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 14:53:31*

Proiect Information:

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

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 75.48m²

Site Reference: Hermitage Lane

Plot Reference: Plot 49

Address:

Client Details:

Name: Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas (c)

Fuel factor: 1.00 (mains gas (c))

Target Carbon Dioxide Emission Rate (TER) 19.86 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.66 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 60.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 45.8 kWh/m²

OK

2 Fabric U-values

Element Highest Average 0.15 (max. 0.70) External wall 0.15 (max. 0.30) OK Floor 0.12 (max. 0.25) 0.12 (max. 0.70) **OK** Roof 0.10 (max. 0.20) 0.10 (max. 0.35) OK **Openings** 1.40 (max. 2.00) 1.40 (max. 3.30) OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 3.00 (design value)

Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

programmer and at least two room thermostats

Hot water controls: No cylinder thermostat

No cylinder

OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK
8 Mechanical ventilation		
Continuous supply and extract system		
Specific fan power:	1.02	
Maximum	1.5	OK
MVHR efficiency:	93%	
Minimum	70%	OK
9 Summertime temperature		
Overheating risk (Thames valley):	Medium	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: North East	1.7m²	
Windows facing: South East	11.46m²	
Ventilation rate:	4.00	
10 Key features		
Air permeablility	3.0 m³/m²h	
Roofs U-value	0.1 W/m ² K	
Floors U-value	0.12 W/m ² K	
Community heating, heat from boilers – mains gas		
Photovoltaic array		

		l Iser I	Details:						
Assessor Name: Software Name:	Software Name: Stroma FSAP 2012 Software Version: Versi								
Address :	F	Property	Address	Plot 49	1				
1. Overall dwelling dime	ensions:								
<u> </u>		Are	a(m²)		Av. He	ight(m)		Volume(m ³	3)
Ground floor			75.48	(1a) x	2	2.5	(2a) =	188.71	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n) 📑	75.48	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	188.71	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys	0 + 0	+ [0	=	0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	<u> </u>	0	Ī - Ē	0	x 2	20 =	0	(6b)
Number of intermittent fa	ins			, <u> </u>	0	x '	10 =	0	(7a)
Number of passive vents	3			F	0	x -	10 =	0	(7b)
Number of flueless gas f	ires			_ [0	X	40 =	0	(7c)
							Air ch	nanges per ho	our
	ys, flues and fans = $(6a)+(6b)+($				0		÷ (5) =	0	(8)
If a pressurisation test has be Number of storeys in t	peen carried out or is intended, procee he dwelling (ns)	ed to (17),	otherwise o	continue fr	om (9) to	(16)		0	(9)
Additional infiltration	ne awaiing (no)					[(9)	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame o	r 0.35 fo	r masoni	y constr	ruction	• ,	•	0	(11)
	resent, use the value corresponding t	o the grea	ter wall are	a (after					
deducting areas of openial If suspended wooden to	ngs); if equal user 0.35 floor, enter 0.2 (unsealed) or 0	.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	,	(***	,,					0	(13)
Percentage of window	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (1	12) + (13)	+ (15) =		0	(16)
,	q50, expressed in cubic metro	-	•	•	etre of e	envelope	area	3	(17)
•	lity value, then $(18) = [(17) \div 20] + (18)$ es if a pressurisation test has been do				io hoina u	and		0.15	(18)
Number of sides sheltere		ne or a de	gree air pe	пеаышу	is being u	seu		2	(19)
Shelter factor			(20) = 1 -	[0.0 75 x (1	19)] =			0.85	(20)
Infiltration rate incorpora	ting shelter factor		(21) = (18) x (20) =				0.13	(21)
Infiltration rate modified f	for monthly wind speed								
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
(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		
	II			<u> </u>				ı	

0.16	0.16	e (allowi	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15]	
Calculate effec		-	rate for t	he appli	cable ca	se						l	_
If mechanica			" 11 (0	(22				. (22)	\			0.5	(23
If exhaust air he		0		, ,	,	. `	,, .	`) = (23a)			0.5	(23
If balanced with		•	•	· ·		,		,				79.05	(23
a) If balance						- ` ` 	1 	ŕ	, 	, 	i ` ´	i ÷ 100] I	(0.
(24a)m= 0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25		(24
b) If balance	ed mecha					 	, 	í `	r Ó T	- 	Ι ,	1	(24
(24b)m= 0		0	0	0	0	0	0	0	0	0	0		(24
c) If whole h if (22b)n					•				5 × (23h	n)			
(24c)m = 0	0.0 %	0	0	0	0	0	0	0	0	0	0]	(24
d) If natural	ventilatio	on or wh	ole hous	e positiv	Le input	L ventilatio	on from	I loft	<u> </u>	<u>!</u>	ļ.	J	
if (22b)n				•	•				0.5]				
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	ld) in bo	x (25)				_	
(25)m= 0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25		(25
3. Heat losse	s and he	eat loss i	paramete	ār.									
ELEMENT	Gros	·	Openin		Net Ar	ea	U-val	ue	AXU		k-value	e A	Χk
	area	(m²)	' m		A ,r	m²	W/m2	2K	(W/I	K)	kJ/m²-l	K k	J/K
Doors					2	X	1.4	=	2.8				(26
Windows Type) 1				1.696	₃ x1	/[1/(1.4)+	- 0.04] =	2.25				(27
Windows Type	2				11.46	4 x1	/[1/(1.4)+	- 0.04] =	15.2				(27
Floor					11.68	3 x	0.12	=	1.4016				(28
Walls Type1	45.7	'3	13.16	3	32.57	7 X	0.15	=	4.89				(29
Walls Type2	28.8	39	2		26.89) x	0.14	=	3.81				(29
Roof	75.4	18	0		75.48	3 x	0.1	=	7.55				(30
Total area of e	lements	, m²			161.7	8							 (31
* for windows and	roof wind	ows, use ϵ	effective wi	ndow U-va	alue calcui	ated using	g formula :	1/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	1 3.2	
** include the area				s and par	titions		(00) (00) . (20)					_
Fabric heat los		•	U)				(26)(30		(00) (0)	a) (aa)	(00.)	37.89	(33
Heat capacity	,		0	TEA) :	. 1. 1/ 21/			***	(30) + (32	, , ,	(32e) =	2387.77	(34
Thermal mass	•	•		,			raajaalu th		tive Value		oblo 1f	100	(35
For design assess can be used instea				CONSTRUCT	ion are no	i kriowri pi	recisely in	e maicauve	e values oi	TIVIPIIIT	аые п		
	es : S (L	x Y) cal	culated ι	using Ap	pendix l	K						20.9	(36
Thermal bridge		are not kn	own (36) =	= 0.05 x (3	1)								
•	al bridging							(33) +	(36) =			58.79	(37
if details of therma													
if details of therma Total fabric he	at loss	alculated	l monthly	/				(38)m	= 0.33 × (25)m x (5)	1	
if details of therma Total fabric hea Ventilation hea	at loss at loss ca Feb	alculated Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
if details of therma Total fabric hea Ventilation hea	at loss	alculated	– í		Jun 14.07	Jul 14.07	Aug 13.87	1	1		<u> </u>		(38
	at loss at loss ca Feb 16.45	Mar 16.25	Apr	May	-	-		Sep 14.46	Oct	Nov 15.46	Dec		(38

Heat loss p	arameter (HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1	1	0.99	0.98	0.98	0.97	0.97	0.96	0.97	0.98	0.98	0.99		
	<u>'</u>		ı	ı			l		Average =	Sum(40) ₁ .	12 /12=	0.98	(40)
Number of	- i	onth (Tab	le 1a)		ı	·		ı					
Ja		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 h	eating ene	rgy requ	irement:								kWh/ye	ar:	
	ccupancy, 13.9, N = 1 13.9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	TFA -13		37		(42)
Annual ave Reduce the ar not more that	nnual average	e hot water	usage by	5% if the c	lwelling is	designed t			se target o		.29		(43)
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usa								- 1		· · ·			
(44)m= 104.	82 101.01	97.2	93.38	89.57	85.76	85.76	89.57	93.38	97.2	101.01	104.82		
		!	<u> </u>	<u> </u>	ļ.	ļ.	<u> </u>		Total = Su	m(44) ₁₁₂ =	=	1143.47	(44)
Energy conter	nt of hot wate	r used - cal	culated m	onthly = 4.	190 x Vd,r	n x nm x C	Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 155.	44 135.95	140.29	122.31	117.36	101.27	93.84	107.68	108.97	127	138.63	150.54		
W. in a faculty of a second		·			()		h (40		Total = Su	m(45) ₁₁₂ =	= [1499.27	(45)
If instantaneou		-	· `	not water	r storage), r	·	DOXES (46)	, , , -		1	· · · · · · · · · · · · · · · · · · ·		
(46)m= 23.3 Water stora		21.04	18.35	17.6	15.19	14.08	16.15	16.35	19.05	20.79	22.58		(46)
Storage vol	-) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If communit	,					_					<u> </u>		(,
Otherwise i				•			. ,	ers) ente	er '0' in ((47)			
Water stora	ge loss:												
a) If manuf	acturer's c	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperatur	e factor fro	om Table	2b								0		(49)
Energy lost		•					(48) x (49)) =		1	10		(50)
b) If manuf			-								1		(54)
Hot water s If communit	•			ie z (KVV	n/iitre/ua	iy)				0.	02		(51)
Volume fac			011 4.0							1.	03		(52)
Temperatur	e factor fro	om Table	2b							-	.6		(53)
Energy lost	from wate	r storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	1.	03		(54)
Enter (50)		_									03		(55)
Water stora	ge loss ca	lculated ¹	for each	month			((56)m = ((55) × (41)	m				
(56)m= 32.0	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 cont		ed solar sto	rage, (57)	<u>I</u> m = (56)m		<u>L</u> H11)] ÷ (5	<u>l</u> 0), else (5	<u>I</u> 7)m = (56)	m where (H11) is fro	m Appendi	хН	
(57)m= 32.0)1 28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circ	ruit loss (a	nnual) fr	m Tahla	·				•			0		(58)
Primary circ	`	,			59)m = ((58) ÷ 36	65 × (41)	ım					, ,
•	by factor			,	•	. ,	, ,		r thermo	stat)			
(59)m= 23.2	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 cal	culated	for each	month (61)m =	(60) ÷ 3	65 × (41)m						
(61)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(61)
Total heat requ	uired for	water he	eating ca	alculated	for eac	h month	(62)n	n = 0.85 ×	 (45)m +	(46)m +	(57)m +	ı (59)m + (61)m	
(62)m= 210.72	185.88	195.57	175.8	172.63	154.76	149.12	162.9		182.27	192.12	205.81]	(62)
Solar DHW input o	alculated	using App	endix G or	· Appendix	H (negat	ive quantity	/) (ente	r '0' if no sola	ır contribu	tion to wate	er heating)	ı	
(add additional	lines if	FGHRS	and/or V	vwhrs	applies	s, see Ap	pendi	x G)					
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0		(63)
Output from wa	ater hea	ter						•	•		•		
(64)m= 210.72	185.88	195.57	175.8	172.63	154.76	149.12	162.9	96 162.46	182.27	192.12	205.81		
						•	C	Output from w	ater heate	er (annual)	l12	2150.11	(64)
Heat gains fror	n water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	5 × (45)m	+ (61)m] + 0.8	x [(46)m	+ (57)m	+ (59)m	ı]	
(65)m= 95.91	85.15	90.87	83.46	83.24	76.47	75.42	80.08	3 79.03	86.45	88.89	94.28		(65)
include (57)r	m in calc	culation of	of (65)m	only if c	ylinder	is in the o	dwellir	ng or hot w	ater is f	rom com	munity h	neating	
5. Internal ga	ins (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= 118.58	118.58	118.58	118.58	118.58	118.58	118.58	118.5	58 118.58	118.58	118.58	118.58		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m= 19.2	17.05	13.87	10.5	7.85	6.63	7.16	9.31	12.49	15.86	18.51	19.73		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m= 209.74	211.92	206.43	194.76	180.02	166.17	156.91	154.7	74 160.22	171.9	186.64	200.49	1	(68)
Cooking gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a), also	see Table	5	•		•	
(69)m= 34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.8	6 34.86	34.86	34.86	34.86	1	(69)
Pumps and far	ns gains	(Table 5	ōa)			•		I					
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(70)
Losses e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)						!		
(71)m= -94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.8	6 -94.86	-94.86	-94.86	-94.86	1	(71)
Water heating	gains (T	able 5)										•	
(72)m= 128.91	126.7	122.13	115.92	111.89	106.2	101.38	107.5	6 109.76	116.19	123.46	126.71]	(72)
Total internal	gains =				(66	5)m + (67)m	ı + (68)	m + (69)m +	(70)m + (71)m + (72))m	ı	
(73)m= 416.42	414.25	401.01	379.75	358.33	337.57	324.02	330.1	18 341.05	362.52	387.17	405.51	1	(73)
6. Solar gains	S:						•			1			
Solar gains are c	alculated	using sola	r flux from	Table 6a	and assoc	ciated equa	itions to	convert to the	ne applica	ble orienta	tion.		
Orientation: A			Area		Flu			_ g	_	FF		Gains	
I	able 6d		m²		Ta	ble 6a		Table 6b	1	able 6c		(W)	_
Northeast _{0.9x}	0.77	Х	1.	7	х	11.28	x	0.63	x	0.7	=	5.85	(75)
Northeast _{0.9x}	0.77	х	1.	7	х	22.97	x	0.63	x [0.7	=	11.9	(75)
Northeast _{0.9x}	0.77	X	1.	7	х	41.38	_ x	0.63	x	0.7	=	21.45	(75)
Northeast _{0.9x}	0.77	X	1.	7	x	67.96	x	0.63	x	0.7	=	35.22	(75)
Northeast _{0.9x}	0.77	X	1.	7	X	91.35	X	0.63	x	0.7	=	47.35	(75)

										_				_
Northeast _{0.9x}	0.77	X	1.7	7	X	9	7.38	X	0.63	X	0.7	=	50.48	(75)
Northeast _{0.9x}	0.77	X	1.7	7	X	9	91.1	X	0.63	X	0.7	=	47.22	(75)
Northeast _{0.9x}	0.77	X	1.	7	X	7	2.63	X	0.63	X	0.7	=	37.64	(75)
Northeast _{0.9x}	0.77	X	1.7	7	X	5	0.42	X	0.63	X	0.7	=	26.13	(75)
Northeast _{0.9x}	0.77	X	1.7	7	X	2	8.07	X	0.63	X	0.7	=	14.55	(75)
Northeast _{0.9x}	0.77	X	1.7	7	X		14.2	x	0.63	X	0.7	=	7.36	(75)
Northeast _{0.9x}	0.77	X	1.7	7	X	,	9.21	x	0.63	x	0.7	=	4.78	(75)
Southeast 0.9x	0.77	X	11.	46	X	3	6.79	x	0.63	X	0.7	=	128.91	(77)
Southeast 0.9x	0.77	X	11.4	46	X	6	2.67	x	0.63	x	0.7	=	219.58	(77)
Southeast 0.9x	0.77	X	11.	46	X	8	35.75	x	0.63	x	0.7	=	300.44	(77)
Southeast _{0.9x}	0.77	X	11.	46	X	1	06.25	x	0.63	х	0.7	=	372.26	(77)
Southeast _{0.9x}	0.77	X	11.	46	X	1	19.01	x	0.63	x	0.7	=	416.96	(77)
Southeast _{0.9x}	0.77	X	11.	46	X	1	18.15	x	0.63	x	0.7	=	413.94	(77)
Southeast _{0.9x}	0.77	X	11.	46	X	1	13.91	x	0.63	x	0.7	=	399.09	(77)
Southeast _{0.9x}	0.77	X	11.	46	X	1	04.39	x	0.63	x	0.7		365.74	(77)
Southeast 0.9x	0.77	x	11.	46	X	9	2.85	х	0.63	x	0.7	=	325.31	(77)
Southeast 0.9x	0.77	х	11.	46	X	6	9.27	х	0.63	x	0.7	=	242.68	(77)
Southeast 0.9x	0.77	X	11.	46	X	4	4.07	x	0.63	x	0.7		154.4	(77)
Southeast 0.9x	0.77	x	11.	46	X	3	31.49	x	0.63	x	0.7	=	110.32	(77)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m														
(83)m= 134.76		321.89	407.48	464.31	_	64.42	446.31	403	.38 351.45	257.2	3 161.76	115.1		(83)
Total gains – i			` 		Ť						-		7	(0.4)
(84)m= 551.18	645.73	722.9	787.23	822.63	8	01.99	770.33	733	.56 692.49	619.7	5 548.94	520.6		(84)
7. Mean inter	nal tempe	rature ((heating	seasor	า)									_
Temperature	during hea	ating p	eriods ir	the liv	ing	area	from Tal	ole 9,	Th1 (°C)				21	(85)
Utilisation fac	 -				n (s	ee Ta	ble 9a)		-			1	7	
Jan	Feb	Mar	Apr	May	+	Jun	Jul	-	ug Sep	Oct	+	Dec	_	(22)
(86)m= 0.94	0.92	0.87	0.79	0.67		0.52	0.4	0.4	3 0.62	0.82	0.92	0.95		(86)
Mean interna	l temperat	ure in I	iving are	ea T1 (f	ollo	w ste	ps 3 to 7	7 in T	able 9c)				-	
(87)m= 19.15	19.45	19.85	20.31	20.66	2	20.88	20.96	20.	95 20.81	20.34	19.67	19.1		(87)
Temperature	during hea	ating p	eriods ir	rest of	dw	elling	from Ta	able 9	9, Th2 (°C)				_	
(88)m= 20.08	20.09	20.09	20.1	20.1	2	20.11	20.11	20.	11 20.11	20.1	20.1	20.09		(88)
Utilisation fac	tor for gain	ns for r	est of d	welling,	h2	,m (se	e Table	9a)						
(89)m= 0.94	0.9	0.85	0.76	0.63		0.47	0.32	0.3	0.56	0.79	0.9	0.95		(89)
Mean interna	l temperat	ure in t	he rest	of dwel	lina	T2 (f	ollow ste	eps 3	to 7 in Tabl	e 9c)			=	
(90)m= 17.62		18.61	19.25	19.73	Ť	20.01	20.09	20.	1	19.31	18.37	17.54		(90)
		!			-				1	LA = Liv	/ing area ÷ (⁴	4) =	0.31	(91)
Mean interna	l temperat	ure (fo	r the wh	റില ർഷം	ماالد	a) – fl	Δ γ Τ1	+ (1	_ fl Δ) ∨ Τ2					
(92)m= 18.09	 	18.99	19.58	20.02	$\overline{}$	9) – 11 20.28	20.36	20.	- i	19.63	18.77	18.02	7	(92)
Apply adjustr								l		<u> </u>		<u> </u>	_	` '
1 12.7 2.00,0.00								,	266.	,				

