabric			, i	aculated	rorily un	ider spec	Jai cono	iitions, s						7(400)
Fabric E	-		-						(99)	+ (108) =	=		47.63	(109)
Target F	abric	Energ	y Efficie	ency (TF	EE)								54.78	(109)

Assessor Name: Zahid Ashraf Stroma Number: STRO001082 Software Name: Stroma FSAP 2012 Software Version: Version: 1.0.5.9 Property Address: Plot 45 Address: 1. Overall dwelling dimensions: Area(m²) Av. Height(m) Volume(m³)
Address: 1. Overall dwelling dimensions: Area(m²) Av. Height(m) Volume(m³)
1. Overall dwelling dimensions: Area(m²) Av. Height(m) Volume(m³)
Ground floor $(1a) \times (2a) = (159.56)$ $(3a)$
Total floor area TFA = $(1a)+(1b)+(1c)+(1d)+(1e)+(1n)$ 63.82 (4)
Dwelling volume $ (3a)+(3b)+(3c)+(3d)+(3e)+(3n) = 159.56 $
2. Ventilation rate:
main secondary other total m³ per hour heating heating
Number of chimneys $0 + 0 + 0 = 0 \times 40 = 0$ (6a)
Number of open flues $0 + 0 + 0 = 0 \times 20 = 0$ (6b)
Number of intermittent fans $0 x 10 = 0 (7a)$
Number of passive vents $0 x 10 = 0 (7b)$
Number of flueless gas fires $0 x 40 = 0 (7c)$
Air changes per hour
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(7a)+(7b)+(7c) = 0$ $\div (5) = 0$ (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16) Number of storeys in the dwelling (ns) (9)
Additional infiltration [(9)-1]x0.1 = 0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction 0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0
If no draught lobby, enter 0.05, else enter 0
Percentage of windows and doors draught stripped 0 (14)
Window infiltration $0.25 - [0.2 \times (14) \div 100] = 0$ (15)
Infiltration rate $(8) + (10) + (11) + (12) + (13) + (15) = 0 $ (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area (17)
If based on air permeability value, then $(18) = [(17) \div 20] + (8)$, otherwise $(18) = (16)$ Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used
Number of sides sheltered 3 (19)
Shelter factor $(20) = 1 - [0.075 \times (19)] = 0.78$ (20)
Infiltration rate incorporating shelter factor $(21) = (18) \times (20) = 0.12$ (21)
Infiltration rate modified for monthly wind speed
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Monthly average wind speed from Table 7
(22)m= 5.1 5 4.9 4.4 4.3 3.8 3.8 3.7 4 4.3 4.5 4.7
Wind Factor $(22a)m = (22)m \div 4$
(22a)m= 1.27 1.25 1.23 1.1 1.08 0.95 0.95 0.92 1 1.08 1.12 1.18

0.15	ation rate	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14		
Calculate effe		-	rate for t	he appli	cable ca	se	<u> </u>	<u>!</u>	<u> </u>	<u> </u>			_
If mechanic			or d'or NL (O	OL) (OO-			15)\		\ (00-\		Į	0.5	(23
If exhaust air h		0 11		, ,	,	. `	,, .	,) = (23a)		ļ	0.5	(23
If balanced with		-	-	_								79.05	(23
a) If balance						- ` ` 		í `	– `	 	`	÷ 100]	(24
(24a)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24		(24
b) If balance (24b)m= 0	ea mecna 0	anicai ve	ntilation	without	neat red	overy (i	0	$\int_{0}^{\infty} \int_{0}^{\infty} dx = (22)$	2b)m + (2 0	23b) 0	0		(24
					<u> </u>								(2-
c) If whole h	າouse exi n < 0.5 ×								5 × (23h	n)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural	ventilation	on or wh	ole hous	e positiv	/e input	ventilatio	n from l	l	<u> </u>	<u> </u>			
	n = 1, the								0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change	rate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)					
(25)m= 0.25	0.25	0.25	0.23	0.23	0.22	0.22	0.21	0.22	0.23	0.24	0.24		(25
3. Heat losse	s and he	eat loss r	paramete	er.									
ELEMENT	Gros	•	Openin		Net Ar	ea	U-val	ue	AXU		k-value	. A	Χk
	area	_	m		A ,r		W/m2		(W/I	K)	kJ/m²-k		
Doors					2	X	1.4	=	2.8				(26
Windows Type	e 1				1.696	x1.	/[1/(1.4)+	0.04] =	2.25				(27
Windows Type	∌ 2				6.097	x1.	/[1/(1.4)+	0.04] =	8.08				(27
Walls Type1	20.3	38	7.79		12.58	x	0.15	=	1.89				(29
Walls Type2	28.8	В	2		26.8	X	0.14		3.79			7 -	(29
Walls Type3	18.1	3	0		18.13	x	0.13	-	2.4			ī <u> </u>	= (29
Roof	63.8	32	0		63.82	2 x	0.1	= i	6.38	T i		ī	(30
Total area of e	elements	 , m²			131.1	3							— (31
* for windows and	l roof wind	ows, use e	ffective wi	ndow U-va	alue calcul	ated using	ı formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	3.2	
** include the area				ls and par	titions						_		_
Fabric heat los		•	U)				(26)(30)) + (32) =			Ţ	27.59	(33
Heat capacity	,	,							(30) + (32	, , ,	(32e) =	1379.58	(34
Thermal mass	•	•		,					tive Value		L	100	(35
For design asses:				construct	ion are no	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
-				using Ap	pendix l	<					Г	13.69	(36
can be used inste		,			•						L	10.00	
can be used inste Thermal bridg	,							(33) +	(36) =		Γ	41.28	(37
can be used inste Thermal bridg if details of therma	al bridging												
can be used inste Thermal bridg if details of therma Total fabric he	al bridging eat loss		l monthly	У				(38)m	= 0.33 × (25)m x (5))		_
can be used inste Thermal bridg if details of therma Total fabric he	al bridging eat loss		l monthly Apr	y May	Jun	Jul	Aug	(38)m Sep	= 0.33 × (25)m x (5) Nov	Dec		
can be used inste Thermal bridg if details of therma Total fabric he Ventilation hea	al bridging eat loss at loss ca	alculated			Jun 11.33	Jul 11.33	Aug 11.18						(38
can be used inste Thermal bridg if details of therma Total fabric he Ventilation hea Jan (38)m= 13.32	eat loss cat	Mar 13.01	Apr	May	-		Ť	Sep 11.64	Oct	Nov 12.4	Dec		(38
can be used inste Thermal bridg if details of therma Total fabric he Ventilation hea	eat loss cat	Mar 13.01	Apr	May	-		Ť	Sep 11.64	Oct 12.1	Nov 12.4	Dec		(36

