Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.18 Printed on 08 November 2019 at 12:20:58

Project Information:

Assessed By: Ross Boulton (STRO028068) **Building Type:** Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 50.5m²

Site Reference: Plot Reference: B2 Stg 4 Issue B2A-102-01

B2A-102-01, Flat Type 2-11A, Wimbledon, London Address:

Client Details:

Name: **Galliard Homes**

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), Mains gas (c)

Fuel factor: 1.00 (mains gas (c), mains gas (c))

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

Dwelling Carbon Dioxide Emission Rate (DER) 9.73 kg/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 34.6 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 35.9 kWh/m²

Fail

Excess energy = $1.31 \text{ kg/m}^2 (03.8 \%)$

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	(no roof)		

OK **Openings** 1.35 (max. 2.00) 1.35 (max. 3.30)

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.15

Air permeability at 50 pascals 5.00 (design value)

Maximum **OK** 10.0

4 Heating efficiency

Main Heating system: Community heating schemes - mains gas

Secondary heating system: None

5 Cylinder insulation

Hot water Storage: No cylinder

6 Controls

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

programmer and at least two room thermostats

Hot water controls: No cylinder thermostat

No cylinder

OK

Regulations Compliance Report

7 Low energy lights		
Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK
8 Mechanical ventilation		
Continuous extract system		
Specific fan power:	0.3	
Maximum	0.7	OK
9 Summertime temperature		
Overheating risk (Thames valley):	Medium	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: South East	6.79m²	
Windows facing: North East	2m²	
Windows facing: South East	2.92m²	
Windows facing: North East	2.92m²	
Ventilation rate:	4.00	
Blinds/curtains:	Light-coloured curtain or rolle	er blind
	Closed 100% of daylight hou	rs

10 Key features

 $Community\ heating,\ heat\ from\ boilers-mains\ gas$

Photovoltaic array

Predicted Energy Assessment

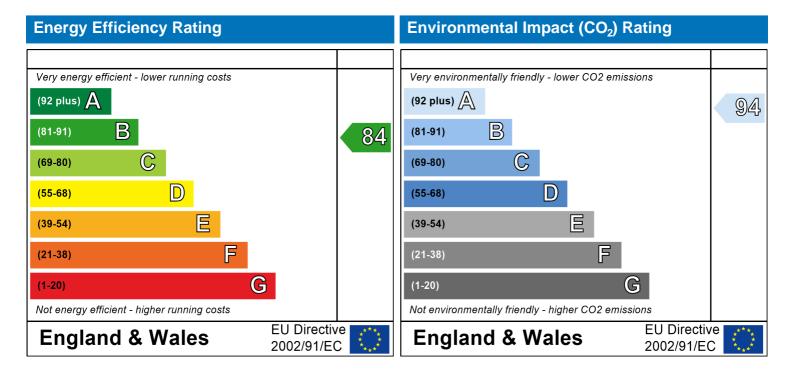


B2A-102-01 Flat Type 2-11A Wimbledon London Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat 01 December 2018 Ross Boulton 50.5 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

SAP Input

Property Details: B2A-102-01

Address: B2A-102-01, Flat Type 2-11A, Wimbledon, London

Located in: England Region: Thames valley

UPRN:

Date of assessment:

Date of certificate:

Assessment type:

01 December 2018
08 November 2019
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: True

PCDF Version: 451

Property description:

Dwelling type: Flat

Detachment:

Year Completed: 2018

Floor Location: Floor area:

Storey height:

Floor 0 50.5 m^2 2.6 m

Living area: 25.678 m² (fraction 0.489)

Front of dwelling faces: North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
SE_2.6_2.61 x 1	Manufacturer	Windows	low-E, $En = 0.05$, soft coat	No	
NE_1.02_1.96 x 1	Manufacturer	Windows	low-E, $En = 0.05$, soft coat	No	
SE_1.14_2.56 x 1	Manufacturer	Windows	low-E, $En = 0.05$, soft coat	No	
NE_1.14_2.56 x 1	Manufacturer	Windows	low-E, $En = 0.05$, soft coat	No	

Name:	Gap:	Frame Fa	actor: g-value:	U-value:	Area:	No. of Openings:
SE_2.6_2.61 x 1	16mm or more	0.8	0.5	1.35	6.79	1
NE_1.02_1.96 x 1	16mm or more	0.8	0.5	1.35	2	1
SE_1.14_2.56 x 1	16mm or more	0.8	0.5	1.35	2.92	1
NF 1 14 2 56 x 1	16mm or more	0.8	0.5	1 35	2 92	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
SE_2.6_2.61 x 1	<i>3</i> i	Wall	South East	2.6	2.61
NE_1.02_1.96 x	1	Wall	North East	1.02	1.96
SE_1.14_2.56 x	1	Wall	South East	1.14	2.56
NE 1.14 2.56 x	1	Wall	North East	1.14	2.56

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Element	<u>ts</u>						
Wall	34.741	14.63	20.11	0.15	0	False	N/A
Upper exposed	2.026			0.13			N/A
Internal Element							

Internal Elements
Party Elements

Thermal bridges:

SAP Input

Thermal bridges: No information on thermal bridging (y=0.15) (y=0.15)

Ventilation:

Pressure test: Yes (As designed)

Ventilation: Centralised whole house extract

Number of wet rooms: Kitchen + 2

Ductwork: , 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: 3
Pressure test: 5

Main heating system

Main heating system: Community heating schemes

Heat source: Community CHP

heat from boilers - mains gas, heat fraction 0.666, efficiency 50.4

Heat source: Community boilers

heat from boilers - mains gas, heat fraction 0.334, efficiency 95

Piping>=1991, pre-insulated, low temp, variable flow

Main heating Control:

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

thermostats

Control code: 2312

Secondary heating system:

Secondary heating system: None

Water heating:

Water heating: From main heating system

Water code: 901

Fuel :heat from boilers - mains gas

No hot water cylinder Solar panel: False

Others:

Electricity tariff: Standard Tariff

In Smoke Control Area: Yes

Conservatory: No conservatory

Low energy lights: 100%

Terrain type: Dense urban

EPC language: English

Wind turbine: No

Photovoltaics: Photovoltaic 1

Installed Peak power: 0.309

Tilt of collector: 30°

Overshading: None or very little Collector Orientation: South West

Assess Zero Carbon Home: No

			lloor D) etaile.						
Assessor Name: Software Name:	Ross Boulton Stroma FSAP 20		User D	Strom Softwa	are Vei	rsion:			0028068 on: 1.0.4.18	
Address :	B2A-102-01, Flat T			Address oledon, L)2-01				
1. Overall dwelling dime) po = 1.	, , , , , , , , , , , , , , , , , , , ,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Ondon					
Ground floor				a(m²) 50.5	(1a) x		ight(m) 2.6	(2a) =	Volume(m³ 131.3) (3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1	e)+(1r	n) [50.5	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3c	d)+(3e)+	.(3n) =	131.3	(5)
2. Ventilation rate:										
Number of chimneys Number of open flues		secondar heating 0 0	ry] + [] + [0 0] = [] = [0 0		40 = 20 =	m³ per hou	(6a)
Number of intermittent fa	ans				 _	0	x	10 =	0	
Number of passive vents	5				F	0	x	10 =	0	`
Number of flueless gas f					_ 	0	x 4	40 =	0	(7c)
gue .					L					()
								Air ch	nanges per ho	ur
Infiltration due to chimne						0		÷ (5) =	0	(8)
If a pressurisation test has b		led, procee	d to (17),	otherwise (ontinue fr	om (9) to	(16)			-
Number of storeys in t Additional infiltration	ne dwelling (ns)						[(0)	4100.4	0	(9)
Structural infiltration: 0) 25 for steel or timber	frame or	. 0 35 fo	r masoni	v conetr	ruction	[(9)	-1]x0.1 =	0	(10)
if both types of wall are p deducting areas of openi	oresent, use the value corre ings); if equal user 0.35	sponding to	the great	ter wall are	a (after	dellon			<u> </u>	
If suspended wooden	,	aled) or 0	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en		(0	(13)
Percentage of window Window infiltration	s and doors draught s	strippea		0.25 - [0.2	v (14) ± 1	001 -			0	(14)
Infiltration rate				(8) + (10)			+ (15) =		0	(15)
Air permeability value,	a50 expressed in cu	bic metre	s per ho		, , ,	, , ,	, ,	area	5	(17)
If based on air permeabi	• •		•	•	•			u. • u	0.25	(18)
Air permeability value applie	•					is being u	sed		0.20	` ′
Number of sides sheltered	ed								3	(19)
Shelter factor				(20) = 1 -		[9)] =			0.78	(20)
Infiltration rate incorpora	_			(21) = (18	x (20) =				0.19	(21)
Infiltration rate modified		1	l		_				1	
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp	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	22)m ÷ 4									
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23		
Calculate effec		-	rate for t	he appli	cable ca	se					•		
If mechanica			andiv N (2	13h) - (23a	a) v Emy (e	aguation (N	VS)) othe	rwica (23h) = (23a)			0.5	(23
If balanced with		0 11		, ,	,	. ,	,, .	,) = (23a)			0.5	(23
		-	-	_					26\m . /	22b) [1 (220)	0	(23
a) If balance			o nulation	o with ne	0		7K) (24a	0	0	230) x [0	+ 100j	(24
.,			<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>						(2)
b) If balance			o nulation	without 0	neat rec	overy (i	0	0	0	230)	0]	(24
				<u> </u>	<u> </u>								(2
c) If whole h if (22b)n				-	-			o) m + 0.	.5 × (23b	o)			
24c)m= 0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		(24
d) If natural if (22b)n									0.51				
24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24
Effective air	change	rate - er	nter (24a) or (24k	o) or (24	c) or (24	d) in box	x (25)				l	
25)m= 0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		(25
2 Hastlesse	a a a d b a		2 0 4 0 122 0 4										
3. Heat losse	s and ne Gros				Net Ar	200	U-val	110	AXU		k-value	`	ΑΧk
ELEMENT	area		Openin m		A,r		W/m2		(W/		kJ/m²-l		ΑΛΚ 〈J/K
Vindows Type	: 1				6.79	x1/	[1/(1.35)-	+ 0.04] =	8.7				(27
Vindows Type	2				2	<u>x</u> 1/	[1/(1.35)-	+ 0.04] =	2.56				(27
Vindows Type	3				2.92	x1/	[1/(1.35)-	+ 0.04] =	3.74	=			(27
Vindows Type	e 4				2.92	x1/	[1/(1.35)-	+ 0.04] =	3.74	Ħ			(27
loor					2.026	3 x	0.13	i	0.2633	<u>=</u> 8 [$\neg \vdash$	(28
Valls	34.7	74	14.6	3	20.11	x	0.15	=	3.02	F i		-	(29
otal area of e	lements	. m²	L		36.77	=							(3
for windows and	roof wind	ows, use e			alue calcul		ı formula 1	/[(1/U-valu	ıe)+0.04] á	as given in	paragraph	3.2	(-
* include the area abric heat los				is and par	titions		(26)(30)) + (32) =					
leat capacity		,	U)				(20)(30)		(30) + (3)	2) + (32a).	(320) -	22.02	(33
hermal mass			2 – Cm	· TEAl ir	k I/m2k/				tive Value	, , ,	(326) =	433.5	(34
For design assess	•	,		,			ecisely the				ahle 1f	100	(35
an be used inste				00770174101			00.00.9	, maroau v	74.400 0.		a.c.c		
hermal bridge	es : S (L	x Y) cal	culated (using Ap	pendix I	<						5.52	(36
details of therma		are not kn	own (36) =	= 0.05 x (3	1)			(0.0)	(2.5)				
otal fabric he								, ,	(36) =			27.53	(37
entilation hea		1		I	l .	l				(25)m x (5)		1	
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(2)
38)m= 21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66		(38
leat transfer of		r	ı	<u> </u>	1	1	1		= (37) + (1		1	
39)m= 49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2		
								•	Average =	Sum(39) ₁	12 /12=	49.2	(3