												•	
(93)m= 18.09	18.48	18.99	19.58	20.02	20.28	20.36	20.35	20.19	19.63	18.77	18.02		(93)
8. Space hea													
Set Ti to the the utilisation			•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fac	l		· ·		<u> </u>								
(94)m= 0.92	0.88	0.83	0.74	0.63	0.48	0.34	0.38	0.57	0.77	0.88	0.93		(94)
Useful gains,	hmGm	, W = (9	4)m x (8	4)m	•								
(95)m= 504.87	568.52	598.79	586.06	515.85	382.32	264.96	275.42	392.33	477.03	483.97	481.71		(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	i			 	- ,	- ` 	<u> </u>				Ī	(07)
	1021.43	937.4	790.79	614.25	413.67	273.73	286.93	446.2	666.92	866.8	1031.85		(97)
Space heatin	g require	251.93	r each n	73.21	/Vh/mon	$\ln = 0.02$	24 x [(97])m – (95 0)m] x (4 141.28	1)m 275.64	409.3		
(98)m= 398.48	304.33	201.90	147.41	73.21		U				<u> </u>	l	2004.6	(98)
							rota	l per year	(kvvn/year) = Sum(9	8)15,912 =	2001.6	╡``
Space heatin	g requir	ement in	kWh/m²	² /year								26.52	(99)
9b. Energy red	quiremer	nts – Coi	mmunity	heating	scheme								
This part is us Fraction of spa										unity sch	neme.	0	7(201)
·			•		-	_	(Table T	1) 0 11 11	one			0	(301)
Fraction of space heat from community system 1 – (301) =									1	(302)			
The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.													
Fraction of hea		-			rom power	Stations.	see Appei	iuix C.				1	(303a)
Fraction of total			•		oilers				(3	02) x (303	a) =	1	(304a)
Factor for conf	trol and	charging	method	(Table	4c(3)) fo	r commı	unity hea	iting sys	tem			1	(305)
Distribution los	ss factor	(Table 1	2c) for (commun	ity heatii	ng syste	m					1.05	(306)
Space heating	g											kWh/yea	 r
Annual space	heating	requiren	nent									2001.6	
Space heat fro	m Com	munity b	oilers					(98) x (30	04a) x (30	5) x (306)	=	2101.68	(307a)
Efficiency of se	econdar	y/supple	mentary	heating	system	in % (fro	om Table	4a or A	ppendix	E)		0	(308
Space heating	require	ment fro	m secon	dary/su	oplemen	tary sys	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water heating	3												
Annual water		equirem	ent									2150.11	
If DHW from c											·		_
Water heat fro		•								5) x (306) :		2257.62	(310a)
Electricity used							0.01	× [(307a).	(307e) +	· (310a)((310e)] =	43.59	(313)
Cooling System	_	•	•					(10 -)	(2.4.1)			0	(314)
Space cooling	,			•		,		= (107) ÷	(314) =			0	(315)
Electricity for p mechanical ve							outeido				į	202.52	(330a)
mechanical ve	าเแสแบก	- paiaii(eu, exilî	aui ui pi	onuve III	out 110111	outside					293.53	(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) =	293.53	(331)
Energy for lighting (calculated in Appendix L)			339.07	(332)
Electricity generated by PVs (Appendix M) (negative quanti	ty)		-765.71	(333)
Electricity generated by wind turbine (Appendix M) (negative	e quantity)		0	(334)
12b. CO2 Emissions – Community heating scheme				
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CI Efficiency of heat source 1 (%) If there is CHP	HP) Pusing two fuels repeat (363) to	(366) for the second fue	94	(367a)
CO2 associated with heat source 1 [(30	07b)+(310b)] x 100 ÷ (367b) x	0.22	1001.71	(367)
Electrical energy for heat distribution	[(313) x	0.52	22.62	(372)
Total CO2 associated with community systems	(363)(366) + (368)(37	2) =	1024.34	(373)
CO2 associated with space heating (secondary)	(309) x	0 =	0	(374)
CO2 associated with water from immersion heater or instan	ntaneous heater (312) x	0.22	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =		1024.34	(376)
CO2 associated with electricity for pumps and fans within d	welling (331)) x	0.52	152.34	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	175.98	(379)
Energy saving/generation technologies (333) to (334) as ap Item 1	pplicable	0.52 x 0.01 =	-397.41	(380)
Total CO2, kg/year sum of (376)(382) =			955.25	(383)
Dwelling CO2 Emission Rate (383) ÷ (4) =			12.66	(384)
El rating (section 14)			89.38	(385)

SAP 2012 Overheating Assessment

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

Property Details: Plot 49

Dwelling type:FlatLocated in:EnglandRegion:Thames valley

Cross ventilation possible: No Number of storeys: 1

Front of dwelling faces: North East

Overshading: Average or unknown

None

Thermal mass parameter: Indicative Value Low

False

Night ventilation: Blinds, curtains, shutters:

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

Overheating Details

Summer ventilation heat loss coefficient: 249.09 (P1)

Transmission heat loss coefficient: 58.8

Summer heat loss coefficient: 307.89 (P2)

Overhangs:

Overhangs:

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

North East (NE) 0 1 South East (SE) 0 1

Solar shading:

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

Solar gains:

Orientation		Area	Flux	g _	FF	Shading	Gains
North East (NE)	0.9 x	1.7	98.85	0.63	0.7	0.9	59.88
South East (SE)	0.9 x	11.46	119.92	0.63	0.7	0.9	491.09
						Total	550.97 (P3/P4)

Internal gains:

	June	July	August
Internal gains	469.81	452.5	460.81
Total summer gains	1049.98	1003.48	967.92 (P5)
Summer gain/loss ratio	3.41	3.26	3.14 (P6)
Mean summer external temperature (Thames valley)	16	17.9	17.8
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.71	22.46	22.24 (P7)
Likelihood of high internal temperature	Slight	Medium	Medium

Assessment of likelihood of high internal temperature: Medium

		User_[Details:						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa					0001082 on: 1.0.5.9	
		Property	Address	: Plot 49					
Address :									
1. Overall dwelling dime	ensions:								
One world floor			ea(m²)	1,, ,	Av. He	• • •	_	Volume(m ³	<u>^</u>
Ground floor			75.48	(1a) x	2	2.5	(2a) =	188.71	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	75.48	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	188.71	(5)
2. Ventilation rate:									
	main seconda heating heating		other		total			m³ per hou	r
Number of chimneys	0 + 0	+	0	=	0	×	40 =	0	(6a)
Number of open flues	0 + 0	Ħ + F	0		0	<u> </u>	(20 =	0	(6b)
Number of intermittent fa	ins			_	3	,	c 10 =	30	(7a)
Number of passive vents				L	0		(10 =	0	(7b)
Number of flueless gas fi				L			(40 =		╡` `
Number of flueless gas in	1165				0		(40 =	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+	(7a)+(7b)+	(7c) =	Γ	30		÷ (5) =	0.16	(8)
	peen carried out or is intended, proce			continue fi		(16)		00	``
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration						[(9	9)-1]x0.1 =	0	(10)
	.25 for steel or timber frame or resent, use the value corresponding			•	ruction			0	(11)
deducting areas of openi	•	io ine grea	iler wall are	a (aner					
If suspended wooden	floor, enter 0.2 (unsealed) or (0.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en								0	(13)
•	s and doors draught stripped		0.05 10.0		1001			0	(14)
Window infiltration			0.25 - [0.2			. (15) -		0	(15)
Infiltration rate	q50, expressed in cubic metr	oc nor h			12) + (13) ·		o aroa	0	= (16)
	lity value, then $(18) = [(17) \div 20] +$	•	•	•	ielie oi e	rivelop	e area	0.31	(17)
•	es if a pressurisation test has been do				is being u	sed		0.31	(10)
Number of sides sheltered	ed							2	(19)
Shelter factor			(20) = 1 -	[0.075 x (19)] =			0.85	(20)
Infiltration rate incorporate	•		(21) = (18	s) x (20) =				0.26	(21)
Infiltration rate modified f			_			1	_	1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	- 1 1 - 1	_	1	•	•	1		1	
(22)m= 5.1 5	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2	2)m ÷ 4								
	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		
<u> </u>		•	1					1	

0.33	ation rat	e (allowi	0.29	0.28	0.25	0.25	(21a) X 0.24	` 	0.20	0.3	0.24	1	
Calculate effe	1				1		0.24	0.26	0.28	0.3	0.31		
If mechanic	al ventila	ition:										0	(23a
If exhaust air h	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(23
If balanced wit	h heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				0	(230
a) If balance	ed mech	anical ve	ntilation	with he	at recove	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(248
b) If balance	1				1		ЛV) (24b	m = (22)	2b)m + (2	23b)		1	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h if (22b)r		tract ven < (23b), t		-	-				5 × (23b	o)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)r		on or when (24d)							0.5]			•	
(24d)m= 0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55		(24
Effective air	change	rate - er	iter (24a) or (24k	o) or (24	c) or (24	d) in box	(25)					
(25)m= 0.56	0.55	0.55	0.54	0.54	0.53	0.53	0.53	0.53	0.54	0.54	0.55		(25)
3. Heat losse	s and he	at loss r	naramete	⊃r·									
ELEMENT	Gros	·	Openin		Net Ar	ea	U-valı	IE.	AXU		k-value	_ Δ	Xk
LLLIVILINI	area		m		A ,r		W/m2		(W/I	〈)	kJ/m²·l		J/K
Doors					2	х	1.4	=	2.8				(26)
Windows Type	e 1				1.696	x1.	/[1/(1.4)+	0.04] =	2.25				(27)
Windows Type	e 2				11.46	4 x1	/[1/(1.4)+	0.04] =	15.2				(27)
Floor					11.68	3 x	0.12	=	1.4016	<u> </u>			(28)
Walls Type1	45.7	'3	13.10	6	32.57	, x	0.15	=	4.89	= [(29)
Walls Type2	28.8	39	2		26.89) x	0.14	=	3.81				(29)
Roof	75.4	H8	0	=	75.48	3 x	0.1	= i	7.55	₹ i			(30)
Total area of	elements	, m²			161.7	8							(31)
* for windows and	l roof wind	ows, use e	ffective wi	ndow U-va	alue calcul	ated using	formula 1	/[(1/U-valu	e)+0.04] a	s given in	paragraph	n 3.2	
** include the are				ls and par	titions								
Fabric heat lo		•	U)				(26)(30)	+ (32) =				37.89	(33)
Heat capacity								((28)	.(30) + (32	2) + (32a).	(32e) =	2387.77	(34)
Thermal mass	•	•		•					tive Value			100	(35)
For design asses can be used inste				construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in Ta	able 1f		
Thermal bridg				using Ap	pendix l	<						20.9	(36)
_	•	,			•								
if details of therm	at loss							(33) +	(36) =			58.79	(37)
				,				(38)m	= 0.33 × (25)m x (5))	,	
Total fabric he	at loss ca	alculated	monthly	<u>/</u>								i .	
Total fabric he	at loss ca	alculated Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Total fabric he	1				Jun 33.07	Jul 33.07	Aug 32.97	Sep 33.28	Oct 33.62	Nov 33.85	Dec 34.1		(38)
Total fabric he Ventilation he Jan	Feb 34.49	Mar 34.36	Apr	May	-		Ť	33.28		33.85	<u> </u>		(38)
Total fabric he Ventilation he Jan (38)m= 34.63	Feb 34.49	Mar 34.36	Apr	May	-		Ť	33.28	33.62	33.85	<u> </u>		(38

Heat loss para	meter (l	-II P) \//	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.24	1.24	1.23	1.23	1.22	1.22	1.22	1.22	1.22	1.22	1.23	1.23		
(13)		0	20						<u> </u>	: Sum(40) _{1.}		1.23	(40)
Number of day	s in mo	nth (Tab	le 1a)						rorago	G a(10)1.		20	
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						I	
4 10/2/2012 201	•										1.30/1.7		
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occur if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13		37		(42)
Annual averag Reduce the annua	ıl average	hot water	usage by	5% if the α	lwelling is	designed t			se target o		.29		(43)
not more that 125	litres per	person per	day (all w	ater use, l	not and co	ld)							
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	n litres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m= 104.82	101.01	97.2	93.38	89.57	85.76	85.76	89.57	93.38	97.2	101.01	104.82		
		•		-		•				ım(44) ₁₁₂ =		1143.47	(44)
Energy content of	hot water	used - cal	culated mo	onthly $= 4$.	190 x Vd,r	n x nm x C	Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 155.44	135.95	140.29	122.31	117.36	101.27	93.84	107.68	108.97	127	138.63	150.54		
					, ,				Total = Su	ım(45) ₁₁₂ =	=	1499.27	(45)
If instantaneous w	ater neati	ng at point	of use (no	not water	storage),	enter 0 in	boxes (46)) to (61)	ī			1	
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage Storage volum		\ inaludin	a opv o	olor or M	WHDC	otorogo	within oc	ama vaa	ool			1	(47)
•	` '		-			•		airie ves	SEI		0		(47)
If community h Otherwise if no	•			•			` '	ars) ante	ar '∩' in <i>(</i>	(47)			
Water storage		not wate	, (till3 li	iciaacs i	iistaiitai	icous co	THE BOIL	Cray Crite) O III ((77)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperature fa					`	,					0		(49)
Energy lost fro				ear			(48) x (49)) =			0		(50)
b) If manufact		_	-		or is not		(10)11(10)				O .		(00)
Hot water stora	age loss	factor fr	om Tabl	e 2 (kW	h/litre/da	ay)					0		(51)
If community h	•		on 4.3										
Volume factor			0.1								0		(52)
Temperature fa											0		(53)
Energy lost fro		•	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (,									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)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	•	•									0		(58)
Primary circuit				,	•	. ,	, ,						
(modified by				i					i			l	/==:
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$														
(61)m= 0	0	0	0	0	0	0) 0		0	0	0	0]	(61)
	ired for	water he	eating ca	alculated	l for ead	h month	(62)r	 n =	0.85 × (′45)m +	(46)m +	(57)m +	ı · (59)m + (61)m	
(62)m= 132.13	115.56	119.25	103.96	99.75	86.08	79.77	91.5	_	92.63	107.95	117.83	127.96	1	(62)
Solar DHW input ca	alculated i	using App	endix G or	· Appendix	H (nega	tive quantity	y) (ent	er '0'	if no sola	r contribu	tion to wate	er heating)	.)	
(add additional	lines if I	FGHRS	and/or V	VWHRS	applies	s, see Ap	pend	ix G	3)					
(63)m= 0	0	0	0	0	0	0	0		0	0	0	0]	(63)
Output from wa	ater heat	ter											_	
(64)m= 132.13	115.56	119.25	103.96	99.75	86.08	79.77	91.5	53	92.63	107.95	117.83	127.96		_
								Outp	out from wa	ater heate	er (annual)	112	1274.38	(64)
Heat gains fron	n water	heating,	kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	+ (6	1)m] + 0.8 x	(46)m	+ (57)m	+ (59)m	<u>[</u>]	
(65)m= 33.03	28.89	29.81	25.99	24.94	21.52	19.94	22.8	38	23.16	26.99	29.46	31.99]	(65)
include (57)n	n in calc	ulation	of (65)m	only if c	ylinder	is in the o	dwelli	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal ga	ins (see	Table 5	and 5a):										
Metabolic gains	s (Table	5), Wat	ts								_		_	
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	Jg	Sep	Oct	Nov	Dec		
(66)m= 118.58	118.58	118.58	118.58	118.58	118.58	118.58	118.	.58	118.58	118.58	118.58	118.58]	(66)
Lighting gains ((calculat	ed in Ap	pendix	L, equat	ion L9 d	or L9a), a	lso s	ee 7	Table 5				_	
(67)m= 19.2	17.05	13.87	10.5	7.85	6.63	7.16	9.3	1	12.49	15.86	18.51	19.73]	(67)
Appliances gair	ns (calcı	ulated in	Append	dix L, eq	uation I	_13 or L1	3a), a	also	see Tal	ble 5				
(68)m= 209.74	211.92	206.43	194.76	180.02	166.17	156.91	154.	.74	160.22	171.9	186.64	200.49]	(68)
Cooking gains	(calcula	ted in Ap	pendix	L, equat	ion L15	or L15a), also	o se	e Table	5				
(69)m= 34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.8	36	34.86	34.86	34.86	34.86]	(69)
Pumps and fan	s gains	(Table 5	ia)										_	
(70)m= 0	0	0	0	0	0	0	0		0	0	0	0]	(70)
Losses e.g. eva	aporatio	n (negat	ive valu	es) (Tab	le 5)									
(71)m= -94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.	86	-94.86	-94.86	-94.86	-94.86]	(71)
Water heating	gains (T	able 5)											_	
(72)m= 44.4	42.99	40.07	36.1	33.52	29.89	26.8	30.7	76	32.16	36.27	40.91	43]	(72)
Total internal	gains =				(66	6)m + (67)m	n + (68)m +	- (69)m + ((70)m + (7	71)m + (72))m	_	
(73)m= 331.91	330.54	318.95	299.93	279.96	261.25	249.45	253.	.37	263.45	282.6	304.63	321.79]	(73)
6. Solar gains														
Solar gains are ca		Ü				•	tions t	0 CO	nvert to th	e applica		tion.		
Orientation: A	ccess F able 6d	actor	Area m²		Fli Ta	ux ıble 6a		т	g_ able 6b	т	FF able 6c		Gains (W)	
							, r			_ '			. ,	1
Northeast 0.9x	0.77	X	1.	==	X	11.28	X		0.63	_ ×	0.7	=	5.85	(75)
Northeast 0.9x	0.77	X	1.	7	X	22.97	X		0.63	_ ×	0.7	=	11.9	(75)
Northeast 0.9x	0.77	×	1.			41.38	X		0.63	x	0.7	=	21.45	(75)
Northeast 0.9x	0.77	X	1.	7	X	67.96	X		0.63	_ ×	0.7	=	35.22	(75)
Northeast _{0.9x}	0.77	X	1.	7	Х	91.35	X		0.63	X	0.7	=	47.35	(75)