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.86	0.85	0.85	0.84	0.84	0.82	0.82	0.82	0.83	0.84	0.84	0.85		
		!							Average =	Sum(40) ₁	12 /12=	0.84	(40)
Number of day	<u> </u>	<u> </u>	le 1a)		<u> </u>			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	irement:								kWh/ye	ear:	
Assumed occurring TFA > 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	TFA -13		09		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the a	lwelling is	designed i			se target o		.19		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i								1 225		1			
(44)m= 97	93.48	89.95	86.42	82.89	79.37	79.37	82.89	86.42	89.95	93.48	97		
. ,	!	!				ļ	ļ		I Total = Su	M(44) ₁₁₂ =		1058.22	(44)
Energy content of	f hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	n x nm x E	OTm / 3600	0 kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 143.85	125.82	129.83	113.19	108.61	93.72	86.85	99.66	100.85	117.53	128.29	139.31		
									Total = Su	m(45) ₁₁₂ =		1387.5	(45)
If instantaneous v	vater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46	to (61)					
(46)m= 21.58	18.87	19.47	16.98	16.29	14.06	13.03	14.95	15.13	17.63	19.24	20.9		(46)
Water storage Storage volum		\ includir	na anv sa	alar or M	WHRS	etorana	within es	ama vas	امء		0		(47)
If community h	,					•		airio voo	001		0		(47)
Otherwise if no	-			_			, ,	ers) ente	er '0' in ((47)			
Water storage			`					,	`	,			
a) If manufact	turer's d	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature f	actor fro	m Table	2b								0		(49)
Energy lost fro		•					(48) x (49)) =		1	10		(50)
b) If manufact			-										
Hot water stor If community h	-			e 2 (KVV	n/litre/da	ay)				0.	02		(51)
Volume factor	•		011 4.3							1	03		(52)
Temperature f			2b							-	.6		(53)
Energy lost fro				ear			(47) x (51)) x (52) x (53) =		03		(54)
Enter (50) or		_	,,					, , , ,	,		03		(55)
Water storage	loss cal	culated t	for each	month			((56)m = ((55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain												ix H	()
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
	<u> </u>				1 00.00	1 02.01	1 02.01	1 30.00	1 02.01				, ,
Primary circuit	`	,			E0\	(EO) - 00	SE /44\				0		(58)
Primary circuit (modified by				,	•	` '	, ,		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)
(00)111- 20.20	21.01	20.20	22.01	20.20	22.01	20.20	20.20	22.01	20.20	22.01	20.20		(00)

Combi loss ca	lculated f	or each	month ((61)m =	(60) ÷ 3	865 x (41)m						
(61)m= 0	0	0	0	0	0	0	0	T 0	0	0	0	1	(61)
	uired for	water he	eating ca	L	L I for eac	.h month	(62)n	$= 0.85 \times$		(46)m +	(57)m +	ı · (59)m + (61)m	
(62)m= 199.13	175.74	185.11	166.68	163.88	147.21	142.12	154.9		172.8	181.78	194.59]	(62)
Solar DHW input	L L calculated ι	using App	endix G or	· Appendix	H (nega	tive quantity	y) (ente	r '0' if no sola	r contribu	tion to wate	r heating)	.	
(add additiona											•		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(63)
Output from w	ater heat	er				•	•	•	•	•	!	•	
(64)m= 199.13	175.74	185.11	166.68	163.88	147.21	142.12	154.9	3 154.34	172.8	181.78	194.59]	
	•			•		•	C	utput from w	ater heate	er (annual) ₁	12	2038.34	(64)
Heat gains fro	m water l	heating,	kWh/mo	onth 0.2	5 ´ [0.8	5 × (45)m	ı + (61)m] + 0.8	x [(46)m	+ (57)m	+ (59)m	n]	
(65)m= 92.05	81.78	87.39	80.43	80.33	73.96	73.1	77.3	6 76.33	83.3	85.45	90.54]	(65)
include (57)	m in calc	ulation o	of (65)m	only if c	ylinder	is in the	dwellir	ng or hot w	ater is f	rom com	munity h	neating	
5. Internal ga	ains (see	Table 5	and 5a):									
Metabolic gain	s (Table	5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec]	
(66)m= 125.24	125.24	125.24	125.24	125.24	125.24	125.24	125.2	125.24	125.24	125.24	125.24]	(66)
Lighting gains	(calculat	ed in Ap	pendix	L, equat	ion L9 d	or L9a), a	ilso se	e Table 5				_	
(67)m= 44.97	39.94	32.48	24.59	18.38	15.52	16.77	21.8	29.26	37.15	43.36	46.22]	(67)
Appliances ga	ins (calcı	ulated in	Append	dix L, eq	uation l	_13 or L1	3a), a	lso see Ta	ble 5		-	_	
(68)m= 272.35	275.18	268.06	252.89	233.76	215.77	203.75	200.9	2 208.05	223.21	242.35	260.33		(68)
Cooking gains	(calculat	ted in A	ppendix	L, equat	ion L15	or L15a), also	see Table	5	-	-		
(69)m= 49.61	49.61	49.61	49.61	49.61	49.61	49.61	49.6	1 49.61	49.61	49.61	49.61		(69)
Pumps and far	ns gains	(Table 5	āa)										
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(70)
Losses e.g. ev	/aporatio	n (negat	tive valu	es) (Tab	le 5)							_	
(71)m= -83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.	-83.5	-83.5	-83.5	-83.5]	(71)
Water heating	gains (T	able 5)										_	
(72)m= 123.73	121.69	117.46	111.71	107.98	102.72	98.25	103.9	7 106.01	111.96	118.68	121.7]	(72)
Total internal	gains =				(66	6)m + (67)m	n + (68)	m + (69)m +	(70)m + (7	71)m + (72))m 	_	
(73)m= 532.41	528.17	509.36	480.55	451.47	425.36	410.13	418.0	6 434.67	463.68	495.74	519.61		(73)
6. Solar gains													
Solar gains are		•				•	ations to		ne applica		tion.		
Orientation: A	Access Fa Fable 6d	actor	Area m²			ux able 6a		g_ Table 6b	Т	FF able 6c		Gains (W)	
_							1 -						1,
Southwesters	0.77	X	1.		—	36.79] <u> </u>	0.63	×	0.7	=	19.07	(79)
Southwesters	0.77	X	1.			62.67	ļ	0.63	×	0.7	=	32.48	[(79)
Southwesters	0.77	×	1.			85.75] <u> </u>	0.63	×	0.7	=	44.45	[(79)
Southwesters	0.77	X	1.	_	—	106.25] <u> </u>	0.63	×	0.7	_ =	55.07	(79)
Southwest _{0.9x}	0.77	X	1.	7	X	119.01	J L	0.63	X	0.7	=	61.69	(79)