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97		
	•	!							Average =	Sum(40) ₁	12 /12=	0.97	(40)
Number of day	·	<u> </u>	· ·										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	iting ene	rgy requi	irement:								kWh/ye	ar:	
Assumed occi if TFA > 13. if TFA £ 13.	.9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		.7		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the α	lwelling is	designed t	,		se target o		.69		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage								<u>'</u>	!				
(44)m= 82.16	79.17	76.18	73.2	70.21	67.22	67.22	70.21	73.2	76.18	79.17	82.16		
									Total = Su	m(44) ₁₁₂ =	=	896.28	(44)
Energy content of	f hot water	used - cal	culated m	onthly = 4.	190 x Vd,r	n x nm x D	OTm / 3600	0 kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 121.84	106.56	109.96	95.87	91.99	79.38	73.56	84.41	85.41	99.54	108.66	117.99		
If instantaneous	water beati	'na at naint	of upo /pa	bot water	r otorogol	antar O in	haves (46		Total = Su	m(45) ₁₁₂ =	-	1175.16	(45)
If instantaneous v			·	1	, , , , , , , , , , , , , , , , , , ,	·	, ,	,		1	i I		(40)
(46)m= 18.28 Water storage	15.98 1088	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7		(46)
Storage volum) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community I	` '					_							` ,
Otherwise if n	_			-			, ,	ers) ente	er '0' in ((47)			
Water storage													
a) If manufac				or is kno	wn (kWł	n/day):					0		(48)
Temperature f											0		(49)
Energy lost fro		•			!4		(48) x (49)) =		1	10		(50)
b) If manufactHot water stor			-								02		(51)
If community h	_			<u> </u>	,	.,,					UZ		(0.)
Volume factor	from Ta	ble 2a								1.	03		(52)
Temperature f	factor fro	m Table	2b							0	.6		(53)
Energy lost fro	om watei	r storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	1.	03		(54)
Enter (50) or	(54) in (55)								1.	03		(55)
Water storage	loss cal	culated t	for each	month			((56)m = ((55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хН	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit	t loss (ar	nual) fro	m Table	3							0		(58)
Primary circuit	`	,			59)m = ((58) ÷ 36	65 × (41))m					
(modified by				,	•	. ,	, ,		r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combi loss cal	culated:	for each	month (′61)m =	(60) ÷ :	365 x (41)m							
(61)m= 0	0	0	0	0	0	0)		0	0	0	0]	(61)
Total heat requ	ired for	water he	eating ca	alculated	l for ea	ch month	(62)	 m =	0.85 × ((45)m +	(46)m +	(57)m +	ı · (59)m + (61)m	
(62)m= 177.12	156.49	165.24	149.36	147.26	132.87		139	_	138.91	154.82	162.15	173.27]`´´``	(62)
Solar DHW input c	alculated	using App	endix G oı	· Appendix	H (nega	tive quantit	y) (ent	er '0'	if no sola	r contribu	tion to wate	er heating)	•	
(add additional	lines if	FGHRS	and/or \	WWHRS	applie	s, see Ap	pend	lix G	3)					
(63)m= 0	0	0	0	0	0	0	0)	0	0	0	0		(63)
Output from wa	ater hea	ter											_	
(64)m= 177.12	156.49	165.24	149.36	147.26	132.87	128.83	139	.68	138.91	154.82	162.15	173.27		_
								Outp	out from wa	ater heate	er (annual)	112	1826	(64)
Heat gains from	n water	heating,	kWh/m	onth 0.2	5 ´ [0.8	5 × (45)m	ı + (6	1)m] + 0.8 x	([(46)m	+ (57)m	+ (59)m	<u>]</u>	
(65)m= 84.73	75.37	80.78	74.67	74.81	69.19	68.68	72.	29	71.19	77.32	78.92	83.45]	(65)
include (57)r	n in calc	culation of	of (65)m	only if c	ylinder	is in the	dwell	ing	or hot w	ater is f	rom com	munity h	neating	
5. Internal ga	ins (see	Table 5	and 5a):										
Metabolic gains	s (Table	5), Wat	ts										_	
Jan	Feb	Mar	Apr	May	Jun	Jul	А	ug	Sep	Oct	Nov	Dec		
(66)m= 102.29	102.29	102.29	102.29	102.29	102.29	102.29	102	.29	102.29	102.29	102.29	102.29		(66)
Lighting gains	(calculat	ted in Ap	pendix	L, equat	ion L9	or L9a), a	lso s	ee -	Table 5				_	
(67)m= 33.1	29.4	23.91	18.1	13.53	11.42	12.34	16.	05	21.54	27.35	31.92	34.02]	(67)
Appliances gai	ns (calc	ulated in	Append	dix L, eq	uation l	_13 or L1	3a),	also	see Tal	ble 5		_	_	
(68)m= 221.69	223.99	218.19	205.85	190.27	175.63	165.85	163	.55	169.35	181.69	197.27	211.91		(68)
Cooking gains	(calcula	ted in A	ppendix	L, equat	ion L15	or L15a), als	o se	e Table	5	-	-	-	
(69)m= 46.93	46.93	46.93	46.93	46.93	46.93	46.93	46.	93	46.93	46.93	46.93	46.93]	(69)
Pumps and far	ns gains	(Table 5	 ба)			-						-	_	
(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= -68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68	.19	-68.19	-68.19	-68.19	-68.19]	(71)
Water heating	gains (T	able 5)				•					-		-	
(72)m= 113.89	112.16	108.58	103.71	100.55	96.09	92.31	97.	16	98.88	103.92	109.62	112.17]	(72)
Total internal	gains =				(6	6)m + (67)n	n + (68	3)m +	- (69)m + ((70)m + (71)m + (72))m	-	
(73)m= 449.71	446.59	431.72	408.7	385.38	364.18	351.54	357	.79	370.8	393.99	419.83	439.13		(73)
6. Solar gains	s:										•			
Solar gains are c	alculated (using sola	r flux from	Table 6a	and asso	ciated equa	ations	to co	nvert to th	e applica	ble orienta	tion.		
Orientation: A		actor	Area			ux		_	g_ 	_	FF		Gains	
	able 6d		m²			able 6a	_		able 6b		able 6c		(W)	_
Northeast _{0.9x}	0.77	X	2	!	X	11.28	X		0.5	X	0.8	=	6.26	(75)
Northeast _{0.9x}	0.77	X	2.9	92	X	11.28	X		0.5	x	0.8	=	9.13	(75)
Northeast _{0.9x}	0.77	X	2	<u> </u>	x	22.97	X		0.5	x	0.8	=	12.73	(75)
Northeast _{0.9x}	0.77	х	2.9	92	х	22.97	x		0.5	x [0.8	=	18.59	(75)
Northeast _{0.9x}	0.77	X	2		x	41.38	X		0.5	X	0.8	=	22.94	(75)