		_					, ,		_				_
Northeast _{0.9x}	0.77	×	1.	7	X	97.38	X	0.63	X	0.7	=	50.48	(75)
Northeast _{0.9x}	0.77	X	1.	7	X	91.1	X	0.63	X	0.7	=	47.22	(75)
Northeast _{0.9x}	0.77	×	1.	7	X	72.63	X	0.63	X	0.7	=	37.64	(75)
Northeast _{0.9x}	0.77	X	1.	7	X	50.42	X	0.63	X	0.7	=	26.13	(75)
Northeast _{0.9x}	0.77	X	1.	7	X	28.07	x	0.63	X	0.7	=	14.55	(75)
Northeast _{0.9x}	0.77	X	1.	7	X	14.2	x	0.63	X	0.7	=	7.36	(75)
Northeast 0.9x	0.77	X	1.	7	x	9.21	x	0.63	X	0.7	=	4.78	(75)
Southeast 0.9x	0.77	x	11.	46	x	36.79	x	0.63	X	0.7	=	128.91	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	62.67	x	0.63	X	0.7	=	219.58	(77)
Southeast 0.9x	0.77	X	11.	46	x	85.75	x	0.63	X	0.7	=	300.44	(77)
Southeast _{0.9x}	0.77	X	11.	46	X	106.25	x	0.63	X	0.7	=	372.26	(77)
Southeast _{0.9x}	0.77	x	11.	46	X	119.01	x	0.63	X	0.7	=	416.96	(77)
Southeast _{0.9x}	0.77	x	11.	46	X	118.15	x	0.63	X	0.7	=	413.94	(77)
Southeast _{0.9x}	0.77	X	11.	46	X	113.91	x	0.63	X	0.7	=	399.09	(77)
Southeast _{0.9x}	0.77	x	11.	46	X	104.39	x	0.63	x	0.7	=	365.74	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	92.85	x	0.63	×	0.7	=	325.31	(77)
Southeast _{0.9x}	0.77	×	11.	46	x	69.27	x	0.63	×	0.7	_ =	242.68	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	44.07	x	0.63	x	0.7		154.4	(77)
Southeast _{0.9x}	0.77	×	11.	46	x	31.49	x	0.63	×	0.7	=	110.32	(77)
Solar gains in						1	ì	= Sum(74)m .			ī	1	(0.0)
(83)m= 134.76		1.89	407.48	464.31	464.42		403	.38 351.45	257.23	3 161.76	115.1		(83)
Total gains – i		solar _{0.83}		<u> </u>	` ´ ´		050	75 044.00	500.00	2 100 00	100.00	1	(0.4)
(84)m= 466.67	562.02 64	0.83	707.41	744.27	725.68	695.75	656	.75 614.89	539.83	3 466.39	436.89]	(84)
7. Mean inter			, ,		<i>′</i>								_
Temperature	ŭ	٠.			Ū		ble 9,	Th1 (°C)				21	(85)
Utilisation fac					` 					T	l _	1	
Jan	 	Mar	Apr	May	Jun	Jul	 	ug Sep	Oct	+	Dec		(0.0)
(86)m= 0.97	0.94 0	.91	0.85	0.76	0.64	0.51	0.5	0.73	0.88	0.95	0.97		(86)
Mean interna	l temperatui	re in I	iving ar	ea T1 (f	ollow st	eps 3 to 7	7 in T	able 9c)			1	1	
(87)m= 18.45	18.77 19	9.24	19.81	20.33	20.71	20.88	20.8	86 20.57	19.88	19.05	18.38		(87)
Temperature	during heat	ing p	eriods ir	n rest of	dwellin	g from Ta	able 9	9, Th2 (°C)					
(88)m= 19.89	19.89 19	9.89	19.9	19.9	19.91	19.91	19.9	91 19.9	19.9	19.9	19.9		(88)
Utilisation fac	tor for gains	s for r	est of d	welling,	h2,m (s	ee Table	9a)					_	
(89)m= 0.96	0.94).9	0.83	0.72	0.56	0.4	0.4	5 0.66	0.86	0.94	0.97		(89)
Mean interna	l temperatu	re in t	he rest	of dwell	ina T2 (follow ste	eps 3	to 7 in Tabl	e 9c)	-	•	•	
(90)m= 17.57	 	3.35	18.91	19.39	19.73	19.85	19.8		18.98	18.17	17.51]	(90)
		!		!			-	f	LA = Liv	∕ing area ÷ (⁴	4) =	0.31	(91)
Mean interna	l temneratu	re (fo	r the wh	ole dwa	lling) –	fl Δ √ Τ1	+ (1	_ fl Δ\ ∨ Τ≎					
(92)m= 17.84		3.62	19.19	19.68	20.03	20.17	20.		19.26	18.45	17.78	1	(92)
(,					20.00	20.17	20	ו השון כן					
Apply adjustr				l	l		ļ				17.70	J	(02)

(93)m=	17.84	18.16	18.62	19.19	19.68	20.03	20.17	20.15	19.91	19.26	18.45	17.78		(93)
8. Spa	ce heat	ting requ	uirement											
Set Ti	to the r	nean int	ernal ter	mperatu	re obtair	ned at st	ep 11 of	Table 9b	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
			or gains	•					,	, ,	,			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisat	tion fac	tor for g	ains, hm]:										
(94)m=	0.95	0.92	0.88	0.81	0.71	0.57	0.43	0.47	0.66	0.84	0.92	0.95		(94)
Useful	gains,	hmGm ,	W = (94	4)m x (8	4)m	-					=			
(95)m=	441.48	516.4	562.88	574.17	529.97	416.15	300.11	308.57	408.39	452.64	430.54	416.33		(95)
Monthl	ly avera	age exte	rnal tem	perature	from T	able 8	•	•			•			
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat Id	oss rate	for mea	an intern	al tempe	erature,	Lm , W =	=[(39)m	x [(93)m	– (96)m]	•			
(97)m=	1265.28	1236.81	1129.21	951.78	737.55	498.84	328.16	344.38	534.67	800.35	1051.12	1261.4		(97)
Space	heating	g require	ement fo	r each n	nonth, k	Wh/mon	th = 0.02	24 x [(97)	m – (95)m] x (4	1)m			
(98)m=	612.91	484.12	421.35	271.88	154.44	0	0	0	0	258.7	446.82	628.73		
_								Tota	l per year	(kWh/yeaı) = Sum(9	8) _{15,912} =	3278.95	(98)
Snace	heating	a require	ement in	k\/\/h/m²	2/vear								43.44	(99)
·					/ycai								43.44	
			luiremen											
Calcula			July and					Ι.			I			
L	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
						†	1	and exte						(4.00)
(100)m=	0	0	0	0	0	863.54	679.81	697.42	0	0	0	0		(100)
_	1	tor for lo		i	i			ı			i	i ı		(10.1)
(101)m=	0	0	0	0	0	0.74	0.81	0.78	0	0	0	0		(101)
Useful	loss, h	mLm (V	/atts) = ((100)m x	(101)m	1	, 				T	1		
(102)m=	0	0	0	0	0	642.8	549.13	547.44	0	0	0	0		(102)
	(solar g	gains ca	lculated	for appli	cable w	1		e Table	10)					
(103)m=	0	0	0	0	0	936.32	899.59	855.49	0	0	0	0		(103)
						dwelling,	continu	ous (kW	h') = 0.02	24 x [(10	03)m – (102)m] x	c (41)m	
· -			104)m <		i	1 044 04	000.74	1 000 40	_	_				
(104)m=	0	0	0	0	0	211.34	260.74	229.19	0	0	0	0		
Cooled	fraction									= Sum(•	=	701.27	(104)
			able 10b	`					10=	cooled	area ÷ (4	+) =	1	(105)
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
(100)111–		Ū	U			0.23	0.23	0.25		 = Sum(l		(106)
Snace	cooling	requirer	ment for	month -	· (104)m	× (105)	√ (106)r	m	TOtal	= Sum(I UH)	=	0	(100)
(107)m=	0	0	0	0	0	52.83	65.19	57.3	0	0	0	0		
(101)		Ü	ŭ			02.00	00.10	07.0		= Sum(L	l	175 22	(107)
0	!!			VA/II. / . C./							1 <u>00</u> 8/)	=	175.32	╡`
·		· ·	ment in k		•				` '	÷ (4) =			2.32	(108)
8f. Fabr	ic Ener	gy Effici	ency (ca	alculated	only un	ider spec	cial cond	ditions, se	ee sectio	on 11)				
Fabric	Energy	/ Efficier	псу						(99) -	+ (108) =	=		45.76	(109)

SAP Input

Property Details: Plot 49

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 75.483 m^2 2.5 m

Living area: 23.307 m² (fraction 0.309)

Front of dwelling faces: North East

Manufacturer

Opening types:

NE

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

NE Manufacturer Windows double-glazed Yes SE Manufacturer Windows double-glazed Yes

Solid

U-value: No. of Openings: Name: Gap: Frame Factor: g-value: Area: ΝE 0 1.4 mm NF 0.7 0.63 1.4 1.696 16mm or more 1 0.63 SE 16mm or more 0.7 1.4 11.464 1

Width: Location: Orient: Height: Name: Type-Name: Corridor Wall North East NE n **External Wall** North East NE 0 0 SE **External Wall** South East 0 0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Element	<u>S</u>						
External Wall	45.73	13.16	32.57	0.15	0	False	N/A
Corridor Wall	28.889	2	26.89	0.15	0.4	False	N/A
Flat Roof	75.483	0	75.48	0.1	0		N/A
Exposed Floor	11.68			0.12			N/A
Internal Element	<u>s</u>						
Party Elements							

Thormal bridges

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1292

Length Psi-value

7.393 0.293 E2 Other lintels (including other steel lintels)

SAP Input

	20.037	0.048	E4	Jamb
	13.243	0.064	E7	Party floor between dwellings (in blocks of flats)
	7.95	0.077	E16	Corner (normal)
	8.742	0.089	E24	Eaves (insulation at ceiling level - inverted)
	17.256	0.56	E15	Flat roof with parapet
[Approved]	3.733	0.04	E3	Sill
	10.902	0.062	E14	Flat roof
	2.65	-0.072	E17	Corner (inverted internal area greater than external area)
	5.3	0.108	E25	Staggered party wall between dwellings
	6.173	0.131	E20	Exposed floor (normal)
	10.307	0.131	E21	Exposed floor (inverted)
	10.455	0	P3	Intermediate floor between dwellings (in blocks of flats)
	10.455	0.24	P4	Roof (insulation at ceiling level)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery

Number of wet rooms: Kitchen + 2

Ductwork: Insulation, rigid

Approved Installation Scheme: True

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

Main heating system:

Main heating system: Community heating schemes

Heat source: Community boilers

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

Central heating pump: 2013 or later Design flow temperature: Unknown

Boiler interlock: Yes

Main heating Control:

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

thermostats

Control code: 2312

Secondary heating system:

Secondary heating system: None

Water heating

Water heating: From main heating system

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

Others:

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

Low energy lights: 100%

Terrain type: Low rise urban / suburban

EPC language: English Wind turbine: No

Photovoltaics: Photovoltaic 1

SAP Input

Installed Peak power: 0.93

Tilt of collector: 30°

Overshading: None or very little Collector Orientation: South West

Assess Zero Carbon Home: No

		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			75.48	(1a) x	2	2.5	(2a) =	188.71	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n)	75.48	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	(3n) =	188.71	(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	<u> </u>	0	>	20 =	0	(6b)
Number of intermittent fa	ins				3	,	c 10 =	30	(7a)
Number of passive vents	;				0	<u> </u>	c 10 =	0	(7b)
Number of flueless gas fi					0		(40 =	0	(7c)
				L					(, o)
							Air ch	nanges per ho	our
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+$	(7a)+(7b)+	·(7c) =	Γ	30		÷ (5) =	0.16	(8)
	peen carried out or is intended, proce	ed to (17),	otherwise of	continue fi	rom (9) to	(16)			_
Number of storeys in the Additional infiltration	he dwelling (ns)					1/0	N 41-0 4	0	(9)
	.25 for steel or timber frame of	or 0 35 fc	nr masoni	rv consti	ruction	[(8	9)-1]x0.1 =	0	(10)
	resent, use the value corresponding			•	detion			0	(11)
deducting areas of openii		24/	1) 1						_
·	floor, enter 0.2 (unsealed) or	J.1 (seal	ed), else	enter 0				0	(12)
If no draught lobby, en	s and doors draught stripped							0	(13)
Window infiltration	s and doors draught stripped		0.25 - [0.2	2 x (14) ÷ 1	100] =			0	(15)
Infiltration rate			(8) + (10)	+ (11) + (12) + (13)	+ (15) =		0	(16)
Air permeability value,	q50, expressed in cubic meti	es per h	our per s	quare m	etre of e	envelop	e area	5	(17)
If based on air permeabil	lity value, then $(18) = [(17) \div 20]$	(8), otherv	vise (18) =	(16)				0.41	(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)] =			0.85	(19) (20)
Infiltration rate incorporat	ting shelter factor		(21) = (18	`	<i>"</i>			0.35	(21)
Infiltration rate modified f	•							0.00	(=.)
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind sp	peed from Table 7	-	<u> </u>	•			•	4	
$(22)m = \begin{bmatrix} 5.1 & 5 \end{bmatrix}$	4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind Easter (22a) == (2)	2)m · 4	•	•	•	•	•	•	•	
Wind Factor $(22a)m = (22a)m = 1.27$ 1.25	2)m ÷ 4 1.23 1.1 1.08 0.95	0.95	0.92	<u> </u>	1.08	1.12	1.18	1	
(220)111- 1.21 1.20	1.20 1.1 1.00 0.95	0.90	0.92		1.00	1.12	1.10	J	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41		
Calculate effe		•	rate for t	he appli	cable ca	se	•			•			
If mechanic If exhaust air h			andiv N. (2	3h) - (23a) v Emy (c	auation (N	VEVV othor	nuico (23h) - (222)			0	(23
If balanced wit) = (23a)			0	(23
		•	•	_					21.)	001.) [4 (00-)	0	(23
a) If balance	ea mech	anicai ve	ntilation	with nea	at recove	ery (IVIVI	1R) (248	$\frac{1}{0} = (2a)$	2b)m + (0	23b) × [$\frac{1 - (23c)}{0}$	i ÷ 100]]	(24
(17											0		(24)
b) If balance	ea mech	anicai ve	ntilation	without	neat red	overy (i	0 (24b	$\int_{0}^{\infty} \int_{0}^{\infty} dx = (2x)^{2}$	2b)m + (. 0	23b) ₀		1	(24
,					<u> </u>						0		(27
c) If whole h	nouse ex n < 0.5 >			•					5 v (23h	<i>)</i>			
$\frac{11(220)1}{(24c)m=0}$	0.57	0	0	0	0	0	0	0	0	0	0		(24
d) If natural													•
,	νεπιιαιί η = 1, th			•	•				0.5]				
(24d)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(24
Effective air	change	rate - er	iter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)				ı	
(25)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(25
										1			
3. Heat losse					N.				A 37.11				
ELEMENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/I		k-value kJ/m²-l		X k J/K
Doors		()			2	x	1	□ = l	2	$\stackrel{\prime}{\Box}$			(26
Windows Type	e 1				1.696	x _{1.}	/[1/(1.4)+	0.04] =	2.25	=			(27
Windows Type					11.46	= .			15.2	=			(27
Floor	_				11.68	=	0.13			╡ ,			(28
Walls Type1	45.5		40.4			=		=	1.5184	<u>-</u>		-	= '
• •	45.7		13.10	<u></u>	32.57	=	0.18	_ =	5.86	믁 ¦			(29
Walls Type2	28.8	_	2	_	26.89	=	0.18	ᆗ -	4.84	닠 ¦		┨	(29
Roof	75.4		0		75.48	3 ×	0.13	=	9.81	[(30
Total area of e					161.7								(31
* for windows and ** include the are						ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	1 3.2	
Fabric heat lo				o ana pan			(26)(30)	+ (32) =				41.48	(33
Heat capacity		,	-,					((28).	(30) + (32	2) + (32a).	(32e) =	2387.77	(34
Thermal mass			P = Cm -	- TFA) ir	n k.J/m²K				tive Value	, , ,	(0_0)	250	(35
For design asses	•	`		,			ecisely the				able 1f	200	(00
can be used inste							, ,						
Thermal bridg	es : S (L	x Y) cal	culated (using Ap	pendix l	<						22.44	(36
if details of therm		are not kn	own (36) =	= 0.05 x (3	1)								
Total fabric he									(36) =			63.92	(37
Ventilation he	1	ı	l monthly		<u> </u>	<u> </u>			= 0.33 × (<u> </u>	1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		_
(38)m= 37.25	37.02	36.78	35.69	35.49	34.53	34.53	34.36	34.9	35.49	35.9	36.33		(38
Heat transfer	coefficie	nt, W/K						(39)m	= (37) + (38)m			
(39)m= 101.18	100.94	100.71	99.61	99.41	98.46	98.46	98.28	98.82	99.41	99.82	100.25		
									Average =	Sum(39) ₁	112 /12=	99.61	(39

eat loss para	meter (H	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
0)m= 1.34	1.34	1.33	1.32	1.32	1.3	1.3	1.3	1.31	1.32	1.32	1.33		
umber of day	s in mor	oth (Tahl	le 1a)				-		Average =	Sum(40) _{1.}	12 /12=	1.32	(40
Jan	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		(41
1. Water heat	ing ener	gy requi	rement:								kWh/ye	ar:	
ssumed occu if TFA > 13.9 if TFA £ 13.9	N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13.		37		(42
nnual averag educe the annua ot more that 125	e hot wa I average	hot water	usage by	5% if the a	welling is	designed t			se target o		.52		(43
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
ot water usage ir	ilitres per	day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)		ļ				
4)m= 99.58	95.96	92.34	88.71	85.09	81.47	81.47	85.09	88.71	92.34	95.96	99.58		 ,
nergy content of	hot water	used - cal	culated mo	onthly = 4 .	190 x Vd,r	n x nm x E	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		1086.3	(4
5)m= 147.67	129.15	133.27	116.19	111.49	96.21	89.15	102.3	103.52	120.65	131.69	143.01		
									Total = Su	m(45) ₁₁₂ =	:	1424.31	(4
instantaneous w													(4
6)m= 0 /ater storage	0 loss:	0	0	0	0	0	0	0	0	0	0		(4
torage volum	e (litres)	includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(4
community h	•			•			` '						
therwise if no		hot wate	er (this in	cludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
ater storage) If manufact		eclared le	oss facto	or is kno	wn (kWł	n/dav):					0		(4
emperature fa					(.,, , .							(4
nergy lost fro				ear			(48) x (49)) =			0		` (5
) If manufact			-										·
ot water stora	•			e 2 (kW	h/litre/da	ıy)					0		(5
community h	_		JN 4.3								0		(5
emperature fa			2b							—	0		(5
ergy lost fro				ear			(47) x (51)) x (52) x (53) =		0		` (5
nter (50) or (-	,	,			() (-)	, (= , (,	-	0		(5
ater storage	, ,	•	or each	month			((56)m = (55) × (41)	m				
6)m= 0	0	0	0	0	0	0	0	0	0	0	0		(5
cylinder contains	-							-				кН	`
7)m= 0	0	0	0	0	0	0	0	0	0	0	0		(5
rimary circuit	loss (an	nual) fro	m Table	3				-			0		(5
rimary circuit	•	•			59)m = ((58) ÷ 36	65 × (41)	m					
•				,	•	. ,	, ,	cylinde	r thermo	stat)			
(modified by							-	-		,			