		_			_					_				_
Southwest _{0.9x}	0.77	X	1.	7	x	1	18.15		0.63	X	0.7	=	61.24	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	1	13.91		0.63	X	0.7	=	59.04	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	10	04.39		0.63	X	0.7	=	54.11	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	9	2.85		0.63	X	0.7	=	48.13	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	6	9.27		0.63	X	0.7	=	35.9	(79)
Southwest _{0.9x}	0.77	x	1.	7	x	4	4.07		0.63	X	0.7	=	22.84	(79)
Southwest _{0.9x}	0.77	X	1.	7	x	3	1.49		0.63	x	0.7	=	16.32	(79)
Northwest _{0.9x}	0.77	X	6.	1	x	1	1.28	X	0.63	x	0.7	=	21.02	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	2	2.97	X	0.63	x	0.7	=	42.79	(81)
Northwest 0.9x	0.77	x	6.	1	x	4	1.38	X	0.63	x	0.7	=	77.1	(81)
Northwest _{0.9x}	0.77	X	6.	1	x	6	7.96	x	0.63	X	0.7	=	126.62	(81)
Northwest _{0.9x}	0.77	X	6.	1	x	9	1.35	x	0.63	X	0.7	=	170.21	(81)
Northwest _{0.9x}	0.77	X	6.	1	x	9	7.38	x	0.63	x	0.7	=	181.46	(81)
Northwest _{0.9x}	0.77	X	6.	1	x	(91.1	x	0.63	x	0.7		169.75	(81)
Northwest _{0.9x}	0.77	X	6.	1	x	7	2.63	x	0.63	x	0.7	=	135.33	(81)
Northwest _{0.9x}	0.77	X	6.	1	x	5	0.42	x	0.63	x	0.7	=	93.95	(81)
Northwest _{0.9x}	0.77	X	6.	1	x	2	8.07	x	0.63	x	0.7		52.3	(81)
Northwest _{0.9x}	0.77	X	6.	1	x		14.2	x	0.63	X	0.7	=	26.45	(81)
Northwest _{0.9x}	0.77	X	6.	1	x	(9.21	x	0.63	x	0.7	_ =	17.17	(81)
Solar gains in		$\overline{}$			$\overline{}$			r –	i = Sum(74)m	- 	1		1	(00)
(83)m= 40.09		1.55	181.7	231.89	<u> </u>	42.7	228.79	189	.43 142.08	88.2	49.3	33.49		(83)
Total gains – i (84)m= 572.5		0.91	662.25	683.37	·	88.06	638.92	607	.49 576.75	551.8	8 545.04	553.1	1	(84)
` '					_	00.00	030.92	007	.49 370.73	331.0	0 343.04	333.1		(04)
7. Mean inter			`						- :					_
Temperature	Ū	٠.			•			ole 9	Th1 (°C)				21	(85)
Utilisation fac		$\overline{}$			Ť						—		1	
Jan	 	Mar	Apr	May	\vdash	Jun	Jul	 	ug Sep	Oct	+	Dec		(00)
(86)m= 0.9		.84	0.75	0.63	<u> </u>).48	0.35	0.3		0.76	0.87	0.91		(86)
Mean interna	r - r			· ·	_							1	1	
(87)m= 19.76	19.92 20).19	20.53	20.79	20	0.94	20.98	20.	98 20.89	20.58	3 20.14	19.73		(87)
Temperature	during heat	ing p	eriods ir	rest of	dwe	elling	from Ta	ble 9	9, Th2 (°C)		-			
(88)m= 20.21	20.21 20).21	20.22	20.22	20	0.23	20.23	20.	23 20.23	20.22	20.22	20.21		(88)
Utilisation fac	tor for gains	for r	est of d	welling,	h2,ı	m (se	e Table	9a)					_	
(89)m= 0.89	0.87 0.	.82	0.73	0.59	0).43	0.29	0.3	0.52	0.73	0.85	0.9		(89)
Mean interna	l temperatur	e in t	he rest	of dwell	ing	T2 (f	ollow ste	ps 3	to 7 in Tab	le 9c)				
(90)m= 18.57	 	9.17	19.65	19.99	Ť	0.18	20.22	20.		19.72	19.11	18.53		(90)
	. !				-			-		fLA = Li	ving area ÷ (4) =	0.51	(91)
Mean interna	l temperatur	re (fo	r the wh	ole dwe	llinc	ו) = fl	A × T1	+ (1	– fLA) × T2					
(92)m= 19.17	 	0.69	20.1	20.4	$\overline{}$	0.56	20.61	20	 	20.16	19.63	19.14]	(92)
Apply adjustr		nean	internal	temper	atu	re fro	m Table	4e,				I	J	•
• • •				•					• •	-				

(93)m= 19.17 19.36 19.69 20.1 20.4 20.56 20.61 20.6 20.51 20.16 19.63 19.14	(93)
8. Space heating requirement	
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate	
the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
Utilisation factor for gains, hm:	
(94)m= 0.87 0.85 0.81 0.72 0.6 0.45 0.32 0.35 0.54 0.73 0.84 0.88	(94)
Useful gains, hmGm , W = (94)m x (84)m	
(95)m= 499.62 512.96 508.66 478.8 410.76 298.75 206.82 215.1 310.96 403.92 455.18 487.35	(95)
Monthly average external temperature from Table 8	
(96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m- (96)m]	
(97)m= 811.9 787.22 715.83 599.28 464.16 313.64 210.7 220.36 338.97 510.13 672.58 806.32	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m	
(98)m= 232.34 184.31 154.14 86.75 39.73 0 0 0 79.02 156.53 237.32	
Total per year (kWh/year) = Sum(98) _{15,912} = 11	(98)
Space heating requirement in kWh/m²/year	(99)
9b. Energy requirements – Community heating scheme	
This part is used for space heating, space cooling or water heating provided by a community scheme.	
Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0 (301)
Fraction of space heat from community system 1 – (301) =	1 (302)
The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter	
includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.	(000-)
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	05 (306)
Space heating kV	 /h/year
Annual space heating requirement	70.12
Space heat from Community boilers (98) x (304a) x (305) x (306) = 12	28.63 (307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	0 (308
Space heating requirement from secondary/supplementary system (98) × (301) × 100 ÷ (308) =	0 (309)
Water heating Annual water heating requirement 20	38.34
If DHW from community scheme:	6.34
	(310a)
Electricity used for heat distribution 0.01 × [(307a)(307e) + (310a)(310e)] = 33	3.69 (313)
Cooling System Energy Efficiency Ratio	0 (314)
Space cooling (if there is a fixed cooling system, if not enter 0) = $(107) \div (314) =$	0 (315)
Electricity for pumps and fans within dwelling (Table 4f):	1.43 (330a)

					_
warm air heating system fans				0	(330b)
pump for solar water heating				0	(330g)
Total electricity for the above, kWh/ye	ear	=(330a) + (330b) + (330g	g) =	221.43	(331)
Energy for lighting (calculated in Appe	endix L)			317.66	(332)
Electricity generated by PVs (Append	lix M) (negative quantity)			-642.21	(333)
Electricity generated by wind turbine	(Appendix M) (negative quantity)			0	(334)
10b. Fuel costs – Community heatin	g scheme				
	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating from CHP	(307a) x	4.24	x 0.01 =	52.09	(340a)
Water heating from CHP	(310a) x	4.24	x 0.01 =	90.75	(342a)
		Fuel Price	<u> </u>		_
Pumps and fans	(331)	13.19	x 0.01 =	29.21	(349)
Energy for lighting	(332)	13.19	x 0.01 =	41.9	(350)
Additional standing charges (Table 12	2)			120	(351)
Energy saving/generation technologic Total energy cost	es = (340a)(342e) + (345)(354) =			333.95	(355)
11b. SAP rating - Community heatin	g scheme				
Energy cost deflator (Table 12)				0.42	(356)
Energy cost factor (ECF)	[(355) x (356)] ÷ [(4) + 45.0] =			1.29	(357)
SAP rating (section12)				82.02	(358)
12b. CO2 Emissions – Community he	eating scheme				
			sion factor 02/kWh	Emissions kg CO2/year	
CO2 from other sources of space and		inyour ng oc	2 /K 11 11	ng OOZiyeai	
Efficiency of heat source 1 (%)	If there is CHP using two fue	els repeat (363) to (366) for	the second fue	94	(367a)
CO2 associated with heat source 1	[(307b)+(310b)])	(100 ÷ (367b) x	.22 =	774.13	(367)
Electrical energy for heat distribution	[(313) x	0	.52 =	17.48	(372)
Total CO2 associated with community	y systems (363)(366) + (368)(372)	=	791.61	(373)
	•				
CO2 associated with space heating (s	secondary) (309) x		0 =		(374)
CO2 associated with space heating (s		eater (312) x 0	0 =	0	(374) (375)
, , , ,	ersion heater or instantaneous he	eater (312) x 0 374) + (375) =		0	J
CO2 associated with water from imme	ersion heater or instantaneous he water heating (373) + (374) + (375) =		0 0 791.61	(375)
CO2 associated with water from imme	ersion heater or instantaneous he water heating (373) + (mps and fans within dwelling (33	374) + (375) = (31)) x 0	=	0 0 791.61 114.92	(375)
CO2 associated with water from immediate CO2 associated with space and CO2 associated with electricity for pure CO2 associated with electricity for light Energy saving/generation technologies	ersion heater or instantaneous he water heating (373) + (mps and fans within dwelling (332))) x	374) + (375) = (31)) x 0	.52 =	0 791.61 114.92 164.87	(375) (376) (378) (379)
CO2 associated with water from immediate CO2 associated with space and CO2 associated with electricity for purchase CO2 associated with electricity for light Energy saving/generation technological light 1	ersion heater or instantaneous here water heating (373) + (373	374) + (375) = (31)) x 0	.52 =	0 0 791.61 114.92	(375) (376) (378) (379) (380)
CO2 associated with water from immediate CO2 associated with space and CO2 associated with electricity for pure CO2 associated with electricity for light Energy saving/generation technologies	ersion heater or instantaneous he water heating (373) + (mps and fans within dwelling (332))) x	374) + (375) = 31)) x 0	.52 =	0 791.61 114.92 164.87	(375) (376) (378) (379)