		,						1		,		_
Northeast _{0.9x}	0.77	X	2.92	X	41.38	X	0.5	X	0.8	=	33.49	(75)
Northeast _{0.9x}	0.77	X	2	X	67.96	X	0.5	X	0.8	=	37.67	(75)
Northeast _{0.9x}	0.77	X	2.92	X	67.96	X	0.5	X	0.8	=	55.01	(75)
Northeast _{0.9x}	0.77	X	2	X	91.35	X	0.5	X	0.8	=	50.64	(75)
Northeast _{0.9x}	0.77	X	2.92	X	91.35	X	0.5	X	0.8	=	73.94	(75)
Northeast _{0.9x}	0.77	X	2	X	97.38	x	0.5	x	0.8	=	53.99	(75)
Northeast 0.9x	0.77	X	2.92	x	97.38	X	0.5	X	0.8	=	78.83	(75)
Northeast _{0.9x}	0.77	X	2	X	91.1	X	0.5	X	0.8	=	50.51	(75)
Northeast _{0.9x}	0.77	X	2.92	X	91.1	X	0.5	X	0.8	=	73.74	(75)
Northeast 0.9x	0.77	X	2	x	72.63	X	0.5	X	0.8	=	40.26	(75)
Northeast _{0.9x}	0.77	X	2.92	x	72.63	x	0.5	x	0.8	=	58.79	(75)
Northeast _{0.9x}	0.77	X	2	x	50.42	X	0.5	x	0.8	=	27.95	(75)
Northeast _{0.9x}	0.77	X	2.92	x	50.42	X	0.5	x	0.8	=	40.81	(75)
Northeast _{0.9x}	0.77	X	2	x	28.07	X	0.5	x	0.8	=	15.56	(75)
Northeast _{0.9x}	0.77	X	2.92	x	28.07	X	0.5	x	0.8	=	22.72	(75)
Northeast _{0.9x}	0.77	X	2	x	14.2	X	0.5	x	0.8	=	7.87	(75)
Northeast _{0.9x}	0.77	X	2.92	x	14.2	X	0.5	X	0.8	=	11.49	(75)
Northeast _{0.9x}	0.77	X	2	x	9.21	X	0.5	x	0.8	=	5.11	(75)
Northeast _{0.9x}	0.77	X	2.92	x	9.21	X	0.5	x	0.8	=	7.46	(75)
Southeast 0.9x	0.54	X	6.79	x	36.79	X	0.5	X	0.8	=	48.57	(77)
Southeast 0.9x	0.77	X	2.92	x	36.79	x	0.5	x	0.8	=	29.78	(77)
Southeast 0.9x	0.54	X	6.79	x	62.67	X	0.5	x	0.8	=	82.73	(77)
Southeast _{0.9x}	0.77	X	2.92	x	62.67	X	0.5	X	0.8	=	50.73	(77)
Southeast 0.9x	0.54	X	6.79	x	85.75	X	0.5	x	0.8	=	113.19	(77)
Southeast _{0.9x}	0.77	x	2.92	х	85.75	x	0.5	x	0.8	=	69.41	(77)
Southeast 0.9x	0.54	X	6.79	x	106.25	X	0.5	X	0.8	=	140.25	(77)
Southeast 0.9x	0.77	X	2.92	x	106.25	x	0.5	x	0.8	=	86	(77)
Southeast 0.9x	0.54	X	6.79	x	119.01	X	0.5	x	0.8	=	157.09	(77)
Southeast 0.9x	0.77	X	2.92	x	119.01	x	0.5	x	0.8	=	96.33	(77)
Southeast 0.9x	0.54	X	6.79	x	118.15	x	0.5	x	0.8	=	155.96	(77)
Southeast 0.9x	0.77	X	2.92	x	118.15	X	0.5	x	0.8	=	95.63	(77)
Southeast 0.9x	0.54	X	6.79	x	113.91	X	0.5	x	0.8	=	150.36	(77)
Southeast 0.9x	0.77	X	2.92	х	113.91	X	0.5	x	0.8	=	92.2	(77)
Southeast _{0.9x}	0.54	x	6.79	х	104.39	x	0.5	x	0.8	=	137.79	(77)
Southeast 0.9x	0.77	x	2.92	x	104.39	x	0.5	x	0.8] <u>=</u>	84.5	(77)
Southeast 0.9x	0.54	X	6.79	x	92.85	x	0.5	x	0.8] =	122.56	(77)
Southeast 0.9x	0.77	x	2.92	x	92.85	x	0.5	x	0.8	<u> </u>	75.16	(77)
Southeast 0.9x	0.54	x	6.79	х	69.27	x	0.5	x	0.8	j =	91.43	(77)
Southeast 0.9x	0.77	x	2.92	x	69.27	x	0.5	x	0.8] =	56.07	(77)
Southeast 0.9x	0.54	x	6.79	х	44.07	x	0.5	x	0.8	j =	58.17	(77)
Southeast 0.9x	0.77	x	2.92	х	44.07	x	0.5	x	0.8	j =	35.67	(77)
_		_		-		- '		•		-		