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m														
(61)m= 0	0	0	0	0	0	0) 0		0	0	0	0]	(61)
	uired for	water he	eating ca	alculated	l for eac	h month	(62)r	—— m =	0.85 × ((45)m +	(46)m +	(57)m +	ı · (59)m + (61)m	
(62)m= 125.52		113.28	98.76	94.77	81.78	75.78	86.9	_	87.99	102.55	111.94	121.56]`´_``	(62)
Solar DHW input	calculated	using App	endix G oı	· Appendix	: H (negat	tive quantity	y) (ent	er '0'	if no sola	r contribu	tion to wate	er heating)	.	
(add additiona	al lines if	FGHRS	and/or \	WWHRS	applies	s, see Ap	pend	lix G	3)					
(63)m= 0	0	0	0	0	0	0	0		0	0	0	0]	(63)
Output from w	vater hea	ter												
(64)m= 125.52	109.78	113.28	98.76	94.77	81.78	75.78	86.9	96	87.99	102.55	111.94	121.56		_
							(Outp	out from wa	ater heate	er (annual) ₁	112	1210.66	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ′ [0.85	5 × (45)m	+ (6	1)m] + 0.8 x	([(46)m	+ (57)m	+ (59)m	<u>]</u>	
(65)m= 31.38	27.45	28.32	24.69	23.69	20.44	18.94	21.7	74	22	25.64	27.98	30.39]	(65)
include (57)	m in calc	culation of	of (65)m	only if c	ylinder	is in the o	dwelli	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal g	ains (see	Table 5	and 5a):										
Metabolic gair	ns (Table	5), Wat	ts		_	_	_			_	_		_	
Jan	Feb	Mar	Apr	May	Jun	Jul	Αι	ug	Sep	Oct	Nov	Dec		
(66)m= 118.58	118.58	118.58	118.58	118.58	118.58	118.58	118.	.58	118.58	118.58	118.58	118.58		(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9 c	or L9a), a	lso s	ee ¯	Table 5				_	
(67)m= 19.2	17.05	13.87	10.5	7.85	6.63	7.16	9.3	1	12.49	15.86	18.51	19.73		(67)
Appliances ga	ains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), a	also	see Tal	ble 5			_	
(68)m= 209.74	211.92	206.43	194.76	180.02	166.17	156.91	154.	.74	160.22	171.9	186.64	200.49]	(68)
Cooking gains	s (calcula	ted in A	ppendix	L, equat	ion L15	or L15a), also	o se	e Table	5	-			
(69)m= 34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.8	86	34.86	34.86	34.86	34.86		(69)
Pumps and fa	ıns gains	(Table 5	āa)											
(70)m= 0	0	0	0	0	0	0	0		0	0	0	0]	(70)
Losses e.g. e	vaporatio	n (nega	tive valu	es) (Tab	le 5)									
(71)m= -94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.	86	-94.86	-94.86	-94.86	-94.86]	(71)
Water heating	g gains (T	able 5)											_	
(72)m= 42.18	40.84	38.07	34.29	31.84	28.39	25.46	29.2	22	30.55	34.46	38.87	40.85]	(72)
Total interna	l gains =				(66	6)m + (67)m	n + (68	8)m +	- (69)m + ((70)m + (7	71)m + (72))m	_	
(73)m= 329.69	328.39	316.94	298.12	278.28	259.76	248.11	251.	.83	261.84	280.79	302.59	319.64		(73)
6. Solar gain														
Solar gains are		ŭ				•	tions t	to co	nvert to th	e applica		tion.		
Orientation:	Access F Table 6d		Area m²		Flu	ux ıble 6a		т	g_ able 6b	т	FF able 6c		Gains (W)	
							1 1						. ,	٦
Northeast 0.9x		X	1.	===		11.28	X		0.63	X	0.7	_ =	5.85	(75)
Northeast 0.9x		X	1.			22.97	X		0.63		0.7	_ =	11.9	(75)
Northeast 0.9x		X	1.			41.38	X		0.63	x	0.7	=	21.45	<u> </u> (75)
Northeast _{0.9x}	0.77	X	1.	7	X	67.96	X		0.63	x	0.7	=	35.22	(75)
Northeast 0.9x	0.77	X	1.	7	Х	91.35	X		0.63	X	0.7	=	47.35	(75)

		_								_				_
Northeast _{0.9x}	0.77	X	1.	7	×	9	7.38	X	0.63	X	0.7	=	50.48	(75)
Northeast _{0.9x}	0.77	X	1.	7	x	9	91.1	X	0.63	X	0.7	=	47.22	(75)
Northeast _{0.9x}	0.77	X	1.	7	X	7	2.63	X	0.63	X	0.7	=	37.64	(75)
Northeast _{0.9x}	0.77	X	1.	7	x [5	0.42	X	0.63	X	0.7	=	26.13	(75)
Northeast _{0.9x}	0.77	X	1.	7	x	2	8.07	X	0.63	X	0.7	=	14.55	(75)
Northeast _{0.9x}	0.77	X	1.	7	x [1	14.2	X	0.63	X	0.7	=	7.36	(75)
Northeast 0.9x	0.77	X	1.	7	x [9	9.21	X	0.63	X	0.7	=	4.78	(75)
Southeast 0.9x	0.77	X	11.	46	x	3	6.79	X	0.63	X	0.7	=	128.91	(77)
Southeast 0.9x	0.77	X	11.	46	x	6	2.67	X	0.63	X	0.7	=	219.58	(77)
Southeast 0.9x	0.77	X	11.	46	x	8	5.75	X	0.63	X	0.7	=	300.44	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	10	06.25	x	0.63	x	0.7		372.26	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	11	19.01	x	0.63	x	0.7		416.96	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	11	18.15	x	0.63	x	0.7	_ =	413.94	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	11	13.91	x	0.63	x	0.7	_ =	399.09	(77)
Southeast _{0.9x}	0.77	x	11.	46	х	10	04.39	x	0.63	x	0.7	=	365.74	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	9	2.85	x	0.63	x	0.7	=	325.31	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	6	9.27	x	0.63	x	0.7	=	242.68	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	4	4.07	x	0.63	x	0.7	=	154.4	(77)
Southeast _{0.9x}	0.77	X	11.	46	x	3	1.49	x	0.63	×	0.7		110.32	(77)
•					-			•						
Solar gains in	watts, cald	culated	for eac	h month	ı			(83)m	n = Sum(74)m	(82)m				
(83)m= 134.76	231.48	321.89	407.48	464.31	46	64.42	446.31	403	.38 351.45	257.2	3 161.76	115.1		(83)
Total gains – i	nternal an	d solar	(84)m =	= (73)m	+ (8	33)m	, watts							
(84)m= 464.45	559.87	638.83	705.6	742.59	72		604.44							
						24.18	694.41	655	.21 613.28	538.0	2 464.35	434.74		(84)
7. Mean inte	rnal tempe	rature ((heating	seasor		24.18	094.41	655	.21 613.28	538.0	2 464.35	434.74		(84)
7. Mean intel Temperature			`		1)					538.0	2 464.35	434.74	21	(84)
	during he	ating p	eriods ir	n the livi	ng a	area f	rom Tab			538.0	2 464.35	434.74	21	_
Temperature	during he	ating p	eriods ir	n the livi	ng a	area f	rom Tab	ole 9		538.0		434.74 Dec	21	_
Temperature Utilisation fac	during he	ating po	eriods ir iving are	n the livi ea, h1,m	ng a	area f	rom Tabble 9a)	ole 9	, Th1 (°C)				21	_
Temperature Utilisation fac	during heater for gain Feb 0.99	ating pons for line Mar	eriods ir iving are Apr 0.96	n the livi ea, h1,m May	ng an (se	area f ee Ta Jun).76	from Tab ble 9a) Jul 0.59	ole 9	, Th1 (°C) ug Sep	Oct	Nov	Dec	21	(85)
Temperature Utilisation fac	during heater for gain Feb 0.99	ating pons for line Mar	eriods ir iving are Apr 0.96	n the livi ea, h1,m May	ng an (se	area f ee Ta Jun).76	from Tab ble 9a) Jul 0.59	ole 9	Table 9c)	Oct	Nov 1	Dec	21	(85)
Temperature Utilisation fac Jan (86)m= 1 Mean interna (87)m= 19.53	tor for gain Feb 0.99 lt temperat 19.71	ating pons for line Mar 0.99 cure in l	eriods ir iving are Apr 0.96 iving are 20.36	n the livi ea, h1,m May 0.9 ea T1 (for	ng an (see	area fee Ta Jun 0.76 w ste	rom Tab ble 9a) Jul 0.59 ps 3 to 7	ole 9,	Sep 0.86 able 9c) 96 20.81	Oct 0.97	Nov 1	Dec 1	21	(85)
Temperature Utilisation factors Jan (86)m= 1 Mean internations (87)m= 19.53 Temperature	tor for gained Feb 0.99 al temperate 19.71 during head	ns for li Mar 0.99 cure in l 20 ating pe	eriods ir iving are Apr 0.96 iving are 20.36 eriods ir	n the livi ea, h1,m May 0.9 ea T1 (for 20.69	ng a second seco	area fee Ta Jun 0.76 w ste 20.9 elling	from Tab ble 9a) Jul 0.59 ps 3 to 7 20.98 from Ta	ole 9,	Sep 34 0.86 Sable 9c) 96 20.81 9, Th2 (°C)	Oct 0.97	Nov 1	Dec 1	21	(85)
Temperature Utilisation fact Jan (86)m= 1 Mean internation (87)m= 19.53 Temperature (88)m= 19.81	tor for gainer feb 0.99 cl temperate 19.71 during her	ns for li Mar 0.99 ture in l 20 ating pe	eriods ir iving are Apr 0.96 iving are 20.36 eriods ir 19.83	n the livi ea, h1,m May 0.9 ea T1 (for 20.69 n rest of	ng a (see of oollow ollow ollo	area fee Ta Jun 0.76 w ste 20.9 elling 9.84	from Table 9a) Jul 0.59 ps 3 to 7 20.98 from Table 19.84	Al 0.67 in T 20.	Sep 34 0.86 Sable 9c) 96 20.81 9, Th2 (°C)	Oct 0.97	Nov 1	Dec 1	21	(85) (86) (87)
Temperature Utilisation fact Jan (86)m= 1 Mean internation (87)m= 19.53 Temperature (88)m= 19.81 Utilisation fact	retor for gain retor	ns for ling portion of the line of the lin	eriods ir iving are 0.96 iving are 20.36 eriods ir 19.83 est of d	n the livies, h1,m May 0.9 ea T1 (for 20.69 n rest of 19.83 welling,	ng a (se o o o o o o o o o o o o o o o o o o o	area fee Ta Jun 0.76 w ste 20.9 elling 9.84 m (se	from Take ble 9a) Jul 0.59 ps 3 to 7 20.98 from Ta 19.84	A 0.6.7 in T 20. 19. 19. 9a)	Sep 0.86 at 0.86 at 0.86 at 0.86 at 0.81 at 0.81 at 0.81 at 0.81 at 0.83 at 0.	Oct 0.97 20.38	Nov 1 19.88	Dec 1 1 19.49 19.82	21	(85) (86) (87) (88)
Temperature Utilisation fact Jan (86)m= 1 Mean internation (87)m= 19.53 Temperature (88)m= 19.81 Utilisation fact (89)m= 1	retor for gain retor	ns for ling portion of the line of the lin	eriods ir iving are 0.96 iving are 20.36 eriods ir 19.83 est of d	n the livies, h1,m May 0.9 ea T1 (for 20.69 n rest of 19.83 welling, 0.85	mg a n (see of other see of oth	area fee Ta Jun 0.76 w ste 20.9 elling 9.84 m (se	from Take ble 9a) Jul 0.59 ps 3 to 7 20.98 from Ta 19.84 ee Table 0.45	A 0.60 19. 19. 19. 19. 19. 19. 19. 19. 19. 19.	Sep 64 0.86 Table 9c) 96 20.81 9, Th2 (°C) 84 19.83	Oct 0.97 20.38 19.83	Nov 1	Dec 1	21	(85) (86) (87)
Temperature Utilisation fact Jan (86)m= 1 Mean internation (87)m= 19.53 Temperature (88)m= 19.81 Utilisation fact (89)m= 1 Mean internation	tor for gain sector for gain s	ns for li Mar 0.99 cure in l 20 ating por 19.81 ns for r 0.98 cure in t	eriods ir iving are 0.96 iving are 20.36 eriods ir 19.83 est of decent of de	n the livies, h1,m May 0.9 ea T1 (for 20.69 n rest of 19.83 welling, 0.85 of dwell	ng a n (see of other see of oth	area fee Ta Jun 0.76 w ste 20.9 elling 9.84 m (se 0.66	from Table 9a) Jul 0.59 ps 3 to 7 20.98 from Table 19.84 ee Table 0.45 pollow steep	A 0.60 19. 19. 19. 19. 19. 19. 19. 19. 19. 19.	Sep 64 0.86 able 9c) 96 20.81 9, Th2 (°C) 84 19.83 5 0.79 to 7 in Tab	Oct 0.97 20.38 19.83 0.96 le 9c)	Nov 1 19.88 19.82	Dec 1 19.49 19.82	21	(85) (86) (87) (88) (89)
Temperature Utilisation fact Jan (86)m= 1 Mean internation (87)m= 19.53 Temperature (88)m= 19.81 Utilisation fact (89)m= 1	tor for gain sector for gain s	ns for ling portion of the line of the lin	eriods ir iving are 0.96 iving are 20.36 eriods ir 19.83 est of d	n the livies, h1,m May 0.9 ea T1 (for 20.69 n rest of 19.83 welling, 0.85	ng a n (see of other see of oth	area fee Ta Jun 0.76 w ste 20.9 elling 9.84 m (se	from Take ble 9a) Jul 0.59 ps 3 to 7 20.98 from Ta 19.84 ee Table 0.45	A 0.60 19. 19. 19. 19. 19. 19. 19. 19. 19. 19.	Sep 64 0.86 Table 9c) 96 20.81 9, Th2 (°C) 84 19.83 5 0.79 to 7 in Tab 83 19.73	Oct 0.97 20.38 19.83 0.96 le 9c) 19.34	Nov 1 19.88 19.82 0.99	Dec 1 19.49 19.82		(85) (86) (87) (88) (89) (90)
Temperature Utilisation fact Jan (86)m= 1 Mean internation (87)m= 19.53 Temperature (88)m= 19.81 Utilisation fact (89)m= 1 Mean internation	tor for gain sector for gain s	ns for li Mar 0.99 cure in l 20 ating por 19.81 ns for r 0.98 cure in t	eriods ir iving are 0.96 iving are 20.36 eriods ir 19.83 est of decent of de	n the livies, h1,m May 0.9 ea T1 (for 20.69 n rest of 19.83 welling, 0.85 of dwell	ng a n (see of other see of oth	area fee Ta Jun 0.76 w ste 20.9 elling 9.84 m (se 0.66	from Table 9a) Jul 0.59 ps 3 to 7 20.98 from Table 19.84 ee Table 0.45 pollow steep	A 0.60 19. 19. 19. 19. 19. 19. 19. 19. 19. 19.	Sep 64 0.86 Table 9c) 96 20.81 9, Th2 (°C) 84 19.83 5 0.79 to 7 in Tab 83 19.73	Oct 0.97 20.38 19.83 0.96 le 9c) 19.34	Nov 1 19.88 19.82	Dec 1 19.49 19.82	0.31	(85) (86) (87) (88) (89)
Temperature Utilisation fact Jan (86)m= 1 Mean internation (87)m= 19.53 Temperature (88)m= 19.81 Utilisation fact (89)m= 1 Mean internation (90)m= 18.48 Mean internation	temperat 19.81 ctor for gain 19.81 ctor for gain 19.81 ctor for gain 18.67 ctor for gain 19.81 ctor for ga	ns for li Mar 0.99 ture in l 20 ating pr 19.81 ns for r 0.98 ture in t 18.95	eriods in iving are 0.96 iving are 20.36 eriods in 19.83 est of drought 19.32 in the whole who iving are 19.32 in the 19.32 in the whole who iving are 19.32 in the whole who iving are 19.32 in the whole who iving are 19.32 in the whole whole who iving are 19.32 in the whole who iving are 19.32 in the whole whole who iving are 19.32 in the whole whole who iving are 19.32 in the whole whole whole whole who iving are 19.32 in the whole who iving are 19.32 in the whole w	n the living the livin	dwww.ling	area f ee Ta Jun 0.76 w ste 20.9 elling 9.84 m (se 0.66 T2 (fc 9.79	From Take ble 9a) Jul 0.59 ps 3 to 7 20.98 from Ta 19.84 se Table 0.45 bllow ste 19.83	All 0.60 19. 19. 19. 19. 19. 19. 19. 19. 19. 19.	Th1 (°C) ug Sep 64 0.86 Table 9c) 96 20.81 9, Th2 (°C) 84 19.83 5 0.79 to 7 in Tab 83 19.73 — fLA) × T2	Oct 0.97 20.38 19.83 0.96 le 9c) 19.34	Nov 1 19.88 19.82 0.99 18.85 ving area ÷ (-	Dec 1 19.49 19.82 1 1 18.45 4) =		(85) (86) (87) (88) (89) (90) (91)
Temperature Utilisation fact Jan (86)m= 1 Mean internation (87)m= 19.53 Temperature (88)m= 19.81 Utilisation fact (89)m= 1 Mean internation (90)m= 18.48	temperate 18.67 during head of the sector for gain of gain of the sector for gain of the sector for gain of the sector for gain of gai	ns for ling portion of the line of the lin	eriods ir iving are Apr 0.96 iving are 20.36 eriods ir 19.83 est of de 0.95 che rest 19.32 r the wh	n the livies, h1,m May 0.9 ea T1 (for 20.69 n rest of 19.83 welling, 0.85 of dwell 19.62 cole dwell 19.95	ng a 0 0 0 0 0 0 0 0 0	area fee Ta Jun 0.76 w ste 20.9 elling 9.84 m (se 0.66 T2 (fc 9.79	rom Table 9a) Jul 0.59 ps 3 to 7 20.98 from Table 19.84 ee Table 0.45 bllow stee 19.83 A × T1 20.18	All 0.60 19. All 0.60 19. 19. 9a) 0.40 19. + (1 20.	Sep 4 0.86 Table 9c) 96 20.81 9, Th2 (°C) 84 19.83 5 0.79 to 7 in Tab 83 19.73 — fLA) × T2 18 20.07	Oct 0.97 20.38 19.83 0.96 le 9c) 19.34 fLA = Liv 19.67	Nov 1 19.88 19.82 0.99 18.85 ving area ÷ (Dec 1 19.49 19.82		(85) (86) (87) (88) (89) (90)