Dwelling CO2 Emission Rate (383) ÷ (4) =			1	1.56 (384)	
El rating (section 14)			90	0.91 (385)	
13b. Primary Energy – Community heating scheme					
	Energy kWh/year	Primary factor	P.Energ kWh/ye	••	
Energy from other sources of space and water heating (not CF Efficiency of heat source 1 (%) If there is CHP us	HP) ing two fuels repeat (363) to	(366) for the second f	uel	94 (367a	1)
Energy associated with heat source 1 [(307b))+(310b)] x 100 ÷ (367b) x	1.22	= 43	72.37 (367)	
Electrical energy for heat distribution	[(313) x		= 10)3.42 (372)	
Total Energy associated with community systems	(363)(366) + (368)(37	2)	= 44	175.8 (373)	
if it is negative set (373) to zero (unless specified otherwise,	see C7 in Appendix C	C)	44	175.8 (373)	
Energy associated with space heating (secondary)	(309) x	0	=	0 (374)	
Energy associated with water from immersion heater or instan	taneous heater(312) x	1.22	=	0 (375)	
Total Energy associated with space and water heating	(373) + (374) + (375) =		44	175.8 (376)	
Energy associated with space cooling	(315) x	3.07	=	0 (377)	
Energy associated with electricity for pumps and fans within d	welling (331)) x	3.07	= 67	79.78 (378)	
Energy associated with electricity for lighting	(332))) x	3.07	= 97	75.22 (379)	
Energy saving/generation technologies Item 1		3.07 × 0.01 :	-19	71.59 (380)	
Total Primary Energy, kWh/year sum of (376))(382) =		41	59.21 (383)	

		l Iser I	Details:							
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012	<u> </u>	Strom Softwa					0001082 on: 1.0.5.9		
	F	roperty	Address	Plot 45						
Address: 1. Overall dwelling dime	ensions:									
1. Overall aweiling aime	, , , , , , , , , , , , , , , , , , ,	Are	a(m²)		Av. He	ight(m)		Volume(m ³	3)	
Ground floor				(1a) x		2.5	(2a) =	159.56	(3a)	
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n) (63.82	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	159.56	(5)	
2. Ventilation rate:										
	main seconda heating heating	ry	other		total			m³ per hou	ır	
Number of chimneys	0 + 0	7 + [0] = [0	X 4	40 =	0	(6a)	
Number of open flues	0 + 0		0	Ī = Ē	0	x2	20 =	0	(6b)	
Number of intermittent fa	ins			, L	2	x ²	10 =	20	(7a)	
Number of passive vents	;			Ē	0	x ′	10 =	0	(7b)	
Number of flueless gas fi	ires			F	0	X 4	40 =	0	(7c)	
				L						
				_			Air ch	nanges per ho	our —	
	ys, flues and fans = (6a)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b)+(6b			continuo fr	20		÷ (5) =	0.13	(8)	
Number of storeys in the		u 10 (17),	ourer wise t	onunae n	om (9) to	(10)		0	(9)	
Additional infiltration						[(9)-	-1]x0.1 =	0	(10)	
	.25 for steel or timber frame o			•	ruction			0	(11)	
it both types of wall are p deducting areas of openii	resent, use the value corresponding t ngs); if equal user 0.35	o the grea	ter wall are	a (after						
•	floor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)	
If no draught lobby, en	•							0	(13)	
Percentage of windows Window infiltration	s and doors draught stripped		0.25 - [0.2	v (14) ± 1	1001 -			0	(14)	
Infiltration rate			(8) + (10)	. ,	-	+ (15) =		0	(15)	
	q50, expressed in cubic metre	es per ho					area	5	(17)	
•	lity value, then $(18) = [(17) \div 20] + (18)$	•	•	•		•		0.38	(18)	
	es if a pressurisation test has been do	ne or a de	gree air pe	rmeability	is being u	sed			_	
Number of sides sheltere Shelter factor	ed		(20) = 1 -	[0.0 75 x (1	19)1 =			3	(19) (20)	
Infiltration rate incorporate	ting shelter factor		(21) = (18		/1			0.78	(21)	
Infiltration rate modified f	•		. , .					0.23	(=.)	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Monthly average wind sp	peed from Table 7					-		•		
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7			
Wind Factor (22a)m = (2.	2)m ÷ 4									
	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18]		
						<u> </u>		J		