Codino	ast _{0.9x}	0.54	x	6.7	79	x 3	31.49	x	0.5	×	0.8	=	41.56	(77)
Southe	ast _{0.9x}	0.77	x	2.9	92	x 3	31.49	x	0.5	x	0.8	_ =	25.49	(77)
	_													<u> </u>
Solar g	gains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m .	(82)m				
(83)m=	93.74	164.78	239.03	318.93	378	384.4	366.8	321.34	266.48	185.78	113.21	79.62		(83)
Total g	jains – ii	nternal a	nd solar	(84)m =	= (73)m ·	+ (83)m	, watts							
(84)m=	543.45	611.37	670.75	727.63	763.38	748.59	718.34	679.12	637.28	579.77	533.04	518.75		(84)
7. Me	an inter	nal temp	erature	(heating	season)								
		•	eating p	`		<i>'</i>	from Tab	ole 9, Th	1 (°C)				21	(85)
-		_	ains for I			_			` ,					
•	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.87	0.83	0.77	0.67	0.54	0.4	0.29	0.32	0.49	0.7	0.83	0.88		(86)
			<u> </u>				<u> </u>	<u> </u>	ļ					
		· ·	ature in		· `	1	i e	i		20.50	20.00	40.00		(97)
(87)m=	19.69	19.93	20.25	20.58	20.82	20.94	20.98	20.98	20.89	20.59	20.09	19.62		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)				•	
(88)m=	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1		(88)
Utilisa	ation fac	tor for g	ains for r	est of d	welling,	h2,m (se	ee Table	9a)						
(89)m=	0.86	0.81	0.74	0.63	0.5	0.35	0.24	0.26	0.44	0.66	0.81	0.87		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	na T2 (f	ollow ste	eps 3 to	7 in Tabl	e 9c)			•	
(90)m=	18.39	18.72	19.16	19.61	19.91	20.05	20.09	20.09	20.01	19.63	18.95	18.28		(90)
							!		lf	LA = Livin	g area ÷ (4	l) =	0.51	(91)
Maaa		1 4		41	-ll	II:\ £	I A T 4	. /4 - £1	A) T O					`
(92)m=	19.05	19.34	ature (fo		i		20.55	`	<u> </u>				ı	
	19.05			20.1	I 2∩ 27				20.46	20 12	1 10 52	19.06		(92)
	, odiuoto	l	l l	20.1	20.37	20.51	l	20.54	20.46	20.12	19.53	18.96		(92)
		nent to t	he mean	interna	l I temper	ature fro	m Table	4e, whe	ere appro	priate				
(93)m=	19.05	nent to t 19.34	he mean 19.71		l		l	l			19.53	18.96		(92)
(93)m= 8. Spa	19.05 ace hea	nent to to 19.34 ting requ	he mean 19.71 uirement	interna 20.1	temper 20.37	ature fro 20.51	m Table 20.55	4e, whe	ere appro	opriate 20.12	19.53	18.96	nulate	
(93)m= 8. Spa	19.05 ace hea	nent to the state of the state	he mean 19.71	interna 20.1 nperatui	temper 20.37	ature fro 20.51	m Table 20.55	4e, whe	ere appro	opriate 20.12	19.53	18.96	culate	
(93)m= 8. Spa	19.05 ace hea	nent to the state of the state	he mean 19.71 uirement ernal ter	interna 20.1 nperatui	temper 20.37	ature fro 20.51	m Table 20.55	4e, whe	ere appro	opriate 20.12	19.53	18.96	culate	
(93)m= 8. Spa Set To the ut	19.05 ace hea i to the rillisation Jan	nent to the second seco	ne mean 19.71 uirement ernal ter or gains	interna 20.1 nperaturusing Ta Apr	temper 20.37 re obtair able 9a	20.51 ed at st	20.55 ep 11 of	4e, who 20.54 Table 9	20.46 b, so tha	opriate 20.12 t Ti,m=(19.53 76)m and	18.96 d re-cald	culate	
(93)m= 8. Spa Set To the ut	19.05 ace hea i to the rillisation Jan	nent to the second seco	he mean 19.71 uirement ternal ter or gains t	interna 20.1 nperaturusing Ta Apr	temper 20.37 re obtair able 9a	20.51 ed at st	20.55 ep 11 of	4e, who 20.54 Table 9	20.46 b, so tha	opriate 20.12 t Ti,m=(19.53 76)m and	18.96 d re-cald	culate	
(93)m= 8. Spa Set T the ut Utilisa (94)m=	19.05 ace head if to the rillisation Jan ation factors 0.84	nent to the second representation of the seco	he mean 19.71 uirement ernal ter or gains of Mar ains, hm	interna 20.1 nperaturusing Ta Apr :	temper 20.37 re obtainable 9a May	20.51 ed at st	om Table 20.55 ep 11 of	4e, who 20.54 Table 9	20.46 b, so tha	t Ti,m=(19.53 76)m and	18.96 d re-calc	culate	(93)
(93)m= 8. Spa Set T the ut Utilisa (94)m=	19.05 ace head if to the rillisation Jan ation factors 0.84	nent to the second representation of the seco	he mean 19.71 uirement ternal ter or gains to Mar ains, hm 0.73	interna 20.1 nperaturusing Ta Apr :	temper 20.37 re obtainable 9a May	20.51 ed at st	om Table 20.55 ep 11 of	4e, who 20.54 Table 9	20.46 b, so tha	t Ti,m=(19.53 76)m and	18.96 d re-calc	culate	(93)
(93)m= 8. Spa Set T the ut Utilisa (94)m= Usefu (95)m=	19.05 ace hear it to the recilisation Jan ation face 0.84 ul gains, 456.25	nent to the second read of the s	he mean 19.71 uirement ernal ter or gains o Mar ains, hm 0.73 , W = (94)	nperaturusing Ta Apr 0.63 1)m x (8-460.87	temper 20.37 re obtainable 9a May 0.51 4)m	20.51 ed at st Jun 0.37	om Table 20.55 ep 11 of Jul 0.27	4e, who 20.54 Table 9 Aug	20.46 b, so tha	t Ti,m=(19.53 76)m and Nov	18.96 d re-calc Dec 0.85	culate	(93)
(93)m= 8. Spa Set T the ut Utilisa (94)m= Usefu (95)m=	19.05 ace hear it to the recilisation Jan ation face 0.84 ul gains, 456.25	nent to the second read of the s	he mean 19.71 uirement ernal ter or gains to Mar ains, hm 0.73 , W = (94 490.93	nperaturusing Ta Apr 0.63 1)m x (8-460.87	temper 20.37 re obtainable 9a May 0.51 4)m	20.51 ed at st Jun 0.37	om Table 20.55 ep 11 of Jul 0.27	4e, who 20.54 Table 9 Aug	20.46 b, so tha	t Ti,m=(19.53 76)m and Nov	18.96 d re-calc Dec 0.85	culate	(93)
(93)m= 8. Spa Set T the ut Utilisa (94)m= Usefu (95)m= Month (96)m=	19.05 ace hea i to the rillisation Jan ation face 0.84 ul gains, 456.25 nly avera	nent to the second representation of the seco	he mean 19.71 uirement ernal ter or gains of Mar ains, hm 0.73 , W = (94 490.93	nperature 20.1 Apr 10.63 10.63 10.63 10.63 10.63 10.63 10.63	temper 20.37 re obtainable 9a May 0.51 4)m 387.84 e from Ta 11.7	20.51 ed at st Jun 0.37 278.84 able 8 14.6	pm Table 20.55 ep 11 of Jul 0.27 190.9	4e, who 20.54 Table 9 Aug 0.29 199.3	20.46 20.46 b, so that Sep 0.46 291.25	opriate 20.12 t Ti,m=(Oct 0.66 382.61	19.53 76)m and Nov 0.79	18.96 d re-calc Dec 0.85	culate	(93) (94) (95)
(93)m= 8. Spa Set T the ut Utilisa (94)m= Usefu (95)m= Month (96)m=	19.05 ace hea i to the rillisation Jan ation face 0.84 ul gains, 456.25 nly avera	nent to the second representation of the seco	he mean 19.71 uirement ernal ter or gains of Mar ains, hm 0.73 , W = (94 490.93 ernal tem 6.5	nperature 20.1 Apr 10.63 10.63 10.63 10.63 10.63 10.63 10.63	temper 20.37 re obtainable 9a May 0.51 4)m 387.84 e from Ta 11.7	20.51 ed at st Jun 0.37 278.84 able 8 14.6	pm Table 20.55 ep 11 of Jul 0.27 190.9	4e, who 20.54 Table 9 Aug 0.29 199.3	20.46 20.46 b, so that Sep 0.46 291.25	opriate 20.12 t Ti,m=(Oct 0.66 382.61	19.53 76)m and Nov 0.79	18.96 d re-calc Dec 0.85	culate	(93) (94) (95)
(93)m= 8. Spanner Set T the uthorized the	19.05 ace hea i to the rillisation Jan ation fac 0.84 all gains, 456.25 nly avera 4.3 loss rate 725.72 e heatin	nent to the second representation of the seco	he mean 19.71 uirement ernal ter or gains of Mar ains, hm 0.73 , W = (94 490.93 ernal tem 6.5 an intern ement fo	nperature 20.1 Apr 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63	temper 20.37 re obtainable 9a May 0.51 4)m 387.84 e from Ta 11.7 erature, 426.67	20.51 ed at st Jun 0.37 278.84 able 8 14.6 Lm , W : 290.55	pm Table 20.55 ep 11 of Jul 0.27 190.9 16.6 =[(39)m : 194.1	4e, who 20.54 Table 9 Aug 0.29 199.3 16.4 x [(93)m 203.68	20.46 20.46 b, so that Sep 0.46 291.25 14.1 - (96)m 312.8	opriate 20.12 t Ti,m=(Oct 0.66 382.61 10.6] 468.4	19.53 76)m and Nov 0.79 422.27 7.1	18.96 d re-calc Dec 0.85 442.33	culate	(93) (94) (95) (96)
(93)m= 8. Spanner Set T the uthorized the	19.05 ace hea i to the rillisation Jan ation face 0.84 ul gains, 456.25 nly avera 4.3 loss rate 725.72	nent to the second representation of the seco	he mean 19.71 uirement ernal ter or gains of Mar ains, hm 0.73 , W = (94 490.93 ernal tem 6.5 an intern	nperature 20.1 Apr 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63 10.63	temper 20.37 re obtainable 9a May 0.51 4)m 387.84 e from Ta 11.7 erature, 426.67	20.51 ed at st Jun 0.37 278.84 able 8 14.6 Lm , W : 290.55	pm Table 20.55 ep 11 of Jul 0.27 190.9 16.6 =[(39)m : 194.1	4e, who 20.54 Table 9 Aug 0.29 199.3 16.4 x [(93)m 203.68	20.46 20.46 b, so that Sep 0.46 291.25 14.1 - (96)m 312.8	opriate 20.12 t Ti,m=(Oct 0.66 382.61 10.6] 468.4	19.53 76)m and Nov 0.79 422.27 7.1	18.96 d re-calc Dec 0.85 442.33	culate	(93) (94) (95) (96)
(93)m= 8. Space 8. Sp	19.05 ace hea i to the rillisation Jan ation fac 0.84 all gains, 456.25 nly avera 4.3 loss rate 725.72 e heatin	nent to the second requirement to the second	he mean 19.71 uirement ernal ter or gains of Mar ains, hm 0.73 , W = (94 490.93 ernal tem 6.5 an intern ement fo	nperature 20.1 Apr 0.63 Apr 460.87 perature 8.9 al tempe 551.11 r each n	temper 20.37 re obtainable 9a May 0.51 4)m 387.84 e from Ta 11.7 erature, 426.67 nonth, k	20.51 ed at st Jun 0.37 278.84 able 8 14.6 Lm , W : 290.55 Wh/mon	m Table 20.55 ep 11 of Jul 0.27 190.9 16.6 =[(39)m : 194.1 th = 0.02	4e, who 20.54 Table 9 Aug 0.29 199.3 16.4 x [(93)m 203.68 24 x [(97 0	20.46 20.46 b, so that Sep 0.46 291.25 14.1 - (96)m 312.8)m - (95	opriate 20.12 t Ti,m=(Oct 0.66 382.61 10.6] 468.4)m] x (4 63.83	19.53 76)m and Nov 0.79 422.27 7.1 611.38 1)m 136.16	18.96 Dec 0.85 442.33 4.2 726.2	eulate 973.99	(93) (94) (95) (96)
(93)m= 8. Spanning Set T the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m=	19.05 ace hea i to the rillisation Jan ation face 0.84 ul gains, 456.25 nly avera 4.3 loss rate 725.72 e heatin 200.49	nent to the second record for the second record for the second record re	he mean 19.71 uirement ernal ter or gains of Mar ains, hm 0.73 , W = (94 490.93 ernal tem 6.5 an intern ement fo	internal 20.1 Inperature Solution (Section 1) (Sectio	temper 20.37 re obtainable 9a May 0.51 4)m 387.84 e from Ta 11.7 erature, 426.67 nonth, k\ 28.88	20.51 ed at st Jun 0.37 278.84 able 8 14.6 Lm , W : 290.55 Wh/mon	m Table 20.55 ep 11 of Jul 0.27 190.9 16.6 =[(39)m : 194.1 th = 0.02	4e, who 20.54 Table 9 Aug 0.29 199.3 16.4 x [(93)m 203.68 24 x [(97 0	20.46 20.46 b, so that Sep 0.46 291.25 14.1 - (96)m 312.8)m - (95 0	opriate 20.12 t Ti,m=(Oct 0.66 382.61 10.6] 468.4)m] x (4 63.83	19.53 76)m and Nov 0.79 422.27 7.1 611.38 1)m 136.16	18.96 Dec 0.85 442.33 4.2 726.2		(93) (94) (95) (96) (97)