(93)m= 18.8 18.99 19.28 19.64 19.95 20.13 20.18 20.18 20.07 19.67 19.17 18.78		(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-calculated at the second seco	ate	
the utilisation factor for gains using Table 9a		
JanFebMarAprMayJunJulAugSepOctNovDec		
Utilisation factor for gains, hm:		
(94)m= 1 0.99 0.98 0.94 0.86 0.69 0.5 0.55 0.8 0.96 0.99 1		(94)
Useful gains, hmGm , W = (94)m x (84)m		
(95)m= 462.56 554.54 624.45 664.68 636.16 498.34 344.74 358.8 492.34 515.6 460.42 433.41		(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= 1467.28 1422.43 1286.74 1069.84 819.74 544.95 352.91 371.47 589.49 901.17 1204.59 1461.23		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m		
(98)m= 747.52 583.22 492.74 291.72 136.59 0 0 0 0 286.86 535.8 764.7		
Total per year (kWh/year) = Sum(98) ₁₅₉₁₂ =	3839.15	(98)
Space heating requirement in kWh/m²/year	50.86	(99)
8c. Space cooling requirement		
Calculated for June, July and August. See Table 10b Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)		
(100)m= 0 0 0 0 0 925.48 728.57 746.92 0 0 0 0		(100)
Utilisation factor for loss hm		(/
(101)m= 0 0 0 0 0 0 0.82 0.89 0.87 0 0 0 0		(101)
Useful loss, hmLm (Watts) = (100)m x (101)m		, ,
(102)m= 0 0 0 0 0 762.5 651.3 650 0 0 0 0		(102)
Gains (solar gains calculated for applicable weather region, see Table 10)		
(103)m= 0 0 0 0 0 934.83 898.25 853.95 0 0 0 0		(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 \times [(103) m – (102) m] \times (0.000)	(41)m	
set (104)m to zero if (104)m $< 3 \times (98)$ m	,	
(104)m= 0 0 0 0 0 124.08 183.73 151.74 0 0 0 0		
Total = Sum(1,04) =	459.55	(104)
Cooled fraction $f C = cooled area \div (4) =$	1	(105)
Intermittency factor (Table 10b)		_
(106)m= 0 0 0 0 0 0.25 0.25 0 0 0 0		
Total = Sum(1.04) =	0	(106)
Space cooling requirement for month = (104) m × (105) × (106) m		_
(107)m= 0 0 0 0 0 31.02 45.93 37.93 0 0 0 0		
Total = Sum(107) =	114.89	(107)
Space cooling requirement in kWh/m²/year $(107) \div (4) =$	1.52	(108)
8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)		
Fabric Energy Efficiency (99) + (108) =	52.38	(109)
Target Fabric Energy Efficiency (TFEE)	60.24	(109)
		 ` '

		عوا ا	r Details:						
Access at Name.	Zabid Ashrof	USE		a Mirros	b a v .		CTDO	001000	
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012)	Strom Softwa					001082 on: 1.0.5.9	
Contware Hame.	Ottoma i Ora 2012		ty Address				VOIOIO	7.0.0.0	
Address :		·							
1. Overall dwelling dime	ensions:								
Ground floor		A	rea(m²)	(1a) x		ight(m)	(2a) =	Volume(m³	(3a)
	a) . (4 b) . (4 a) . (4 d) . (4 a)	. (45)				2.5	(2a) =	188.71	(Sa)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)	+(1n)	75.48	(4)	\	n (O)	(0.)		_
Dwelling volume				(3a)+(3b))+(3c)+(3c	d)+(3e)+	.(3n) =	188.71	(5)
2. Ventilation rate:	main se	condary	other		total			m³ per hou	r
Number of allignments	heating he	eating		,			40 =	-	_
Number of chimneys		-	0] = [0			0	(6a)
Number of open flues	0 +	0 +	0] = [0		20 =	0	(6b)
Number of intermittent fa				Ĺ	0		10 =	0	(7a)
Number of passive vents	;			L	0	X '	10 =	0	(7b)
Number of flueless gas fi	ires				0	X 4	40 =	0	(7c)
							Air ch	nanges per ho	our
Infiltration due to chimne	vs_flues and fans = (6a))+(6b)+(7a)+(7b)+(7c) =	Г	0		÷ (5) =	0	(8)
	peen carried out or is intended			ontinue fr			- (3) =	0	(0)
Number of storeys in the	he dwelling (ns)							0	(9)
Additional infiltration						[(9)	-1]x0.1 =	0	(10)
	.25 for steel or timber fr resent, use the value correspond			•	ruction			0	(11)
deducting areas of openi		onding to trie gr	ealer wall are	a (aner					
If suspended wooden	floor, enter 0.2 (unseale	d) or 0.1 (se	aled), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
· ·	s and doors draught stri	pped						0	(14)
Window infiltration			0.25 - [0.2					0	(15)
Infiltration rate			(8) + (10)					0	(16)
•	q50, expressed in cubic	•	•	•	etre of e	envelope	area	3	(17)
If based on air permeabil	es if a pressurisation test has				is heina u	sad .		0.15	(18)
Number of sides sheltere		occir done or d	acgree an pe	modelinty	io boilig a	oou		2	(19)
Shelter factor			(20) = 1 -	0.075 x (1	19)] =			0.85	(20)
Infiltration rate incorporate	ting shelter factor		(21) = (18	x (20) =				0.13	(21)
Infiltration rate modified f	or monthly wind speed						,		
Jan Feb	Mar Apr May	Jun Ju	l Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	peed from Table 7								
(22)m= 5.1 5	4.9 4.4 4.3	3.8 3.8	3.7	4	4.3	4.5	4.7		
Wind Factor (22a)m = (2.	2\m <i>÷</i> 4								
	1.23 1.1 1.08	0.95 0.95	5 0.92	1	1.08	1.12	1.18		
, .,		3.00						J	

		e (allowi			1	` 	`	`				Ī	
0.16 Calculate effec	0.16 Ctive air	0.16 change i	0.14 rate for t	0.14 he appli	0.12 cable ca	0.12 SE	0.12	0.13	0.14	0.14	0.15		
If mechanica	al ventila	ition:										0.5	(23
If exhaust air he	eat pump i	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0.5	(23
If balanced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				79.05	(23
a) If balance		anical ve	ntilation	with he	at recove	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	
(24a)m= 0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25		(24
b) If balance	d mech	anical ve	ntilation	without	heat red	overy (N	ЛV) (24b	p)m = (22)	2b)m + (23b)		Ī	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h if (22b)n				•	•				.5 × (23k	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural if (22b)n				•	•				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	(25)	-				
25)m= 0.27	0.26	0.26	0.25	0.24	0.23	0.23	0.22	0.23	0.24	0.25	0.25		(25
3. Heat losse	s and he	eat loss r	naramete	⊃r.									
ELEMENT	Gros	·	Openin		Net Ar	ea	U-valı	ue	AXU		k-value	e A	Χk
	area	_	m		A ,r		W/m2		(W/		kJ/m²-l		/K
Doors					2	X	1.4	=	2.8				(26
Windows Type	· 1				1.696	x1	/[1/(1.4)+	0.04] =	2.25				(27
Windows Type	2				11.46	4 x1	/[1/(1.4)+	0.04] =	15.2				(27
Floor					11.68	3 x	0.12	=	1.4016	; [(28
Nalls Type1	45.7	' 3	13.10	3	32.57	, X	0.15	=	4.89				(29
Walls Type2	28.8	39	2		26.89) X	0.14	=	3.81				(29
Roof	75.4	18	0		75.48	3 x	0.1	=	7.55				(30
Total area of e	lements	, m²			161.7	8							(3
for windows and						ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragraph	3.2	
** include the area				ls and pan	titions		(00) (00)	(00)					_
Fabric heat los		•	U)				(26)(30)		(00) (0	o) (00)	(00.)	37.89	(33
Heat capacity	^	,		TEA) :				., ,	, , ,	2) + (32a).	(32e) =	2387.77	<u></u> (34
Thermal mass	•	`		,			ooiooly the		tive Value		abla 1f	100	(3
For design assess an be used inste				CONSTRUCT	ion are noi	kilowii pi	ecisely lile	rinaicative	values of	TIVIT III T	аые п		
hermal bridge	es : S (L	x Y) cal	culated i	using Ap	pendix l	<						20.9	(3
f details of therma		are not kn	own (36) =	= 0.05 x (3	1)								
otal fabric he								(33) +	(36) =			58.79	(3
entilation hea					<u> </u>	<u> </u>	ı			(25)m x (5)		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
38)m= 16.65	16.45	16.25	15.26	15.06	14.07	14.07	13.87	14.46	15.06	15.46	15.85		(38
leat transfer of	oefficier	nt, W/K			_	T	1	(39)m	= (37) + (38)m		•	
39)m= 75.44	75.24	75.04	74.05	73.85	72.86	72.86	72.66	73.25	73.85	74.25	74.64		
										Sum(39) ₁			(3

Heat loss p	arameter (HLP), W	/m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1	1	0.99	0.98	0.98	0.97	0.97	0.96	0.97	0.98	0.98	0.99		
	<u>'</u>		ı	ı			l		Average =	Sum(40) ₁ .	12 /12=	0.98	(40)
Number of	- i	onth (Tab	le 1a)		ı	·		ı					
Ja	_	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 h	eating ene	rgy requ	irement:								kWh/ye	ar:	
	ccupancy, 13.9, N = 1 13.9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	TFA -13		37		(42)
Annual ave Reduce the ar not more that	nnual average	e hot water	usage by	5% if the c	lwelling is	designed t			se target o		.29		(43)
Ja	n Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usa								*F		· · · ·			
(44)m= 104.	82 101.01	97.2	93.38	89.57	85.76	85.76	89.57	93.38	97.2	101.01	104.82		
		!	<u> </u>	<u> </u>	ļ.	ļ.	<u> </u>		Total = Su	m(44) ₁₁₂ =	=	1143.47	(44)
Energy conter	nt of hot wate	r used - cal	culated m	onthly = 4.	190 x Vd,r	n x nm x C	Tm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 155.	44 135.95	140.29	122.31	117.36	101.27	93.84	107.68	108.97	127	138.63	150.54		
W. in a facility of a second		·			()		h (40		Total = Su	m(45) ₁₁₂ =	= [1499.27	(45)
If instantaneou		-	· `	not water	r storage), r	·	DOXES (46)	, , , -		1	· · · · · · · · · · · · · · · · · · ·		
(46)m= 23.3 Water stora		21.04	18.35	17.6	15.19	14.08	16.15	16.35	19.05	20.79	22.58		(46)
Storage vol	-) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If communit	•					_					<u> </u>		(,
Otherwise i				•			. ,	ers) ente	er '0' in ((47)			
Water stora	ge loss:												
a) If manuf	acturer's c	eclared I	oss facto	or is kno	wn (kWł	n/day):					0		(48)
Temperatur	e factor fro	om Table	2b								0		(49)
Energy lost		•					(48) x (49)) =		1	10		(50)
b) If manuf			-								1		(54)
Hot water s If communit	•			ie z (KVV	n/iitre/ua	iy)				0.	02		(51)
Volume fac			011 4.0							1.	03		(52)
Temperatur	e factor fro	om Table	2b							-	.6		(53)
Energy lost	from wate	r storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	1.	03		(54)
Enter (50)		_									03		(55)
Water stora	ge loss ca	lculated ¹	for each	month			((56)m = ((55) × (41)	m				
(56)m= 32.0	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 cont		ed solar sto	rage, (57)	<u>I</u> m = (56)m		<u>L</u> H11)] ÷ (5	<u>l</u> 0), else (5	<u>I</u> 7)m = (56)	m where (H11) is fro	m Appendi	хН	
(57)m= 32.0)1 28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circ	ruit loss (a	nnual) fr	m Tahla					•			0		(58)
Primary circ	`	,			59)m = ((58) ÷ 36	65 × (41)	ım					, ,
•	by factor			,	•	. ,	, ,		r thermo	stat)			
(59)m= 23.2	26 21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Ohilana	la. data d	£		(04)	(00) - 0	OF (44)	\						
Combi loss ca	liculated 0	or each	month	(61)m =	(60) ÷ 30	05 × (41))m 0	T 0	0	Ιο	0	1	(61)
] · (59)m + (61)m	(01)
(62)m= 210.72	185.88	195.57	175.8	172.63	154.76	149.12	162.96		182.27	192.12	205.81	(59)III + (61)III]	(62)
Solar DHW input				<u> </u>		<u> </u>						1	(02)
(add additiona									CONTINU	ion to wat	or ricating)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(63)
Output from w	ater hea	ter		<u>I</u>			l .	Į.				J	
(64)m= 210.72	185.88	195.57	175.8	172.63	154.76	149.12	162.96	162.46	182.27	192.12	205.81]	
		l .	l .	<u> </u>		!	Ou	tput from w	ater heate	r (annual)	12	2150.11	(64)
Heat gains fro	m water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)	m] + 0.8 x	k [(46)m	+ (57)m	+ (59)m		_
(65)m= 95.91	85.15	90.87	83.46	83.24	76.47	75.42	80.03	79.03	86.45	88.89	94.28	1	(65)
include (57)	m in cald	culation of	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 ga	ains (see	Table 5	and 5a):	-								
Metabolic gair	ì			,									
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 142.29	142.29	142.29	142.29	142.29	142.29	142.29	142.29	142.29	142.29	142.29	142.29		(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5		-		_	
(67)m= 48	42.63	34.67	26.25	19.62	16.56	17.9	23.27	31.23	39.65	46.28	49.33]	(67)
Appliances ga	ins (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	o see Ta	ble 5		-	_	
(68)m= 313.05	316.3	308.11	290.68	268.69	248.01	234.2	230.95	239.13	256.56	278.56	299.24		(68)
Cooking gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a), also s	ee Table	5			-	
(69)m= 51.6	51.6	51.6	51.6	51.6	51.6	51.6	51.6	51.6	51.6	51.6	51.6]	(69)
Pumps and fa	ns gains	(Table 5	5a)									_	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(70)
Losses e.g. ev	/aporatio	n (nega	tive valu	es) (Tab	le 5)								
(71)m= -94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86]	(71)
Water heating	gains (T	able 5)										_	
(72)m= 128.91	126.7	122.13	115.92	111.89	106.2	101.38	107.56	109.76	116.19	123.46	126.71]	(72)
Total internal	gains =				(66))m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	71)m + (72))m	_	
(73)m= 588.99	584.67	563.95	531.88	499.22	469.81	452.5	460.81	479.15	511.44	547.32	574.32		(73)
6. Solar gain													
Solar gains are		•				•	itions to c		ne applical		tion.		
Orientation: /	Access F Table 6d		Area m²		Flu Tal	ix ble 6a		g_ Table 6b	т	FF able 6c		Gains (W)	
_							. —					. ,	1
Northeast 0.9x	0.77	X	1.			1.28	X	0.63	_ ×	0.7	=	5.85	(75)
Northeast 0.9x	0.77	X	1.			22.97	X	0.63		0.7	=	11.9	(75)
Northeast 0.9x	0.77	X	1.			11.38	X	0.63	×	0.7	=	21.45	(75)
Northeast 0.9x	0.77	X	1.		<u> </u>	67.96	X	0.63	_ ×	0.7	=	35.22	(75)
Northeast _{0.9x}	0.77	X	1.	7	x 9	91.35	X	0.63	Х	0.7	=	47.35	(75)