0.37	ation rate	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34		
Calculate effe													
If mechanic											Ĺ	0	(23
If exhaust air h		0 11		, ,	,	. `	,, .	•) = (23a)		Ĺ	0	(23
If balanced with		•	•	•		,	,				L	0	(23
a) If balance		ı				<u> </u>	- ^ ` `	<u> </u>	 		``	÷ 100]	(= .
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
b) If balance						<u> </u>	- ``	<u> </u>	r i				(0.4
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h	iouse exti n < 0.5 ×			•	•				5 v (22h	.\			
$\frac{11(220)1}{24c)m=0}$	0.5 x	0	0	$\frac{1}{0} = (230)$	0	0	0 = (221)	0	0	0	0		(24
d) If natural													(
,	n = 1, the			•	•				0.5]				
(24d)m= 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(24
Effective air	change r	rate - en	ter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)					
(25)m= 0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56		(25
3. Heat losse	s and hal	ot loop r	aramata	r:									
ELEMENT	Gros	•	Openin		Net Ar	02	U-valı	ام	AXU		k-value	Δ	Χk
	area (m		A,r		W/m2		(W/F	<)	kJ/m ² ·K		/K
Doors					2	X	1	= [2				(26
Nindows Type	• 1				1.696	x1/	/[1/(1.4)+	0.04] =	2.25				(27
Nindows Type	∍ 2				6.097	x1/	/[1/(1.4)+	0.04] =	8.08				(27
Nalls Type1	20.38	3	7.79		12.58	x	0.18		2.27	= [(29
Walls Type2	28.8		2	=	26.8	X	0.18	<u> </u>	4.82	=			(29
Walls Type3	18.13	3	0		18.13	x	0.18		3.26	=		i	<u> </u>
Roof	63.82		0	=	63.82	<u> </u>	0.13	-	8.3	=			(30
Total area of e					131.13	=							` (31
i Ulai ai Ca Ui C			ffective wii	ndow U-va			ı formula 1	/[(1/ -valu	e)+0.04] a	s given in	paragraph	3.2	ν-
							TOTTIUIA 1	I I O Valu		•			
for windows and		sides of in	ternal wall	s and part	titions		TOTTIUIA 1	n in O vana					
* for windows and ** include the area	as on both s			s and part	titions		(26)(30)				[30.98	(33
t for windows and the include the area abric heat los	as on both s ss, W/K =	S (A x		s and part	titions			+ (32) =	.(30) + (32	2) + (32a).	(32e) =	30.98 1379.58	=
for windows and include the area Fabric heat los Heat capacity	as on both s ss, W/K = Cm = S(A	= S (A x A x k)	U)	,				+ (32) = ((28)	.(30) + (32 tive Value:	, , ,	(32e) = [(34
* for windows and ** include the area Fabric heat los Heat capacity Thermal mass For design asses	as on both sees, W/K = Cm = S(A) seeparamet seeparamets whe	S (A x A x k) ter (TMF ere the det	U) $P = Cm \div tails of the$	· TFA) in	n kJ/m²K		(26)(30)	+ (32) = ((28)	tive Value:	Medium		1379.58	(33 (34 (35
* for windows and ** include the area Fabric heat los Heat capacity Thermal mass For design assess can be used inste	as on both s ss, W/K = Cm = S(A paramet sments whe had of a deta	S (A x A x k) ter (TMF ere the det ailed calcu	U) P = Cm ÷ tails of the ulation.	· TFA) ir constructi	n kJ/m²K ion are not	t known pr	(26)(30)	+ (32) = ((28)	tive Value:	Medium		1379.58 250	(34
for windows and include the area fabric heat loss feat capacity for design assess and be used instellations.	as on both sess, W/K = Cm = S(A) separamet sements whee ad of a deta es : S (L)	S (A x A x k) ter (TMF ere the det ailed calcu x Y) calc	U) P = Cm ÷ tails of the ulation. culated t	· TFA) in constructi	n kJ/m²K ion are not pendix k	t known pr	(26)(30)	+ (32) = ((28)	tive Value:	Medium		1379.58	(34
for windows and include the area fabric heat loss feat capacity. Thermal mass for design assess and be used instead for thermal bridger of the fatalls of the remains for the	as on both sees, W/K = Cm = S(A) separamet sements whee and of a deta es : S (L) al bridging a	S (A x A x k) ter (TMF ere the det ailed calcu x Y) calc	U) P = Cm ÷ tails of the ulation. culated t	· TFA) in constructi	n kJ/m²K ion are not pendix k	t known pr	(26)(30)	+ (32) = ((28)	tive Value:	Medium		1379.58 250	(34
for windows and it include the area fabric heat los fleat capacity fhermal mass for design assess fan be used inste fleatmal bridg f details of therma fotal fabric he	as on both sess, W/K = Cm = S(A) separamet sements whe had of a deta es : S (L) al bridging a hat loss	ES (A x A x k) ter (TMF ere the det ailed calcu x Y) calcu are not know	U) P = Cm ÷ tails of the ulation. culated to own (36) =	- TFA) in constructi using Ap - 0.05 x (3	n kJ/m²K ion are not pendix k	t known pr	(26)(30)	(28) Indica indicative	tive Value:	Medium TMP in Ta	able 1f	1379.58 250 10.73	(34
for windows and include the area fabric heat loss. Heat capacity Thermal mass for design assess an be used instead for the the fotal fabric hear for the fabric hear for the fabric hear for the fabric hear for the fabric hear fabric he	as on both sess, W/K = Cm = S(A) separamet sements whe had of a deta es : S (L) al bridging a hat loss	ES (A x A x k) ter (TMF ere the det ailed calcu x Y) calcu are not know	U) P = Cm ÷ tails of the ulation. culated to own (36) =	- TFA) in constructi using Ap - 0.05 x (3	n kJ/m²K ion are not pendix k	t known pr	(26)(30)	(28) Indica indicative	tive Value: values of (36) =	Medium TMP in Ta	able 1f	1379.58 250 10.73	(34
* for windows and ** include the area -abric heat los -leat capacity	as on both sess, W/K = Cm = S(A) aparamet sements when the sead of a detailer of the seat loss cat loss cat	S (A x A x k) ter (TMF ere the det ailed calcu x Y) calcu are not known	U) P = Cm ÷ tails of the ulation. culated u own (36) =	TFA) in constructiusing Ap	n kJ/m²K ion are not spendix h	t known pr	(26)(30)	(28) Indica indicative (33) + (38)m	(36) = = 0.33 × (Medium TMP in Ta	able 1f	1379.58 250 10.73	(34
for windows and include the area fabric heat loss feat capacity. Thermal mass for design assess and be used instead for details of thermal fotal fabric head fabri	as on both sess, W/K = Cm = S(A) separamet sements whee ad of a deta es : S (L x) al bridging a eat loss at loss ca Feb 29.81	e S (A x A x k) ter (TMF ere the declared calculated Mar 29.67	U) P = Cm ÷ tails of the ulation. culated u own (36) = monthly	· TFA) in constructiusing Ap · 0.05 x (3	n kJ/m²K ion are not pendix h 1) Jun	t known pro	ecisely the	(33) + (38)m Sep 28.55	tive Value: values of (36) = = 0.33 × (25)m x (5) Nov 29.15	able 1f	1379.58 250 10.73	(34)