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none Fraction of space heat from community system 1 – (301) = The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C. Fraction of heat from Community CHP Fraction of community heat from heat source 2 Fraction of total space heat from Community CHP Fraction of total space heat from community heat source 2 Fraction of total space heat from heat source 2 Fraction of total space heat from heat source 2 Fraction of total space heat from heat source 2 Fraction of total space heat from heat source 2 Fraction of total space heat from heat source 2	
The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C. Fraction of heat from Community CHP Fraction of community heat from heat source 2 Fraction of total space heat from Community CHP Fraction of total space heat from community heat source 2 Factor for control and charging method (Table 4c(3)) for community heating system Distribution loss factor (Table 12c) for community heating system Distribution loss factor (Table 12c) for community heating system Space heating Annual space heating requirement Space heat from Community CHP (98) x (304a) x (305) x (306) = 681.11 Space heat from heat source 2 (98) x (304b) x (305) x (306) = 241.58 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	(303a) (303b) (304a) (304b) (305) (306) ear
includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C. Fraction of heat from Community CHP Fraction of community heat from heat source 2 Fraction of total space heat from Community CHP Fraction of total space heat from community heat source 2 Fraction of total space heat from community heat	(303b) (304a) (304b) (305) (306)
Fraction of community heat from heat source 2 Fraction of total space heat from Community CHP Fraction of total space heat from community heat source 2 Fractor for control and charging method (Table 4c(3)) for community heating system Distribution loss factor (Table 12c) for community heating system Space heating Annual space heating requirement Space heat from Community CHP Space heat from Community CHP Space heat from heat source 2 (98) x (304b) x (305) x (306) = Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) O .33 O .67 EVALUATION OF TABLE 10 O .67 O .	(303b) (304a) (304b) (305) (306)
Fraction of total space heat from Community CHP Fraction of total space heat from community heat source 2 Fraction of total space heat from community heat source 2 Factor for control and charging method (Table 4c(3)) for community heating system Distribution loss factor (Table 12c) for community heating system 1.05 Space heating Annual space heating requirement Space heat from Community CHP (98) × (304a) × (305) × (306) = Space heat from heat source 2 (98) × (304b) × (305) × (306) = Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0.67	(304a) (304b) (305) (306) ear
Fraction of total space heat from community heat source 2 (302) x (303b) = 0.33 Factor for control and charging method (Table 4c(3)) for community heating system 1 Distribution loss factor (Table 12c) for community heating system 1.05 Space heating Annual space heating requirement 973.99 Space heat from Community CHP (98) x (304a) x (305) x (306) = 681.11 Space heat from heat source 2 (98) x (304b) x (305) x (306) = 341.58 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0	(304b) (305) (306) ear
Factor for control and charging method (Table 4c(3)) for community heating system Distribution loss factor (Table 12c) for community heating system 1.05 Space heating Annual space heating requirement Space heat from Community CHP (98) x (304a) x (305) x (306) = Space heat from heat source 2 (98) x (304b) x (305) x (306) = 341.58 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0	(305) (306) ear
Distribution loss factor (Table 12c) for community heating system Space heating Annual space heating requirement Space heat from Community CHP Space heat from heat source 2 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 1.05 kWh/y (98) x (304a) x (305) x (306) = (98) x (304b) x (305) x (306) = 341.58	(306)
Space heating Annual space heating requirement Space heat from Community CHP (98) x (304a) x (305) x (306) = 681.11 Space heat from heat source 2 (98) x (304b) x (305) x (306) = 341.58 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0	ear
Annual space heating requirement 973.99 Space heat from Community CHP $(98) \times (304a) \times (305) \times (306) = 681.11$ Space heat from heat source 2 $(98) \times (304b) \times (305) \times (306) = 341.58$ Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0	
Space heat from Community CHP $(98) \times (304a) \times (305) \times (306) =$ 681.11 Space heat from heat source 2 $(98) \times (304b) \times (305) \times (306) =$ 341.58 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0	
Space heat from heat source 2 (98) x (304b) x (305) x (306) = 341.58 Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0	
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)	(307a)
	(307b)
	(308
Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0	(309)
Water heating Annual water heating requirement 1826	\neg
If DHW from community scheme: Water heat from Community CHP (64) x (303a) x (305) x (306) = 1276.92	(310a)
Water heat from heat source 2 (64) x (303b) x (305) x (306) = 640.38	(310b)
Electricity used for heat distribution 0.01 × [(307a)(307e) + (310a)(310e)] = 29.4	(313)
Cooling System Energy Efficiency Ratio 0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0) = $(107) \div (314) = 0$	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside 62.47	(330a)
warm air heating system fans	(330b)
pump for solar water heating 0	(330g)
Total electricity for the above, kWh/year $= (330a) + (330b) + (330g) = 62.47$	(331)
Energy for lighting (calculated in Appendix L)	(332)
Electricity generated by PVs (Appendix M) (negative quantity) -254.41	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity) 0	(334)
10b. Fuel costs – Community heating scheme	(004)
FuelFuel PriceFuel CokWh/year(Table 12)£/year	st
Space heating from CHP $(307a)$ x 3.35 x $0.01 = 22.82$	