Al di d					г			1		_				_
Northeast _{0.9x}	0.77	X	1.7	7	X	9	7.38	X	0.63	×	0.7	=	50.48	(75)
Northeast _{0.9x}	0.77	X	1.7	7	X	9)1.1	X	0.63	X	0.7	=	47.22	(75)
Northeast _{0.9x}	0.77	X	1.7	7	x	72	2.63	X	0.63	X	0.7	=	37.64	(75)
Northeast _{0.9x}	0.77	X	1.7	7	X	50	0.42	X	0.63	X	0.7	=	26.13	(75)
Northeast _{0.9x}	0.77	X	1.7	7	x	28	8.07	X	0.63	X	0.7	=	14.55	(75)
Northeast _{0.9x}	0.77	X	1.7	7	x	1	4.2	X	0.63	X	0.7	=	7.36	(75)
Northeast 0.9x	0.77	X	1.7	7	x	9).21	x	0.63	X	0.7	=	4.78	(75)
Southeast 0.9x	0.77	X	11.	46	x	30	6.79	x	0.63	X	0.7	=	128.91	(77)
Southeast _{0.9x}	0.77	X	11.	46	x	62	2.67	x	0.63	X	0.7	=	219.58	(77)
Southeast 0.9x	0.77	X	11.	46	x	8	5.75	x	0.63	X	0.7	=	300.44	(77)
Southeast _{0.9x}	0.77	X	11.	46	x	10	06.25	x	0.63	x	0.7		372.26	(77)
Southeast _{0.9x}	0.77	X	11.	46	x	11	9.01	x	0.63	x	0.7		416.96	(77)
Southeast 0.9x	0.77	X	11.	46	x	11	8.15	х	0.63	x	0.7	=	413.94	(77)
Southeast 0.9x	0.77	x	11.	46	x	11	3.91	x	0.63	x	0.7	=	399.09	(77)
Southeast 0.9x	0.77	X	11.	46	x	10)4.39	х	0.63	x	0.7	=	365.74	(77)
Southeast 0.9x	0.77	x	11.	46	x [92	2.85	x	0.63	x	0.7		325.31	(77)
Southeast 0.9x	0.77	X	11.4	46	x	69	9.27	x	0.63	x	0.7		242.68	(77)
Southeast 0.9x	0.77	X	11.4	46	x [44	4.07	x	0.63	x	0.7		154.4	(77)
Southeast 0.9x	0.77	x	11.	46	x	3	1.49	x	0.63	×	0.7	=	110.32	(77)
_					_			•						
Solar gains in	watts, cal	culated	for eacl	h month	1			(83)m	n = Sum(74)m .	(82)m				
(83)m= 134.76		321.89	407.48	464.31	_	64.42	446.31	403	.38 351.45	257.23	3 161.76	115.1	1	(83)
									.00 001.40	207.20	1			(00)
Total gains – i	nternal an	nd solar	(84)m =	= (73)m	+ (8	33)m ,		<u>!</u>	.00 001.40	207.20			J	(55)
		nd solar 885.83	(84)m = 939.36	= (73)m 963.53	Ò	33)m , 34.23		864		768.67	-	689.41]	(84)
Total gains – i (84)m= 723.74	816.15	885.83	939.36	963.53	93	.	watts	<u> </u>			-]	
Total gains – i	816.15	885.83 erature (939.36 (heating	963.53 season	93	34.23	watts 898.81	864	.19 830.6		-		21	
Total gains – i (84)m= 723.74 7. Mean inter	816.15 mal tempe during he	885.83 erature (eating pe	939.36 (heating	963.53 season the livi	93 ng a	34.23 area f	watts 898.81 rom Tab	864	.19 830.6				21	(84)
Total gains – i (84)m= 723.74 7. Mean inter Temperature	816.15 mal tempe during he	885.83 erature (eating pe	939.36 (heating	963.53 season the livi	93 ng a	34.23 area f	watts 898.81 rom Tab	864 ole 9	.19 830.6		7 709.09		21	(84)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fac	816.15 rnal tempe during he ctor for gai	erature (eating period of the line for	939.36 (heating eriods in ving are	963.53 season the livi	93 ng an (se	area f	watts 898.81 rom Tab ble 9a)	864 ole 9	.19 830.6 , Th1 (°C)	768.6	7 709.09	689.41	21	(84)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.9	816.15 nal tempe during he etor for gai Feb 0.87	erature (eating poins for limited Mar 0.81	939.36 (heating eriods in Apr 0.72	963.53 season the livi ea, h1,m May 0.61	93 ng a n (se	area f ee Tal Jun	watts 898.81 rom Tab ble 9a) Jul 0.35	864 ole 9,	.19 830.6 , Th1 (°C) ug Sep .37 0.54	768.61 Oct	7 709.09 Nov	689.41 Dec	21	(84)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.9 Mean interna	nal temper during he etor for gain Feb 0.87	erature (eating poins for li	939.36 (heating eriods in Apr 0.72	963.53 season the livi ea, h1,m May 0.61	93 ng a collowollow	area f ee Tal Jun	watts 898.81 rom Tab ble 9a) Jul 0.35	864 ole 9, A 0.3	.19 830.6 , Th1 (°C) ug Sep .37 0.54	768.61 Oct	7 709.09 Nov	689.41 Dec	21	(84)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.9 Mean interna (87)m= 19.48	nal temper during he ctor for gain Feb 0.87	erature (eating period ins for limber 10.81 ture in labeled 20.08	939.36 (heating eriods in Apr 0.72 iving are 20.46	963.53 season the livi ea, h1,m May 0.61 ea T1 (fo	93 ng a	area f ee Tal Jun 0.46 w step	watts 898.81 rom Tak ble 9a) Jul 0.35 os 3 to 7 20.97	864 ole 9 Al 0.3 7 in T 20.	.19 830.6 , Th1 (°C) ug Sep 	768.6 Oct 0.74	7 709.09 Nov 0.86	Dec 0.91	21	(84)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.9 Mean interna (87)m= 19.48 Temperature	816.15 nal tempe during he etor for gain Feb 0.87 I temperate 19.74 during he	erature (eating period ins for limited Mar 0.81 ture in label 20.08 eating period eating eating period eating eati	939.36 (heating eriods in Apr 0.72 iving are 20.46 eriods in a control of the con	963.53 season the livi ea, h1,m May 0.61 ea T1 (for 20.75	93 ng a (see 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	area free Tal Jun 0.46 w ster 0.92 elling	watts 898.81 rom Tak ble 9a) Jul 0.35 os 3 to 7 20.97 from Tak	864 ole 9 Al 0.3 7 in T 20.	.19 830.6 Th1 (°C) ug Sep 7 0.54 Table 9c) 97 20.86 9, Th2 (°C)	768.6 Oct 0.74	7 709.09 Nov 0.86	Dec 0.91	21	(84) (85) (86) (87)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.9 Mean internat (87)m= 19.48 Temperature (88)m= 20.08	816.15 nal tempe during he etor for gain Feb 0.87 I temperate 19.74 during he 20.09	erature (eating period ins for limited in leading period perio	939.36 (heating eriods in Apr 0.72 iving are 20.46 eriods in 20.1	963.53 season the livi ea, h1,m May 0.61 ea T1 (for 20.75 rest of	93 93 93 93 93 93 93 94 95 95 96 96 97 97 97 97 97 97 97 97 97 97 97 97 97	area free Tal Jun 0.46 w ster 0.92 elling	watts 898.81 rom Tak ble 9a) Jul 0.35 os 3 to 7 20.97 from Tak 20.11	864 A 0.3 7 in T 20.	.19 830.6 Th1 (°C) ug Sep 7 0.54 Table 9c) 97 20.86 9, Th2 (°C)	768.6 Oct 0.74	7 709.09 Nov 0.86	Dec 0.91	21	(84)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.9 Mean interna (87)m= 19.48 Temperature (88)m= 20.08 Utilisation fact	setor for gaing setor for gain	erature (eating poins for line of line	939.36 (heating eriods in Apr 0.72 iving are 20.46 eriods in 20.1 est of decrease in the control of the control	963.53 season the livi ea, h1,m May 0.61 ea T1 (for 20.75 rest of 20.1 welling,	933 933 933 933 933 933 933 933 933 933	area f ee Tal Jun 0.46 w ster 0.92 elling 0.11 m (se	watts 898.81 rom Tak ble 9a) Jul 0.35 os 3 to 7 20.97 from Ta 20.11 e Table	864 Ai 0.3 7 in T 20. 9a)	.19 830.6 Th1 (°C) ug Sep 37 0.54 Table 9c) 97 20.86 9, Th2 (°C) 11 20.11	768.6 Oct 0.74 20.5	7 709.09 Nov 0.86 19.94	Dec 0.91 19.43 20.09	21	(84) (85) (86) (87) (88)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.9 Mean internat (87)m= 19.48 Temperature (88)m= 20.08	816.15 nal tempe during he etor for gain Feb 0.87 I temperate 19.74 during he 20.09	erature (eating period ins for limited in leading period perio	939.36 (heating eriods in Apr 0.72 iving are 20.46 eriods in 20.1	963.53 season the livi ea, h1,m May 0.61 ea T1 (for 20.75 rest of	933 933 933 933 933 933 933 933 933 933	area free Tal Jun 0.46 w ster 0.92 elling	watts 898.81 rom Tak ble 9a) Jul 0.35 os 3 to 7 20.97 from Tak 20.11	864 A 0.3 7 in T 20.	.19 830.6 Th1 (°C) ug Sep 37 0.54 Table 9c) 97 20.86 9, Th2 (°C) 11 20.11	768.6 Oct 0.74	7 709.09 Nov 0.86	Dec 0.91	21	(84) (85) (86) (87)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.9 Mean interna (87)m= 19.48 Temperature (88)m= 20.08 Utilisation fact	setor for gain during here. 19.74 during here. 20.09 eter for gain during here.	erature (eating poins for line 1 20.08 eating poins for rows)	939.36 (heating eriods in ving are 20.46 eriods in 20.1 est of do 0.69 he rest	963.53 season the livi ea, h1,m May 0.61 ea T1 (for 20.75 rest of 20.1 welling, 0.57 of dwell	93 ng a (See of other order of the other order of the other order	area f ee Tal Jun 0.46 w ster 0.92 elling 0.11 m (se	watts 898.81 rom Tak ble 9a) Jul 0.35 os 3 to 7 20.97 from Ta 20.11 e Table 0.28 bllow ste	864 Al 0.3 7 in T 20. 9a) 0.3	.19 830.6 Th1 (°C) ug Sep 87 0.54 Table 9c) 97 20.86 9, Th2 (°C) 11 20.11	768.6 Oct 0.74 20.5 20.1	7 709.09 Nov 0.86 19.94	Dec 0.91 19.43 20.09	21	(84) (85) (86) (87) (88) (89)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.9 Mean interna (87)m= 19.48 Temperature (88)m= 20.08 Utilisation fact (89)m= 0.89	setor for gain during here. 19.74 during here. 20.09 eter for gain during here.	erature (eating poins for line 1 20.08 eating poins for rows)	939.36 (heating eriods in ving are 20.46 eriods in 20.1 est of do	963.53 season the livi ea, h1,m May 0.61 ea T1 (for 20.75 rest of 20.1 welling, 0.57	93 93 10 (See	area f ee Tal Jun 0.46 w ster 0.92 elling 0.11 m (se	watts 898.81 rom Tak ble 9a) Jul 0.35 os 3 to 7 20.97 from Ta 20.11 e Table 0.28	864 Al 0.3 7 in T 20. 9a) 0.3	.19 830.6 Th1 (°C) ug Sep 87 0.54 Table 9c) 97 20.86 9, Th2 (°C) 11 20.11 81 0.49 to 7 in Tabl 09 19.98	768.6 Oct 0.74 20.5 20.1 0.71 e 9c) 19.52	7 709.09 Nov 0.86 19.94 20.1 0.84	Dec 0.91 19.43 20.09 0.9	21	(84) (85) (86) (87) (88) (89)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fac Jan (86)m= 0.9 Mean interna (87)m= 19.48 Temperature (88)m= 20.08 Utilisation fac (89)m= 0.89 Mean interna	sector for gain sector for gai	erature (eating period ins for III 20.08 eating period 20.09 eating period ins for III 20.79 eating period in III 20.79 eating	939.36 (heating eriods in ving are 20.46 eriods in 20.1 est of do 0.69 he rest	963.53 season the livi ea, h1,m May 0.61 ea T1 (for 20.75 rest of 20.1 welling, 0.57 of dwell	93 93 10 (See	area free Tal Jun 0.46 w ster 0.92 elling 0.11 m (se 0.41 T2 (fc	watts 898.81 rom Tak ble 9a) Jul 0.35 os 3 to 7 20.97 from Ta 20.11 e Table 0.28 bllow ste	864 A 0.3 7 in T 20. able 9 0.3 pa) 0.3 pps 3	.19 830.6 Th1 (°C) ug Sep 87 0.54 Table 9c) 97 20.86 9, Th2 (°C) 11 20.11 81 0.49 to 7 in Tabl 09 19.98	768.6 Oct 0.74 20.5 20.1 0.71 e 9c) 19.52	7 709.09 Nov 0.86 19.94 20.1 0.84	Dec 0.91 19.43 20.09 0.9	21	(84) (85) (86) (87) (88) (89)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fac Jan (86)m= 0.9 Mean interna (87)m= 19.48 Temperature (88)m= 20.08 Utilisation fac (89)m= 0.89 Mean interna	816.15 nal temper during he etor for gain service ser	erature (eating period ins for line) ture in lagrange 20.09 ins for range 20.79 ture in tale 18.92	939.36 (heating eriods in ving are Apr 0.72 iving are 20.46 eriods in 20.1 est of do 0.69 he rest 19.45	963.53 season the livi ea, h1,m May 0.61 ea T1 (for 20.75 rest of 20.1 welling, 0.57 of dwell 19.82	93 ng a n (see 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	area f ee Tal Jun 0.46 w ster 0.92 elling 0.11 m (se 0.41 T2 (fc 0.04	watts 898.81 rom Tak ble 9a) Jul 0.35 os 3 to 7 20.97 from Ta 20.11 e Table 0.28 bllow ste 20.09	864 Ali 0.3 7 in T 20. 9a) 0.3 eps 3	.19 830.6 .Th1 (°C) ug Sep .37 0.54 Table 9c) 97 20.86 9, Th2 (°C) 11 20.11 10 0.49 to 7 in Table 10 19.98	768.6 Oct 0.74 20.5 20.1 0.71 e 9c) 19.52	7 709.09 Nov 0.86 19.94 20.1 0.84	Dec 0.91 19.43 20.09 0.9		(84) (85) (86) (87) (88) (89)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fact Jan (86)m= 0.9 Mean interna (87)m= 19.48 Temperature (88)m= 20.08 Utilisation fact (89)m= 0.89 Mean interna (90)m= 18.08	816.15 nal temper during he etor for gain service ser	erature (eating period ins for line) ture in lagrange 20.09 ins for range 20.79 ture in tale 18.92	939.36 (heating eriods in ving are Apr 0.72 iving are 20.46 eriods in 20.1 est of do 0.69 he rest 19.45	963.53 season the livi ea, h1,m May 0.61 ea T1 (for 20.75 rest of 20.1 welling, 0.57 of dwell 19.82	93 ng a n (see of old	area f ee Tal Jun 0.46 w ster 0.92 elling 0.11 m (se 0.41 T2 (fc 0.04	watts 898.81 rom Tak ble 9a) Jul 0.35 os 3 to 7 20.97 from Ta 20.11 e Table 0.28 bllow ste 20.09	864 Ali 0.3 7 in T 20. 9a) 0.3 eps 3	.19 830.6 .Th1 (°C) ug Sep .67 0.54 .Table 9c) .97 20.86 .9, Th2 (°C) .11 20.11 .11 0.49 .15 to 7 in Table .19 19.98 .10 -fLA) × T2	768.6 Oct 0.74 20.5 20.1 0.71 e 9c) 19.52	7 709.09 Nov 0.86 19.94 20.1 0.84 18.75 ving area ÷ (Dec 0.91 19.43 20.09 0.9		(84) (85) (86) (87) (88) (89)
Total gains – i (84)m= 723.74 7. Mean inter Temperature Utilisation fac Jan (86)m= 0.9 Mean interna (87)m= 19.48 Temperature (88)m= 20.08 Utilisation fac (89)m= 0.89 Mean interna (90)m= 18.08	816.15 nal temper during he etor for gain service ser	erature (eating period ins for line 1 20.08 eating period 20.09 ins for real 18.92 eating period 19.28 eat	939.36 (heating eriods in ving are 20.46 eriods in 20.46 eriods in 20.46 eriods in 20.4 est of do 0.69 he rest 19.45	963.53 season the livi ea, h1,m May 0.61 ea T1 (for 20.75 rest of 20.1 welling, 0.57 of dwell 19.82	93 ng a (see of see of	area f ee Tal Jun 0.46 w ster 0.92 elling 0.11 T2 (fc 0.04 g) = fL 0.31	watts 898.81 rom Tak ble 9a) Jul 0.35 os 3 to 7 20.97 from Ta 20.11 e Table 0.28 bllow ste 20.09 A × T1 20.37	864 All 0.3 7 in T 20. 9a) 0.3 eps 3 20. + (1 20.	.19 830.6 .Th1 (°C) ug Sep .37 0.54 Table 9c) 97 20.86 9, Th2 (°C) 11 20.11 31 0.49 to 7 in Tabl 09 19.98 f -fLA) × T2 36 20.25	768.6 Oct 0.74 20.5 20.1 0.71 e 9c) 19.52 LA = Liv	7 709.09 Nov 0.86 19.94 20.1 0.84 18.75 ving area ÷ (Dec 0.91 19.43 20.09 0.9 18.01 4) =		(84) (85) (86) (87) (88) (89) (90) (91)