Heat loss para	meter (l	HIP) W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.12	1.12	1.12	1.11	1.11	1.1	1.1	1.1	1.1	1.11	1.11	1.11		
(40)1112	1.12	1.12	1.11	1		1	1	<u> </u>		Sum(40) ₁ .		1.11	(40)
Number of day	s in mo	nth (Tabl	le 1a)					•	rtvorago –	Cum(40)	12712-	1.11	()
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)
								ļ	<u>!</u>	!			
4 \0/242 1 2 24											1-) 0 //- /		
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		09		(42)
Annual averag Reduce the annua	al average	hot water	usage by	5% if the α	lwelling is	designed t			se target o		.78		(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 pe	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m= 92.15	88.8	85.45	82.1	78.75	75.4	75.4	78.75	82.1	85.45	88.8	92.15		
										m(44) ₁₁₂ =		1005.31	(44)
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D	Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 136.66	119.52	123.34	107.53	103.18	89.03	82.5	94.67	95.8	111.65	121.88	132.35		_
If in a to into in a sure we			-f (n.			t O :	havea (40		Total = Su	m(45) ₁₁₂ =	=	1318.12	(45)
If instantaneous w			or use (no	not water			DOXES (46)			1			
(46)m= 20.5	17.93	18.5	16.13	15.48	13.36	12.38	14.2	14.37	16.75	18.28	19.85		(46)
Water storage Storage volum) includin	n anv so	olar or M	/WHRS	storane	within sa	ame ves	امء		150		(47)
If community h	` '		-			•		arric vos	301		150		(47)
Otherwise if no	•			•			` '	ers) ente	er '0' in <i>(</i>	(47)			
Water storage			(o. o, o		/			
a) If manufact		eclared l	oss facto	or is kno	wn (kWł	n/day):				1.	39		(48)
Temperature fa	actor fro	m Table	2b							0.	54		(49)
Energy lost fro	m watei	r storage	, kWh/ye	ear			(48) x (49)) =		0.	75		(50)
b) If manufact			-										
Hot water stora	-			e 2 (kW	h/litre/da	ıy)					0		(51)
If community h	_		on 4.3								. 1		(50)
Temperature fa			2h								0		(52) (53)
•				201			(47) v (54)) v (E2) v (E2\ -				, ,
Energy lost fro Enter (50) or (_	, KVVII/yt	zai			(47) X (31)) x (52) x (33) =		0 75		(54) (55)
Water storage		•	or each	month			((56)m = (55) × (41)	m	0.	73		(00)
					00.50	i	., , ,		ı	I 00 50	00.00		(FC)
(56)m= 23.33 If cylinder contains	21.07 s dedicate	23.33 d solar sto	22.58 rage, (57)ı	23.33 m = (56)m	22.58 x [(50) – (23.33 H11)] ÷ (5	23.33 0), else (5	22.58 7)m = (56)	23.33 m where (22.58 H11) is fro	23.33 m Append	ix H	(56)
(57)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Primary circuit	loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit	loss cal	culated f	or each	month (•	. ,	, ,						
(modified by					ı —	ı —		<u> </u>		- 			,·
(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 o	alculated	for each	month ((61)m –	(60) · 3	65 v (11	\m						
(61)m= 0	0 0	0	0	0	0 + 3	05 x (41	0	0	0	0	0]	(61)
						<u> </u>	ļ	<u> </u>	<u> </u>	<u> </u>	<u> </u>	J (59)m + (61)m	(0.1)
(62)m= 183.20	-	169.93	152.62	149.77	134.13	129.1	141.27	140.9	158.25	166.97	178.94	(39)111 + (01)111	(62)
Solar DHW inpu		LI				1		1		ļ		I	(- /
(add addition									ii ooniiibai	ion to wat	or ricating)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from	water hea	ter					•	•	•	•	•	•	
(64)m= 183.20	6 161.61	169.93	152.62	149.77	134.13	129.1	141.27	140.9	158.25	166.97	178.94]	
	•				•		Out	put from w	ater heate	r (annual) ₁	l12	1866.74	(64)
Heat gains fr	om water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	n + (61)r	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m= 82.72	73.41	78.29	71.83	71.58	65.68	64.71	68.75	67.93	74.4	76.6	81.28		(65)
include (57	')m in cal	culation o	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is f	rom com	munity h	neating	
5. Internal	gains (see	e Table 5	and 5a):									
Metabolic ga													
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m= 104.3°	7 104.37	104.37	104.37	104.37	104.37	104.37	104.37	104.37	104.37	104.37	104.37		(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5	•	•	•	•	
(67)m= 17.99	15.98	12.99	9.84	7.35	6.21	6.71	8.72	11.7	14.86	17.34	18.49		(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= 182.48	3 184.37	179.6	169.44	156.62	144.56	136.51	134.62	139.39	149.55	162.37	174.42		(68)
Cooking gair	ıs (calcula	ted in Ap	pendix	L, equat	ion L15	or L15a), also s	ee Table	5	•	•	•	
(69)m= 33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44	33.44		(69)
Pumps and f	ans gains	(Table 5	ia)									•	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g. 6	evaporatio	n (negat	ive valu	es) (Tab	le 5)	-	-		-	-	-		
(71)m= -83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5	-83.5		(71)
Water heatin	g gains (1	Table 5)				-	-		-	-	-		
(72)m= 111.18	3 109.24	105.22	99.76	96.21	91.22	86.97	92.41	94.35	100	106.38	109.25		(72)
Total interna	al gains =	•			(66)m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	'1)m + (72))m		
(73)m= 368.9	366.9	355.12	336.35	317.49	299.3	287.51	293.06	302.75	321.72	343.41	359.47		(73)
6. Solar gai	ns:												
Solar gains are	calculated	using solai	r flux from	Table 6a		•	ations to c	onvert to th	ne applicat		tion.		
Orientation:	Access F Table 6d		Area m²		Flu		-	g_ Fable 6b	т	FF		Gains	
						ble 6a	, –	able ob	_ '	able 6c		(W)	7
Southwest _{0.9x}		X	1.	7	x ;	36.79	ļ L	0.63	x	0.7	=	19.07	(79)
Southwest _{0.9x}	0.11	X	1.	7	X	62.67	ļ Ļ	0.63	x	0.7	=	32.48	(79)
Southwest _{0.9x}		X	1.	7	X	35.75	ļ Ļ	0.63	x	0.7	=	44.45	(79)
Southwest _{0.9x}		X	1.	7	x 1	06.25	ļ <u>L</u>	0.63	x	0.7	=	55.07	(79)
Southwest _{0.9x}	0.77	X	1.	7	x 1	19.01		0.63	Х	0.7	=	61.69	(79)