(307b) x

Space heating from heat source 2

(340b)

16.36

x 0.01 =

Water heating from CHP	(310a) x		3.35 × 0.01	42.78	(342a)
Water heating from heat source 2	(310b) x		4.79 × 0.01	30.67	(342b)
	(00.1)	F	uel Price		
Pumps and fans	(331)	Ĺ	0 x 0.01	10.57	(349)
Energy for lighting	(332)	L	0 x 0.01	41.06	(350)
Additional standing charges (Table	12)			88	(351)
Energy saving/generation technolo	•				
Total energy cost	= (340a)(342e) + (345).	(354) =		252.66	(355)
11b. SAP rating - Community hea	ting scheme				
Energy cost deflator (Table 12)				0.42	(356)
Energy cost factor (ECF)	$[(355) \times (356)] \div [(4) + 45.6]$	0] =		1.14	(357)
SAP rating (section12)				84.12	(358)
12b. CO2 Emissions – Community	heating scheme				
Electrical efficiency of CHP unit				32	(361)
Heat efficiency of CHP unit				50.4	(362)
		Energy kWh/year	Emission fact kg CO2/kWh	or Emissions kg CO2/yea	ar
Space heating from CHP)	(307a) × 100 ÷ (362) =	1351.42	x 0.22	291.91	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	432.45	x 0.52	-224.44	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	2533.57	X 0.22	547.25	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	810.74	x 0.52	-420.78	(366)
Efficiency of heat source 2 (%)	If there is CHP us	ing two fuels repeat (363) to (366) for the second	fuel 95	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b)	x 0.22	= 223.27	(368)
Electrical energy for heat distribution	n	[(313) x	0.52	= 15.26	(372)
Total CO2 associated with commun	nity systems	(363)(366) + (368)	(372)	= 432.46	(373)
CO2 associated with space heating	g (secondary)	(309) x	0	= 0	(374)
CO2 associated with water from im	mersion heater or instanta	neous heater (312)	x 0.22	= 0	(375)
Total CO2 associated with space a	nd water heating	(373) + (374) + (375) =	:	432.46	(376)
CO2 associated with electricity for	pumps and fans within dwe	elling (331)) x	0.52	= 32.42	(378)
CO2 associated with electricity for	lighting	(332))) x	0.52	= 121.37	(379)
Energy saving/generation technolo Item 1	gies (333) to (334) as appli	icable	0.52 × 0.01	-132.04	1 (380)
Total CO2, kg/year	sum of (376)(382) =	L		454.22	_
Dwelling CO2 Emission Ra	te (383) ÷ (4) =			8.99	(384)
El rating (section 14)				93.63	(385)
13b. Primary Energy – Community	heating scheme				
Electrical efficiency of CHP unit				32	(361)