(93)m= 18.51	18.84	19.28	19.76	20.11	20.31	20.37	20.36	20.25	19.83	19.12	18.45		(93)
8. Space hea													
Set Ti to the the utilisation			•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation fac	ļ	l			<u> </u>		_ 3	1					
(94)m= 0.86	0.83	0.77	0.68	0.57	0.42	0.3	0.32	0.5	0.7	0.82	0.88		(94)
Useful gains,	hmGm	, W = (94	4)m x (8	4)m								•	
(95)m= 625.5	673.59	681.79	641.25	545.33	393.24	268.37	280.04	412.21	535.56	581.9	603.63		(95)
Monthly aver		T T		r								1	(00)
(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 (97)m= 1072.29	i	an intern	804.24	620.94	Lm , VV =	=[(39)m 274.4	x [(93)m	- (96)m 450.51	681.28	892.2	1063.78		(97)
Space heatin	l .	<u> </u>	l	l	l			L			1003.76		(37)
(98)m= 332.41	252.25	206.04	117.36	56.25	0	0.02	0	0	108.42	223.42	342.35		
	<u> </u>	<u>!</u>	<u> </u>	<u> </u>	<u> </u>		Tota	l per year	(kWh/year) = Sum(9	8) _{15,912} =	1638.5	(98)
Space heatin	a requir	ement in	k\/\/h/m²	2/vear				. ,	` ,	, ,	,	21.71	(99)
·	•											21.71	
9b. Energy red This part is us			The state of the s	Ĭ			ting prov	ided by	a comm	unity sol	nomo		
Fraction of spa										urnity Sci	icilic.	0	(301)
Fraction of spa	ace heat	from co	mmunity	svstem	1 – (30	1) =						1	(302)
The community so			•	•	,	,	allows for	CHP and i	up to four	other heat	sources: ti	he latter	`
includes boilers, h		-							ap to rour .	suror riout		no iditor	
Fraction of hea	at from C	Commun	ity boiler	'S								1	(303a)
Fraction of total	al space	heat fro	m Comn	nunity b	oilers				(3	02) x (303	a) =	1	(304a)
Factor for con	trol and	charging	method	(Table	4c(3)) fo	r comm	unity hea	ating sys	tem			1	(305)
Distribution los	ss factor	(Table 1	2c) for o	commun	ity heatii	ng syste	m					1.05	(306)
Space heating	g										,	kWh/yea	 r
Annual space	heating	requiren	nent									1638.5	
Space heat fro	m Com	munity b	oilers					(98) x (30	04a) x (30	5) x (306)	=	1720.43	(307a)
Efficiency of s	econdar	y/supple	mentary	heating	system	in % (fro	om Table	4a or A	ppendix	E)		0	(308
Space heating	require	ment fro	m secon	dary/su	oplemen	tary sys	tem	(98) x (30	01) x 100 -	÷ (308) =		0	(309)
Water heating	,												
Annual water		requirem	ent									2150.11	
If DHW from c	ommuni	ty schem	ne:										_
Water heat fro	m Comr	nunity bo	oilers					(64) x (30	03a) x (30	5) x (306)	=	2257.62	(310a)
Electricity use	d for hea	at distribu	ution				0.01	× [(307a).	(307e) +	(310a)	(310e)] =	39.78	(313)
Licetifolty doc											ı		—
Cooling Syste		y Efficie	ncy Rati	0								0	(314)
•	m Energ	-	•		n, if not e	enter 0)		= (107) ÷	(314) =			0	(314)
Cooling System Space cooling Electricity for p	m Energ (if there oumps a	is a fixe	d cooling	g systen velling (Γable 4f)	:		= (107) ÷	(314) =			0	(315)
Cooling System Space cooling	m Energ (if there oumps a	is a fixe	d cooling	g systen velling (Γable 4f)	:	outside	= (107) ÷	(314) =				=

warm air heating system fans			0	(330b)
pump for solar water heating			0	(330g)
Total electricity for the above, kWh/yea	ar	=(330a) + (330b) + (330g) =	293.53	(331)
Energy for lighting (calculated in Appe	ndix L)		339.07	(332)
Electricity generated by PVs (Appendix	x M) (negative quantity)		-765.71	(333)
Electricity generated by wind turbine (A	Appendix M) (negative quantity)		0	(334)
10b. Fuel costs – Community heating	scheme			
	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year	
Space heating from CHP	(307a) x	4.24 x 0.01 =	72.95	(340a)
Water heating from CHP	(310a) x	4.24 x 0.01 =	95.72	(342a)
		Fuel Price		
Pumps and fans	(331)	13.19 × 0.01 =	00.72	(349)
Energy for lighting	(332)	13.19 x 0.01 =	44.72	(350)
Additional standing charges (Table 12)			120	(351)
Energy saving/generation technologies				
Total energy cost	= (340a)(342e) + (345)(354) =		372.11	(355)
11b. SAP rating - Community heating	scheme			
Energy cost deflator (Table 12)			0.42	(356)
Energy cost factor (ECF)	$[(355) \times (356)] \div [(4) + 45.0] =$			(357)
SAP rating (section12)	Alin or a charma		81.9	(358)
12b. CO2 Emissions – Community hea		ergy Emission factor	Emissions	
		h/year kg CO2/kWh	kg CO2/year	
CO2 from other sources of space and Efficiency of heat source 1 (%)		s repeat (363) to (366) for the second fu	gel 94	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x	100 ÷ (367b) x 0.22	914.1	(367)
Electrical energy for heat distribution	[(313) x	0.52	= 20.65	(372)
Total CO2 associated with community	systems (363)(3	66) + (368)(372)	934.75	(373)
CO2 associated with space heating (se	econdary) (309) x	0	= 0	(374)
CO2 associated with water from imme	rsion heater or instantaneous hea	ater (312) x 0.22	= 0	(375)
Total CO2 associated with space and	water heating (373) + (3	74) + (375) =	934.75	(376)
CO2 associated with electricity for pun	nps and fans within dwelling (331	0.52	= 152.34	(378)
CO2 associated with electricity for light	ting (332))) x	0.52	= 175.98	(379)
Energy saving/generation technologies	s (333) to (334) as applicable	0.52 × 0.01 =		(000)
Item 1	sum of (376)(382) =	0.52 X 0.01 =	007777	(380)
Total CO2, kg/year	3um or (3/0)(302) =		865.67	(383)

Dwelling CO2 Emission Rate (383) ÷ (4) =				11.47	(384)
El rating (section 14)				90.37	(385)
13b. Primary Energy – Community heating scheme					
	Energy kWh/year	Primary factor		Energy /h/year	
Energy from other sources of space and water heating (not CF Efficiency of heat source 1 (%) If there is CHP usi	HP) ing two fuels repeat (363) to	(366) for the second t	uel	94	(367a)
Energy associated with heat source 1 [(307b))+(310b)] x 100 ÷ (367b) x	1.22	= [5163	(367)
Electrical energy for heat distribution	[(313) x		= [122.13	(372)
Total Energy associated with community systems	(363)(366) + (368)(37	2)	= [5285.12	(373)
if it is negative set (373) to zero (unless specified otherwise,	see C7 in Appendix C	C)		5285.12	(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) =			5285.12	(376)
Energy associated with space cooling	(315) x	3.07	= [0	(377)
Energy associated with electricity for pumps and fans within de	welling (331)) x	3.07	= [901.15	(378)
Energy associated with electricity for lighting	(332))) x	3.07	=	1040.94	(379)
Energy saving/generation technologies Item 1		3.07 x 0.01	=	-2350.74	(380)
Total Primary Energy, kWh/year sum of (376)	(382) =			4876.47	(383)

		User D)etails: _						
Assessor Name: Software Name:	Zahid Ashraf Stroma FSAP 2012		Strom Softwa	are Ve	rsion:			0001082 on: 1.0.5.9	
Address :	F	Property	Address	Plot 49					
1. Overall dwelling dime	ensions:								
3		Are	a(m²)		Av. He	ight(m)		Volume(m	³)
Ground floor		7	75.48	(1a) x	2	2.5	(2a) =	188.71	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e)+(1	n) 7	75.48	(4)					
Dwelling volume				(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	188.71	(5)
2. Ventilation rate:									
	main seconda heating heating	ry	other		total			m³ per hou	ır
Number of chimneys	0 + 0	+	0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 + 0	- + -	0	Ī - [0	x 2	20 =	0	(6b)
Number of intermittent fa	ns				3	x -	10 =	30	(7a)
Number of passive vents	;			Ē	0	x ′	10 =	0	(7b)
Number of flueless gas fi	res			F	0	X 4	40 =	0	(7c)
				L					
				_			Air ch	nanges per ho	our —
	ys, flues and fans = $(6a)+(6b)+(6b)+(6a)+(6b)+(6a)+(6b)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a)+(6a$				30		÷ (5) =	0.16	(8)
Number of storeys in the	neen carried out or is intended, procee he dwelling (ns)	ea 10 (17),	ourierwise	onunue ir	om (9) to	(10)		0	(9)
Additional infiltration	3 \					[(9)-	-1]x0.1 =	0	(10)
	.25 for steel or timber frame o			•	ruction			0	(11)
if both types of wall are padeducting areas of openia	resent, use the value corresponding t	o the grea	ter wall are	a (after					
,	floor, enter 0.2 (unsealed) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else enter 0							0	(13)
-	s and doors draught stripped							0	(14)
Window infiltration			0.25 - [0.2	. ,	-			0	(15)
Infiltration rate	250 averaged in autic mate		(8) + (10)					0	(16)
•	q50, expressed in cubic metro lity value, then $(18) = [(17) \div 20] + (18)$	-		•	etre or e	envelope	area	5	(17)
•	es if a pressurisation test has been do				is being u	sed		0.41	(10)
Number of sides sheltered	ed							2	(19)
Shelter factor			(20) = 1 -		19)] =			0.85	(20)
Infiltration rate incorporat	•		(21) = (18) x (20) =				0.35	(21)
Infiltration rate modified f	- 1 	1	Ι,			T		1	
Jan Feb	Mar Apr May Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp (22)m= 5.1 5	peed from Table 7 4.9 4.4 4.3 3.8	3.8	3.7	4	4.3	4.5	4.7	1	
(22)m= 5.1 5	4.3 3.8] 3.6	3.1	4	4.3	J 4.0	4.1	J	
Wind Factor $(22a)m = (2a)m =$	2)m ÷ 4							1	
(22a)m= 1.27 1.25	1.23 1.1 1.08 0.95	0.95	0.92	1	1.08	1.12	1.18		

0.44	0.43	0.43	0.38	0.37	0.33	peed) = 0.33	0.32	0.35	0.37	0.39	0.41		
Calculate effe							0.32	0.33	0.37	0.39	0.41		
If mechanic	al ventila	tion:										0	(23
If exhaust air h	eat pump ι	using Appe	endix N, (2	3b) = (23a	ı) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(23
If balanced wit	h heat reco	very: effic	iency in %	allowing for	or in-use fa	actor (from	Table 4h) =				0	(23
a) If balance	ed mecha	anical ve	ntilation	with hea	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		(24
b) If balance	ed mecha	anical ve	ntilation	without	heat rec	overy (N	ЛV) (24b)m = (22	2b)m + (2	23b)			
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
c) If whole h if (22b)r	nouse ext n < 0.5 ×			•	•				5 × (23b)			
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
d) If natural	ventilation								0.51				
(24d)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(24
Effective air	change	rate - er	ıter (24a	or (24b	o) or (24	c) or (24	d) in box	(25)					
(25)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(25
2 Heat lease		ot loop r											
3. Heat losse	s and ne	•	Openin		Net Ar	00	U-valı	10	AXU		k-value	Λ	Χk
ELEMENT	area		m		A,r		W/m2		(W/I	<)	kJ/m ² ·K		J/K
Doors					2	x	1	= [2				(26)
Windows Type	e 1				1.696	x1/	/[1/(1.4)+	0.04] =	2.25				(27
Windows Type	e 2				11.46	4 x1/	/[1/(1.4)+	0.04] =	15.2	=			(27
Floor					11.68	x	0.13		1.5184	<u> </u>			(28
Walls Type1	45.7	3	13.16	3	32.57	· x	0.18	=	5.86	Ħ i			(29
Walls Type2	28.8	9	2		26.89	x	0.18	<u> </u>	4.84	Ŧ i			(29
				=		=							
Roof	75.4	δI	0		75.48	X	0.13	<u> </u>	9.81				(30
			0		75.48	=	0.13	=	9.81				
Total area of e	elements	, m²		ndow U-va	161.7	8		= [s given in	paragraph	3.2	
Total area of e	elements I roof windo	, m² ows, use e	ffective wi		161.78	8 ated using	formula 1	= [/[(1/U-valu		s given in	paragraph	3.2	
Total area of e * for windows and ** include the are Fabric heat los	elements I roof windo as on both ss, W/K =	, m² ows, use e sides of in = S (A x	ffective wi		161.78	8 ated using		= [/[(1/U-valu + (32) =	e)+0.04] a			3.2	(31
Total area of e * for windows and ** include the are Fabric heat los Heat capacity	elements I roof winder as on both ss, W/K = Cm = S(, m² bws, use e sides of in S (A x A x k)	ffective wi ternal wall	s and part	161.76 alue calcula titions	8 ated using	formula 1	= [/[(1/U-valu + (32) = ((28)	e)+0.04] a	2) + (32a).			(31
Total area of e * for windows and ** include the are Fabric heat los Heat capacity Thermal mass	elements I roof winder as on both as, W/K = Cm = S(, m² ows, use e sides of in = S (A x A x k) ter (TMF	ffective winternal walk U) P = Cm ÷	s and part	161.76 alue calculatitions	8 ated using	(26)(30)	= [/[(1/U-valu + (32) = ((28) Indica	e)+0.04] a .(30) + (32) tive Value:	2) + (32a). : Medium	(32e) = [41.48	(31
Total area of e * for windows and ** include the are. Fabric heat los Heat capacity Thermal mass For design asses	elements I roof windo as on both ss, W/K = Cm = S(a parame sments wh	, m² bws, use e sides of in = S (A x A x k) ter (TMF ere the de	ffective winternal walk U) $P = Cm \div tails of the$	s and part	161.76 alue calculatitions	8 ated using	(26)(30)	= [/[(1/U-valu + (32) = ((28) Indica	e)+0.04] a .(30) + (32) tive Value:	2) + (32a). : Medium	(32e) = [41.48	(31
Total area of e * for windows and ** include the are. Fabric heat los Heat capacity Thermal mass For design asses can be used inste	elements I roof winder as on both as, W/K = Cm = S(a parame aments wheread of a december of the second contents o	, m² cows, use e sides of in S (A x A x k) ter (TMF ere the de	ffective winternal walk U) P = Cm ÷ tails of the ulation.	s and part - TFA) in	161.7s alue calculatitions a kJ/m²K ion are not	8 ated using	(26)(30)	= [/[(1/U-valu + (32) = ((28) Indica	e)+0.04] a .(30) + (32) tive Value:	2) + (32a). : Medium	(32e) = [41.48	(31
Total area of e * for windows and ** include the area Fabric heat los Heat capacity Thermal mass For design assess can be used inste Thermal bridg	elements I roof windo as on both ss, W/K = Cm = S(a parame sments whead of a det es : S (L	, m² bws, use e sides of in a	ffective winternal walk U) P = Cm ÷ tails of the ulation. culated to	s and part - TFA) ir constructi	161.73 hitions h kJ/m²K hon are not	8 ated using	(26)(30)	= [/[(1/U-valu + (32) = ((28) Indica	e)+0.04] a .(30) + (32) tive Value:	2) + (32a). : Medium	(32e) = [41.48 2387.77 250	(31
Total area of e * for windows and ** include the are. Fabric heat los Heat capacity Thermal mass For design assess can be used inste Thermal bridg if details of thermal	elements I roof windo as on both ss, W/K = Cm = S(a parame sments whe had of a det es : S (L al bridging	, m² bws, use e sides of in a	ffective winternal walk U) P = Cm ÷ tails of the ulation. culated to	s and part - TFA) ir constructi	161.73 hitions h kJ/m²K hon are not	8 ated using	(26)(30)	= [/[(1/U-valu + (32) = ((28) Indica	e)+0.04] a .(30) + (32 tive Value: values of	2) + (32a). : Medium	(32e) = [41.48 2387.77 250	(31 (33 (34 (35) (36)
Roof Total area of e * for windows and ** include the are. Fabric heat los Heat capacity Thermal mass For design asses can be used inste Thermal bridg if details of thermal Total fabric head	elements I roof windo as on both as, W/K = Cm = S(a parame and of a det es : S (L al bridging eat loss	, m² bws, use e sides of in a	ffective winternal walk U) P = Cm ÷ tails of the lation. culated to	- TFA) in constructiusing Ap	161.73 hitions h kJ/m²K hon are not	8 ated using	(26)(30)	= [/[(1/U-valu + (32) = ((28) Indica e indicative (33) +	e)+0.04] a .(30) + (32 tive Value: values of	2) + (32a). : Medium TMP in Ta	(32e) = [41.48 2387.77 250 22.44	(30 (31 (33 (34 (35) (36) (37)
Total area of e * for windows and ** include the are. Fabric heat los. Heat capacity Thermal mass For design assess can be used inste Thermal bridg if details of therm. Total fabric he	elements I roof windo as on both as, W/K = Cm = S(a parame and of a det es : S (L al bridging eat loss	, m² bws, use e sides of in a	ffective winternal walk U) P = Cm ÷ tails of the lation. culated to	- TFA) in constructiusing Ap	161.73 hitions h kJ/m²K hon are not	8 ated using	(26)(30)	= [/[(1/U-valu + (32) = ((28) Indica e indicative (33) +	e)+0.04] a .(30) + (32) tive Value: values of	2) + (32a). : Medium TMP in Ta	(32e) = [41.48 2387.77 250 22.44	(31 (33 (34 (35 (36 (37
Total area of e * for windows and ** include the are Fabric heat los Heat capacity Thermal mass For design asses can be used inste Thermal bridg if details of thermal Total fabric head Ventilation head	elements I roof winder as on both as, W/K = Cm = S(a parame and of a det es : S (L al bridging eat loss at loss ca	, m² bws, use e sides of interest (A x k) ter (TMF) ere the detailed calcut x Y) calcut are not kn	ffective winternal walk U) P = Cm ÷ tails of the culation. culated to cown (36) =	- TFA) in constructions Ap = 0.05 x (3	161.7s alue calculations a kJ/m²K fon are not spendix k	8 ated using	(26)(30)	= [/[(1/U-valu + (32) = ((28) Indica e indicative (33) + (38)m	e)+0.04] a .(30) + (32) tive Values values of (36) = = 0.33 × (2) + (32a). Medium TMP in Ta	(32e) = [41.48 2387.77 250 22.44	(31) (33) (34) (35) (36)
Total area of e * for windows and ** include the are. Fabric heat los Heat capacity Thermal mass For design assess can be used inste Thermal bridg if details of therm. Total fabric head Ventilation head	elements I roof windo as on both as, W/K = Cm = S(a parame sments whead of a det es : S (L al bridging eat loss at loss ca Feb 37.02	, m² bws, use e sides of in a	ffective winternal walk U) P = Cm ÷ tails of the ulation. culated to own (36) = I monthly	- TFA) in constructi using Ap = 0.05 x (3	161.73 h kJ/m²K fon are not spendix h 1) Jun	8 ated using	formula 1. (26)(30) ecisely the	= [/[(1/U-valu + (32) = ((28) Indica e indicative (33) + (38)m Sep 34.9	e)+0.04] a .(30) + (32) tive Value: values of (36) = = 0.33 × (Oct	2) + (32a). Medium TMP in Ta 25)m x (5) Nov 35.9	(32e) = [[able 1f	41.48 2387.77 250 22.44	(31 (33 (34 (35) (36) (37)