					_		_		_				_
Southwest _{0.9x}	0.77	X	1.7	7	x	118.15	╛	0.63	X	0.7	=	61.24	(79)
Southwest _{0.9x}	0.77	X	1.7	7	x	113.91]	0.63	X	0.7	=	59.04	(79)
Southwest _{0.9x}	0.77	X	1.7	7	x	104.39		0.63	X	0.7	=	54.11	(79)
Southwest _{0.9x}	0.77	X	1.7	7	x	92.85		0.63	X	0.7	=	48.13	(79)
Southwest _{0.9x}	0.77	X	1.7	7	x	69.27]	0.63	X	0.7	=	35.9	(79)
Southwest _{0.9x}	0.77	X	1.7	7	x	44.07		0.63	X	0.7	=	22.84	(79)
Southwest _{0.9x}	0.77	X	1.7	7	x	31.49		0.63	X	0.7	=	16.32	(79)
Northwest _{0.9x}	0.77	X	6.′	1	x	11.28	x	0.63	X	0.7	=	21.02	(81)
Northwest _{0.9x}	0.77	X	6.′	1	x	22.97	x	0.63	X	0.7	=	42.79	(81)
Northwest 0.9x	0.77	X	6.′	1	x	41.38	x	0.63	X	0.7	=	77.1	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	67.96	x	0.63	x	0.7	=	126.62	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	91.35	x	0.63	x	0.7	=	170.21	(81)
Northwest _{0.9x}	0.77	x	6.	1	x [97.38	x	0.63	x	0.7	=	181.46	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	91.1	X	0.63	×	0.7		169.75	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	72.63	X	0.63	x	0.7		135.33	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	50.42	X	0.63	x	0.7	-	93.95	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	28.07	X	0.63	×	0.7		52.3	(81)
Northwest _{0.9x}	0.77	x	6.	1	x	14.2	x	0.63	x	0.7	_	26.45	(81)
Northwest _{0.9x}	0.77	x	6.	1	x T	9.21	X	0.63	x	0.7	<u> </u>	17.17	(81)
Solar gains in (83)m= 40.09	T - T	culated 121.55	for each	h month 231.89	_	228.79	(83)m	n = Sum(74)m . .43 142.08	(82)m 88.2	49.3	33.49]	(83)
Total gains – i	nternal and	d solar	(84)m =	= (73)m ·	+ (8	3)m , watts		<u> </u>			l	J	
Total gains – i $(84)m = 409.05$		d solar 176.67	(84)m = 518.04	= (73)m - 549.39	·	3)m , watts 42 516.3	482	2.5 444.83	409.92	2 392.71	392.96]	(84)
	442.18 4	176.67	518.04	549.39	5		482	2.5 444.83	409.92	2 392.71	392.96		(84)
(84)m= 409.05	442.18 4	176.67 rature (518.04 (heating	549.39 season	5	42 516.3			409.92	2 392.71	392.96	21	(84)
(84)m= 409.05 7. Mean inter	442.18 4 rnal temper during hea	rature (518.04 (heating eriods in	549.39 season) ng a	42 516.3 area from Ta			409.92	2 392.71	392.96	21	_
(84)m= 409.05 7. Mean inter Temperature	442.18 4 rnal temper during hea	rature (518.04 (heating eriods in	549.39 season	ng a	42 516.3 area from Ta	ble 9		409.92 Oct		392.96 Dec	21	_
(84)m= 409.05 7. Mean inter Temperature Utilisation fac	442.18 4 rnal temper during hea ctor for gair Feb	rature (ating pe	518.04 (heating eriods in	season the livinga, h1,m	ng a	516.3 area from Ta e Table 9a)	ble 9	, Th1 (°C)				21	_
(84)m= 409.05 7. Mean inter Temperature Utilisation fact Jan (86)m= 1	442.18 4 rnal temper during hea eter for gair Feb 1	rature (ating pens for li Mar	518.04 (heating eriods in ving are Apr	season the living the May	5 ng a (se	42 516.3 area from Ta the Table 9a) lun Jul 1.75 0.58	ble 9	, Th1 (°C) ug Sep 64 0.87	Oct	Nov	Dec	21	(85)
(84)m= 409.05 7. Mean inter Temperature Utilisation fac	during heat tor for gair Feb 1 temperate	rature (ating pens for li Mar	518.04 (heating eriods in ving are Apr	season the living the May	ng a (se	42 516.3 area from Ta the Table 9a) lun Jul 1.75 0.58	ble 9	Th1 (°C) Sep 0.87 Table 9c)	Oct	Nov 0.99	Dec	21	(85)
(84)m= 409.05 7. Mean interconduction factors Utilisation factors Jan (86)m= 1 Mean internation (87)m= 19.83	during head tor for gair Feb 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	rature (ating pens for li Mar 0.99 ure in l	518.04 (heating eriods in Apr 0.97 iving are 20.48	season the living the living the sea, h1,m May 0.9 the sea T1 (for 20.76)	5. ng a (se 0. ollow 20	trea from Table 9a) Jun Jul 75 0.58 v steps 3 to 0.94 20.99	ble 9 A 0.6 7 in T 20.	Sep 0.87 able 9c) 98 20.86	Oct 0.98	Nov 0.99	Dec 1	21	(85)
7. Mean intercondense (84)m= 409.05 7. Mean intercondense (86)m= 1 Mean internal	442.18 4 rnal temper during hea eter for gair Feb 1 1 1 temperate 19.95 2 during hea	rature (ating pens for li Mar 0.99 ure in l	518.04 (heating eriods in Apr 0.97 iving are 20.48	season the living the living the sea, h1,m May 0.9 the sea T1 (for 20.76)	ng a li (see	trea from Table 9a) Jun Jul 75 0.58 v steps 3 to 0.94 20.99	ble 9 A 0.6 7 in T 20.	Sep 34 0.87 Sable 9c) 98 20.86 9, Th2 (°C)	Oct 0.98	Nov 0.99	Dec 1	21	(85)
(84)m= 409.05 7. Mean inter Temperature Utilisation fact Jan (86)m= 1 Mean interna (87)m= 19.83 Temperature (88)m= 19.98	442.18 4 rnal temper during hea eter for gair Feb 1 1 1 temperate 19.95 2 during hea 19.98	rature (ating pens for li Mar 0.99 ure in l 20.17 ating pe	518.04 (heating eriods in Apr 0.97 iving are 20.48 eriods in 19.99	season the livin ea, h1,m May 0.9 ea T1 (for 20.76 n rest of	ollowed week	trea from Table 9a) lun Jul .75 0.58 v steps 3 to 0.94 20.99 elling from T	A 0.67 in T 20.	Sep 34 0.87 Sable 9c) 98 20.86 9, Th2 (°C)	Oct 0.98	Nov 0.99 20.12	Dec 1 1 19.81	21	(85) (86) (87)
(84)m= 409.05 7. Mean interconduction factors Temperature Utilisation factors Jan (86)m= 1 Mean internation factors (87)m= 19.83 Temperature (88)m= 19.98 Utilisation factors	442.18 4 rnal temper during hea ctor for gain Feb 1 1temperate 19.95 2 during hea 19.98 ctor for gain	rature (ating pens for li Mar 0.99 ure in l 20.17 ating pens for r	518.04 (heating eriods in Apr 0.97 iving are 20.48 eriods in 19.99 est of decided in the second in t	season the livin ea, h1,m May 0.9 ea T1 (for 20.76 n rest of 20 welling,	ng a (see J J o.) and dwee shape sha	trea from Table 9a) lun Jul 175 0.58 v steps 3 to 1.94 20.99 elling from Table 20 20 m (see Table	A 0.6 7 in T 20. able 9	Sep 64 0.87 Table 9c) 98 20.86 9, Th2 (°C) 0 20	Oct 0.98 20.51	Nov 0.99 20.12	Dec 1 19.81 19.99	21	(85) (86) (87)
(84)m= 409.05 7. Mean intercondent Temperature Utilisation fact [86)m= 1 Mean internation [87)m= 19.83 Temperature (88)m= 19.98 Utilisation fact (89)m= 1	during head temperate 19.95 2 during head 19.98 ctor for gair 19.98 ctor for gair 19.99	rature (ating pens for li Mar 0.99 ure in l 20.17 ating pens for r 0.99	518.04 (heating eriods in ving are 20.48 eriods in 19.99 est of do 0.96	season the livin ea, h1,m May 0.9 ea T1 (for 20.76 n rest of 20 welling, 0.86	5 5 5 5 5 5 5 5 5 5	142 516.3	A 0.6 7 in T 20. able 9 20 9a) 0.5	Sep 64 0.87 Table 9c) 98 20.86 9, Th2 (°C) 20 11 0.81	Oct 0.98 20.51 20 0.97	Nov 0.99 20.12	Dec 1 1 19.81	21	(85) (86) (87) (88)
(84)m= 409.05 7. Mean interest Temperature Utilisation fact Jan (86)m= 1 Mean interna (87)m= 19.83 Temperature (88)m= 19.98 Utilisation fact (89)m= 1 Mean interna	442.18 4 mal temper during heater for gair Feb 1 1 temperate 19.95 2 during heater for gair 19.98 ctor for gair 0.99	rature (ating pens for li Mar 0.99 ure in l 20.17 ating pens for r 0.99 ure in t	518.04 (heating eriods in ving are 20.48 eriods in 19.99 est of do 0.96 he rest	season the livin ea, h1,m May 0.9 ea T1 (for 20.76 n rest of 20 welling, 0.86 of dwelli	5 5 5 5 5 5 5 5 5 5	trea from Table 9a) lun	A 0.67 in T 20. able 9 0.5 eps 3	Sep 64 0.87 Fable 9c) 98 20.86 9, Th2 (°C) 0 20 61 0.81 to 7 in Table	Oct 0.98 20.51 20 0.97 e 9c)	Nov 0.99 20.12 19.99 0.99	Dec 1 19.81 19.99	21	(85) (86) (87) (88) (89)
(84)m= 409.05 7. Mean intercondent Temperature Utilisation fact [86)m= 1 Mean internation [87)m= 19.83 Temperature (88)m= 19.98 Utilisation fact (89)m= 1	442.18 4 mal temper during heater for gair Feb 1 1 temperate 19.95 2 during heater for gair 19.98 ctor for gair 0.99	rature (ating pens for li Mar 0.99 ure in l 20.17 ating pens for r 0.99	518.04 (heating eriods in ving are 20.48 eriods in 19.99 est of do 0.96	season the livin ea, h1,m May 0.9 ea T1 (for 20.76 n rest of 20 welling, 0.86	5 5 5 5 5 5 5 5 5 5	142 516.3	A 0.6 7 in T 20. able 9 20 9a) 0.5	Th1 (°C) ug Sep 64 0.87 Table 9c) 98 20.86 9, Th2 (°C) 0 20 61 0.81 to 7 in Table 0 19.88	Oct 0.98 20.51 20 0.97 e 9c) 19.42	Nov 0.99 20.12 19.99 0.99	Dec 1 19.81 19.99		(85) (86) (87) (88) (89) (90)
(84)m= 409.05 7. Mean inter Temperature Utilisation face (86)m= 1 Mean interna (87)m= 19.83 Temperature (88)m= 19.98 Utilisation face (89)m= 1 Mean interna (90)m= 18.43	442.18 4 mal temper during head tor for gair Feb 1 1 temperate 19.95 2 during head 19.98 2 ctor for gair 0.99 al temperate 18.6	rature (ating pens for li Mar 0.99 ure in l 20.17 ating pens for r 0.99 ure in t	518.04 (heating eriods in ving are Apr 0.97 iving are 20.48 eriods in 19.99 est of do 0.96 he rest 19.37	season the livin ea, h1,m May 0.9 ea T1 (for 20.76 n rest of 20 welling, 0.86 of dwelling, 19.75	5 5 5 5 5 5 5 5 5 5	142 516.3 142 516.3 143 516.3 144 516.3 145 516.3 146 72 72 73 74 74 74 74 74 74 74	A 0.6 7 in T 20. able 9 0.5 eps 3	Th1 (°C) ug Sep 64 0.87 Table 9c) 98 20.86 9, Th2 (°C) 0 20 61 0.81 to 7 in Table 0 19.88	Oct 0.98 20.51 20 0.97 e 9c) 19.42	Nov 0.99 20.12 19.99 0.99	Dec 1 19.81 19.99	0.51	(85) (86) (87) (88) (89)
(84)m= 409.05 7. Mean interest Temperature Utilisation fact Jan (86)m= 1 Mean interna (87)m= 19.83 Temperature (88)m= 19.98 Utilisation fact (89)m= 1 Mean interna (90)m= 18.43 Mean interna	during head temperature of the second	rature (ating pens for line 19.99 ating pens for rough) ure in the 18.92 are (for rough) ure (518.04 (heating eriods in a six of the ating are 20.48) eriods in 19.99 est of do 0.96 he rest 19.37	season the livin ea, h1,m May 0.9 ea T1 (fc 20.76 n rest of 20 welling, 0.86 of dwelli 19.75	5 5 5 1 1 1 1 1 1 1	142 516.3 142 516.3 143 516.3 144 516.3 145 516.3 146 72 75 75 75 75 75 75 75	ble 9 A 0.6 7 in T 20. able 9 0.5 eps 3 + (1	Th1 (°C) ug Sep 64 0.87 Table 9c) 98 20.86 9, Th2 (°C) 0 20 51 0.81 to 7 in Table 0 19.88	Oct 0.98 20.51 20 0.97 e 9c) 19.42	Nov 0.99 20.12 19.99 0.99	Dec 1 19.81 19.99 1 1 18.4 4) =		(85) (86) (87) (88) (89) (90) (91)
(84)m= 409.05 7. Mean inter Temperature Utilisation face (86)m= 1 Mean interna (87)m= 19.83 Temperature (88)m= 19.98 Utilisation face (89)m= 1 Mean interna (90)m= 18.43	during head temperate 19.95 ctor for gair 0.99 ctor for gair 18.6 ctor for gair 19.28 ctor for gair 19.28 ctor for gair 19.28	rature (ating pens for li Mar 0.99 ure in l 20.17 ating pens for r 0.99 ure in t 18.92 ure (for	518.04 (heating eriods in ving are Apr 0.97 iving are 20.48 eriods in 19.99 est of do 0.96 he rest 19.37 r the wh 19.93	season the livin ea, h1,m May 0.9 ea T1 (for 20.76 n rest of 20 welling, 0.86 of dwelling, 19.75 ole dwe 20.26	5 5 5 5 5 5 5 5 5 5	10.45 20.5	ble 9 A 0.6 7 in T 20. able 9 0.5 eps 3 + (1 20.	Sep 34 0.87 Table 9c) 98 20.86 9, Th2 (°C) 0 20 10 19.88 11 11 - fLA) × T2 12 49 20.37	Oct 0.98 20.51 20 0.97 e 9c) 19.42 LA = Liv	Nov 0.99 20.12 19.99 0.99 2 18.86 ving area ÷ (4	Dec 1 19.81 19.99		(85) (86) (87) (88) (89) (90)