Heat loss para	meter (l	HLP). W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.34	1.34	1.33	1.32	1.32	1.3	1.3	1.3	1.31	1.32	1.32	1.33		
` ′							<u> </u>	<u> </u>	L Average =	L Sum(40)₁.	12 /12=	1.32	(40)
Number of day	s in mo	nth (Tab	le 1a)							, ,	!		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4 Water heat	ing one	rav roqui	romont:								kWh/ye	or:	
4. Water heat	ing ene	rgy requi	rement.								KVVII/ye	di.	
Assumed occu if TFA > 13.9 if TFA £ 13.9	0, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9))2)] + 0.0	0013 x (⁻	TFA -13		37		(42)
Annual average Reduce the annua									an torget o		.52		(43)
not more that 125	-				-	•	o acnieve	a water us	se target o	οτ			
							۸۰۰۵	Con	Oct	Nov	Doo		
Jan Hot water usage in	Feb	Mar day for ea	Apr	Vd.m = fa	Jun	Jul Table 1c x	Aug (43)	Sep	Oct	Nov	Dec		
	·						, ,	00.74			00.50		
(44)m= 99.58	95.96	92.34	88.71	85.09	81.47	81.47	85.09	88.71	92.34	95.96	99.58	4000.0	— (44)
Energy content of	hot water	used - cal	culated mo	onthly = 4 .	190 x Vd.r	n x nm x D)Tm / 3600			m(44) ₁₁₂ = ables 1b. 1		1086.3	(44)
(45)m= 147.67	129.15	133.27	116.19	111.49	96.21	89.15	102.3	103.52	120.65	131.69	143.01		
(45)111= 147.07	129.13	133.27	110.19	111.49	90.21	09.13	102.3				l .	1424.31	(45)
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		rotai = Su	m(45) ₁₁₂ =	=	1424.31	(43)
(46)m= 22.15	19.37	19.99	17.43	16.72	14.43	13.37	15.35	15.53	18.1	19.75	21.45		(46)
Water storage		19.99	17.43	10.72	14.43	13.37	15.55	15.55	10.1	19.75	21.45		(40)
Storage volume) includin	g any so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	eating a	and no ta	nk in dw	vellina. e	nter 110	litres in	(47)						, ,
Otherwise if no	•			•			` '	ers) ente	er '0' in ((47)			
Water storage	loss:		·					·					
a) If manufacto	urer's d	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 from	m watei	storage	, kWh/ye	ear			(48) x (49)) =		0.	75		(50)
b) If manufacti	urer's d	eclared o	ylinder l	oss fact	or is not	known:							
Hot water stora	•			e 2 (kWl	h/litre/da	ıy)					0		(51)
If community h	_		on 4.3										
Volume factor f			2h								0		(52)
Temperature fa											0		(53)
Energy lost from		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (, ,	,								0.	75		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)ı	m 				
(56)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(56)
If cylinder contains	dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	ix H	
(57)m= 23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33		(57)
Primary circuit	loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit				•	•	. ,	, ,						
(modified by										- 			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss calculated for each month $(61)m = (60) \div 365 \times (41)m$													
$\begin{array}{c c} \text{Combinoss o} \\ \text{(61)m=} & 0 \end{array}$	balculated 0	or each	month (0 1)m =	(6U) ÷ 30	05 × (41)	0	0	0	0	0	1	(61)
	_!						<u> </u>	<u> </u>		<u> </u>		(50) == : (64) ==	(01)
(62)m= 194.2	-i	179.87	161.28	158.08	141.3	135.74	148.9	148.61	167.24	176.79	189.61	(59)m + (61)m]	(62)
` /								1				J	(02)
Solar DHW inpo									r contribut	ion to wate	er nealing)		
(63)m= 0	0	0	0	0	0) 300 Ap	0) 0	0	0	0	1	(63)
Output from			Ů									J	()
(64)m= 194.2		179.87	161.28	158.08	141.3	135.74	148.9	148.61	167.24	176.79	189.61]	
	-1					<u> </u>	Out	put from w	ater heate	<u>ı </u>	12	1972.93	(64)
Heat gains f	rom water	heating,	kWh/mo	onth 0.2	5 ′ [0.85	× (45)m	+ (61)r	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	.]	-
(65)m= 86.38	1	81.59	74.71	74.35	68.06	66.92	71.29	70.49	77.39	79.86	84.83	ĺ	(65)
include (5	7)m in cal	culation o	of (65)m	onlv if c	vlinder i	s in the o	dwellina	or hot w	ater is f	rom com	munity h	ı neating	
5. Internal	<u> </u>		. ,				9				• •	Jan y	
Metabolic gains (Table 5), Watts													
Jar		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 118.5	8 118.58	118.58	118.58	118.58	118.58	118.58	118.58	118.58	118.58	118.58	118.58		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m= 19.2	17.05	13.87	10.5	7.85	6.63	7.16	9.31	12.49	15.86	18.51	19.73		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m= 209.7	4 211.92	206.43	194.76	180.02	166.17	156.91	154.74	160.22	171.9	186.64	200.49		(68)
Cooking gair	ns (calcula	ated in A	pendix	L, equat	ion L15	or L15a)	, also s	ee Table	5	•	•	•	
(69)m= 34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86		(69)
Pumps and	fans gains	(Table 5	āa)									•	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g.	evaporatio	n (negat	ive valu	es) (Tab	le 5)		=	-		-		•	
(71)m= -94.8	6 -94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86	-94.86		(71)
Water heatir	ng gains (7	rable 5)				•			•	•	•	•	
(72)m= 116.°	1 114.01	109.66	103.76	99.93	94.53	89.94	95.82	97.91	104.02	110.92	114.01		(72)
Total intern	al gains =				(66))m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	'1)m + (72))m		
(73)m= 406.6	1 404.55	391.54	370.59	349.37	328.9	315.59	321.44	332.19	353.35	377.64	395.81]	(73)
6. Solar ga	ins:												
Solar gains ar	e calculated	using sola	r flux from	Table 6a	and assoc	iated equa	tions to c	onvert to th	ne applicat	ole orientat	tion.		
Orientation:			Area		Flu		_	g_ -	_	FF		Gains	
	Table 6d		m²			ble 6a		Table 6b	_ '	able 6c		(W)	
Northeast 0.9		X	1.	7	X 1	1.28	X	0.63	x	0.7	=	5.85	(75)
Northeast 0.9	× 0.77	X	1.	7	x 2	22.97	х	0.63	x	0.7	=	11.9	(75)
Northeast 0.9	•	Х	1.	7	X	11.38	x	0.63	x	0.7	=	21.45	(75)
Northeast 0.9	× 0.77	X	1.	7	x 6	67.96	x	0.63	x	0.7	=	35.22	(75)
Northeast 0.9	× 0.77	X	1.	7	x 9	91.35	x	0.63	x	0.7	=	47.35	(75)

N1		_			_		7		_				–
Northeast _{0.9x}	0.77	×	1.	7	x	97.38	X	0.63	×	0.7	=	50.48	(75)
Northeast _{0.9x}	0.77	X	1.	7	X	91.1	X	0.63	X	0.7	=	47.22	(75)
Northeast _{0.9x}	0.77	×	1.	7	X	72.63	X	0.63	X	0.7	=	37.64	(75)
Northeast _{0.9x}	0.77	X	1.	7	X	50.42	X	0.63	X	0.7	=	26.13	(75)
Northeast _{0.9x}	0.77	X	1.	7	x	28.07	X	0.63	X	0.7	=	14.55	(75)
Northeast _{0.9x}	0.77	X	1.	7	x	14.2	X	0.63	X	0.7	=	7.36	(75)
Northeast 0.9x	0.77	X	1.	7	x	9.21	X	0.63	X	0.7	=	4.78	(75)
Southeast 0.9x	0.77	X	11.	46	x	36.79	X	0.63	X	0.7	=	128.91	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	62.67	X	0.63	X	0.7	=	219.58	(77)
Southeast 0.9x	0.77	x	11.	46	x	85.75	X	0.63	x	0.7	=	300.44	(77)
Southeast _{0.9x}	0.77	×	11.	46	x	106.25	x	0.63	x	0.7		372.26	(77)
Southeast _{0.9x}	0.77	x	11.	46	x	119.01	X	0.63	x	0.7	=	416.96	(77)
Southeast 0.9x	0.77	x	11.	46	x	118.15	X	0.63	x	0.7	=	413.94	(77)
Southeast 0.9x	0.77	x	11.	46	x	113.91	x	0.63	x	0.7	=	399.09	(77)
Southeast 0.9x	0.77	x	11.	46	х	104.39	X	0.63	x	0.7	=	365.74	(77)
Southeast 0.9x	0.77	i x	11.	46	x	92.85	j×	0.63	×	0.7	_ =	325.31	(77)
Southeast 0.9x	0.77	X	11.	46	х	69.27	X	0.63	×	0.7	_ =	242.68	(77)
Southeast 0.9x	0.77	X	11.	46	x	44.07	X	0.63	x	0.7	=	154.4	(77)
Southeast 0.9x	0.77	i x	11.	46	x	31.49	X	0.63	×	0.7		110.32	(77)
(1)													
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m													
(83)m= 134.76		1.89	407.48	464.31	464.4	2 446.31	403		257.23	3 161.76	115.1]	(83)
Total gains – i	nternal and	solar	(84)m =	= (73)m	+ (83)	m , watts	!	!				J	
(84)m= 541.37	636.04 71	3.43	778.07	813.67	793.3	2 761.89	724	.82 683.64	610.58	3 539.4	510.9]	(84)
7. Mean inter	nal tempera	ture ((heating	seasor	n)	•		•			•		
Temperature			,		<i></i>	a from Ta	ble 9.	Th1 (°C)				21	(85)
Utilisation fac	•	•			•			(-)					`
Jan	<u>_</u>	Mar	Apr	May	Jui		Α	ug Sep	Oct	Nov	Dec]	
(86)m= 1		.98	0.95	0.87	0.71	-	0.5		0.96	0.99	1		(86)
Mean interna	l temperatur	ro in I	iving ar	oa T1 (f	ollow s	stone 3 to	7 in T	able 9c)			!	J	
(87)m= 19.62	· · · · · ·	0.08	20.43	20.74	20.9	_ i	20.		20.46	19.97	19.58]	(87)
	ļ .			<u> </u>				!		1	1	J	()
Temperature						<u> </u>	1		40.00	10.00	10.00	1	(88)
(88)m= 19.81	19.81 19	9.81	19.83	19.83	19.8	19.84	19.	19.83	19.83	19.82	19.82		(00)
Utilisation fac		- 1			т —	`	T		ı			1	
(89)m= 0.99	0.99 0	.97	0.93	0.82	0.61	0.41	0.4	6 0.74	0.94	0.99	1		(89)
Mean interna	l temperatui	re in t	he rest	of dwell	ing T2	(follow ste	eps 3	to 7 in Tabl	e 9c)	_		_	
(90)m= 17.99	18.27 18	3.67	19.17	19.57	19.7	9 19.83	19.	83 19.72	19.22	18.52	17.95		(90)
								1	LA = Liv	ring area ÷ (4) =	0.31	(91)
Mean interna	l temperatui	re (fo	r the wh	ole dwe	elling) =	= fLA × T1	+ (1	– fLA) × T2					_
		`			٠,							_	
(92)m= 18.49	18.74 19	9.11	19.56	19.93	20.1	4 20.19	20.	18 20.07	19.6	18.97	18.46		(92)
(92)m= 18.49 Apply adjustr	ll			l	1				l		18.46		(92)

			· · · · · · · · · · · · · · · · · · ·				•				•		•	
(93)m=	18.49	18.74	19.11	19.56	19.93	20.14	20.19	20.18	20.07	19.6	18.97	18.46		(93)
			uirement											
			ernal ter or gains			ed at ste	ep 11 of	Table 9	b, so tha	ıt Ti,m=(76)m an	d re-calc	culate	
uic at	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa			ains, hm	<u> </u>	····ωy	0 0111		1 7.09			1.101			
(94)m=	0.99	0.98	0.97	0.92	0.82	0.64	0.46	0.5	0.75	0.94	0.98	0.99		(94)
Usefu	ıl gains,	hmGm .	, W = (94	4)m x (84	4)m		Į.		Į.	l .		Į.		
(95)m=	536.97	625.55	688.6	715.68	668.02	509.91	347.3	362.9	515.67	571.3	530.77	507.64		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8							•	
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
							- ` 	x [(93)m	`		.	i	ı	
(97)m=	1436.17	1397.06	1269.64	1062.19	818.29	545.3	353.11	371.76	589.94	894.99	1184.74	1429.27		(97)
	r i		i				ı	24 x [(97	í ·	í - ·	r		İ	
(98)m=	669	518.46	432.29	249.49	111.8	0	0	0	0	240.83	470.85	685.69		٦,,,,,,
								Tota	ıl per year	(kWh/yea	r) = Sum(9	8) _{15,912} =	3378.41	(98)
Space	e heating	g require	ement in	kWh/m²	/year								44.76	(99)
9a. En	ergy req	uiremer	nts – Indi	vidual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Space	e heatin	ıg:												_
Fracti	on of sp	ace hea	t from s	econdar	y/supple	mentary	system						0	(201)
Fraction of space heat from main system(s) (202) = 1 - (201) =										1	(202)			
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] =$									1	(204)				
Efficiency of main space heating system 1										93.5	(206)			
Efficiency of secondary/supplementary heating system, %										0	(208)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	⊐ ar
Space	e heating	g require	ement (c	•	•)			· ·				,	
	669	518.46	432.29	249.49	111.8	0	0	0	0	240.83	470.85	685.69		
(211)m	n = {[(98])m x (20	4)] } x 1	00 ÷ (20)6)			•	•	•	•	•	•	(211)
	715.51	554.5	462.35	266.83	119.57	0	0	0	0	257.57	503.59	733.36		
•								Tota	l (kWh/yea	ar) =Sum(2	211) _{15,1012}	=	3613.27	(211)
Space	e heating	g fuel (s	econdar	y), kWh/	month									_
= {[(98])m x (20	1)] } x 1	00 ÷ (20	8)					-	-		_		
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	ıl (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water	heating	l												
Output			ter (calc				·	T	l	·	r	l	I	
⊏ ((; . ; . ;	194.27	171.24	179.87	161.28	158.08	141.3	135.74	148.9	148.61	167.24	176.79	189.61		7(040)
	ncy of w							T					79.8	(216)
(217)m=		87.58	87.07	85.97	83.91	79.8	79.8	79.8	79.8	85.79	87.3	87.95		(217)
		-	kWh/mo (217) ÷ (
	221.13	195.51	206.58	187.6	188.4	177.07	170.11	186.59	186.23	194.95	202.49	215.59		
								Tota	l = Sum(2	19a) ₁₁₂ =		ı	2332.25	(219)
Annua	l totals									k'	Wh/year	•	kWh/year	」 `
Space	heating	fuel use	ed, main	system	1						-		3613.27	
														_

Water heating fuel used				2332.25	
Electricity for pumps, fans and electric keep-hot					_
central heating pump:			30		(230c)
boiler with a fan-assisted flue	45		(230e)		
Total electricity for the above, kWh/year	sum of (230	0a)(230g) =		75	(231)
Electricity for lighting				339.07	(232)
12a. CO2 emissions – Individual heating system	s including micro-CHP				
	Energy kWh/year	Emission fac kg CO2/kWh	tor	s ar	
Space heating (main system 1)	(211) x	0.216	=	780.47	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	503.77	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1284.23	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	175.98	(268)
Total CO2, kg/year	Sul	m of (265)(271) =		1499.14	(272)

TER =

(273)

19.86