_							·	1			1	1		
` ′	19.14	19.28	19.55	19.93	20.26	20.45	20.5	20.49	20.37	19.97	19.49	19.11		(93)
			uirement											
			ernal ter or gains	•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			ains, hm		iviay	Odii	<u> </u>	l mag	СОР	000	1101	200		
(94)m=	1	0.99	0.98	0.96	0.88	0.7	0.52	0.58	0.84	0.97	0.99	1		(94)
Useful o	gains, l	hmGm ,	, W = (9 ²	1)m x (84	4)m			<u> </u>	l			<u>!</u>		
_	107.16	438.84	469.11	495.32	481.09	381.82	268.31	278.33	371.44	396.15	389.3	391.48		(95)
 Monthly	/ avera	ge exte	rnal tem	perature	from Ta	able 8		!			!			
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat los	ss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]	•	•		
(97)m= 10	063.43	1028.49	931.47	779.99	604.69	410.1	273.03	286.25	440.82	661.38	878.23	1060.67		(97)
Space h	heating	require	ement fo	r each n	nonth, k\	Wh/mont	th = 0.02	24 x [(97)m – (95)m] x (4	1)m			
(98)m= 4	188.27	396.24	343.99	204.97	91.96	0	0	0	0	197.33	352.03	497.88		_
								Tota	l per year	(kWh/yeaı	r) = Sum(9	8) _{15,912} =	2572.66	(98)
Space h	heating	require	ement in	kWh/m²	/year								40.31	(99)
9a. Ener	av real	uiremen	nts — Indi	vidual h	eating s	vstems i	ncluding	ı micro-C	:HP)					
Space I			ito iriai	Madain	caming 5	y Storris II	ricidaling	TITIOIO C	<i>/</i>					
-		_	nt from s	econdar	y/supple	mentary	system						0	(201)
			at from m			,	-	(202) = 1	- (201) =				1	(202)
			ng from	-	• ,			(204) = (2	02) x [1 –	(203)] =			1	(204)
			_	-				(201) – (2	02) X [1	(200)] -				╡゛
	•	•	ace heat				٥,						93.5	(206)
Efficien	cy of s	econda	ry/suppl	ementar	y heating	g system	າ, %				1		0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
· -	Ť	•	ement (c		· ·		1				i	1		
4	188.27	396.24	343.99	204.97	91.96	0	0	0	0	197.33	352.03	497.88		
(211)m =	= {[(98)	m x (20	4)] } x 1	00 ÷ (20	6)		•							(211)
5	522.21	423.79	367.91	219.21	98.36	0	0	0	0	211.04	376.51	532.49		_
								Tota	I (kWh/yea	ar) =Sum(2	211) _{15,1012}	2=	2751.51	(211)
Space h	heating	fuel (s	econdar	y), kWh/	month									
= {[(98)m	1 x (20	1)] } x 1	00 ÷ (20	8)			ı	,	1		,			
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	2=	0	(215)
Water he	_													
Output fr						40440	400.4	444.07	140.0	450.05	400.07	470.04		
<u> </u>	183.26	161.61	169.93	152.62	149.77	134.13	129.1	141.27	140.9	158.25	166.97	178.94		7(040)
Efficienc	·							T					79.8	(216)
· · ·	87.31	87.12	86.66	85.6	83.56	79.8	79.8	79.8	79.8	85.4	86.76	87.4		(217)
Fuel for \		0.												
(219)m = 2	209.9	185.51	196.1	178.29	179.24	168.08	161.78	177.03	176.56	185.29	192.45	204.74		
, -/						,			I = Sum(2		I		2214.97	(219)
Annual t	totals								,		Wh/yeaı	•	kWh/year	」 ``
Space he		fuel use	ed, main	system	1					ĸ	y cai		2751.51	7
	-												<u> </u>	_

Water heating fuel used				2214.97	٦
Electricity for pumps, fans and electric keep-hot					_
central heating pump:		[30		(230c)
boiler with a fan-assisted flue	45		(230e)		
Total electricity for the above, kWh/year		75	(231)		
Electricity for lighting				317.66	(232)
12a. CO2 emissions – Individual heating system	s including micro-CHP				
	Energy kWh/year	Emission fact kg CO2/kWh	tor	Emissions kg CO2/ye	
Space heating (main system 1)	(211) x	0.216	=	594.33	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	478.43	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1072.76	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	164.87	(268)
Total CO2, kg/year	sur	n of (265)(271) =		1276.55	(272)

TER =

(273)