Heat efficiency of CHP unit					50.4	(362)
		Energy kWh/year	Primary factor		Energy Wh/year	
Space heating from CHP)	(307a) × 100 ÷ (362) =	1351.42 ×	1.22		1648.73	(363)
less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	432.45 ×	3.07		-1327.63	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	2533.57 ×	1.22		3090.96	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	810.74 ×	3.07		-2488.98	(366)
Efficiency of heat source 2 (%)	If there is CHP using	ng two fuels repeat (363) to	(366) for the second	fuel	95	(367b)
Energy associated with heat source	e 2 [(307b)	+(310b)] x 100 ÷ (367b) x	1.22	=	1261.04	(368)
Electrical energy for heat distribution	on	[(313) x		=	90.26	(372)
Total Energy associated with comm	nunity systems	(363)(366) + (368)(37	2)	=	2274.37	(373)
if it is negative set (373) to zero	(unless specified otherwise,	see C7 in Appendix C	C)		2274.37	(373)
Energy associated with space heat	ting (secondary)	(309) x	0	=	0	(374)
Energy associated with water from	immersion heater or instant	taneous heater(312) x	1.22	=	0	(375)
Total Energy associated with space	e and water heating	(373) + (374) + (375) =			2274.37	(376)
Energy associated with space cool	ing	(315) x	3.07	=	0	(377)
Energy associated with electricity f	or pumps and fans within dv	welling (331)) x	3.07	=	191.79	(378)
Energy associated with electricity f	or lighting	(332))) x	3.07	=	717.93	(379)
Energy saving/generation technolo	ogies		3.07 × 0.01	= [-781.05	(380)
Total Primary Energy, kWh	/year sum of (376)	(382) =			2403.04	(383)

				N - (- ') -						
			User D							
Assessor Name:	Ross Boulton			Strom					0028068	
Software Name:	Stroma FSAP			Softwa				Versio	on: 1.0.4.18	
	DOA 400 04 EL			Address)2-01				
Address:	B2A-102-01, Fla	at Type 2-11	A, Wimi	oledon, L	ondon					
1. Overall dwelling dim	ensions:		۸ro	o(m²)		۸۰٬ ۵۰	iaht/m\		Volumo/m3	31
Ground floor				a(m²) 50.5	(1a) x		2.6	(2a) =	Volume(m ³	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)	+(1e)+(1r	n)	50.5	(4)			•		_
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	131.3	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m³ per hou	ır
Number of chimneys		+ 0] + [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0	+ 0	+ [0	=	0	x 2	20 =	0	(6b)
Number of intermittent fa	ans					2	x -	10 =	20	(7a)
Number of passive vent	S				F	0	x ·	10 =	0	(7b)
Number of flueless gas	fires				F	0	X	40 =	0	(7c)
· ·					L					`
								Air ch	nanges per ho	our
Infiltration due to chimne	eys, flues and fans	= (6a)+(6b)+(7a)	7a)+(7b)+((7c) =	Γ	20		÷ (5) =	0.15	(8)
If a pressurisation test has		tended, procee	d to (17),	otherwise (continue fr	rom (9) to	(16)			_
Number of storeys in the Additional infiltration	the dwelling (ns)							41.04	0	(9)
	O OF for atool or tim	har frama ar	. 0 2E fo	r maaan		u otion	[(9)	-1]x0.1 =	0	(10)
Structural infiltration: (if both types of wall are p					•	uction			0	(11)
deducting areas of open			g		- (
If suspended wooden	,	•	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, er	·								0	(13)
Percentage of window	s and doors draug	ht stripped							0	(14)
Window infiltration				0.25 - [0.2	. ,	-	. (45)		0	(15)
Infiltration rate		. 1.2		(8) + (10)					0	(16)
Air permeability value If based on air permeab	•		•	•	•	etre of e	envelope	area	5	(17)
Air permeability value appli	-					is heina u	sed		0.4	(18)
Number of sides shelter		ot nao boon doi	10 01 a ao	groo an po	moubility	io boilig a	000		3	(19)
Shelter factor				(20) = 1 -	[0.0 75 x (1	19)] =			0.78	(20)
Infiltration rate incorpora	ating shelter factor			(21) = (18) x (20) =				0.31	(21)
Infiltration rate modified	for monthly wind sp	peed								
Jan Feb	Mar Apr N	lay Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind s	peed from Table 7	•							•	
(22)m= 5.1 5	·	.3 3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind Footon (COn)	20) 4	•	•	•		•	•	•	•	
Wind Factor (22a)m = $(2^{23})^{m}$	' 1	08 005	0.05	0.00	4	4.00	4 40	1 10	1	
(22a)m= 1.27 1.25	1.23 1.1 1.	0.95	0.95	0.92	1	1.08	1.12	1.18	J	

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37]	
Calculate effe		_	rate for t	he appli	cable ca	se	•	•		•	•	-	
If mechanical If exhaust air h			andiv N. (2	2h) _ (22a) Em. (auation (N	VEVV otho	muino (22h	\ _ (22a)			0	(23
		0		, ,	, ,	. ,	,, .	,) = (23a)			0	(23
If balanced with		•	•	Ū		`		,	51. \		4 (00.)	0	(23
a) If balance	i				i	- 	- ^ `	í `	 	- 	1 ` ´) ÷ 100] 1	(0.4
24a)m= 0			0	0	0	0	0	0	0	0	0]	(24
b) If balance	1				ı —		r ´`	í `	 	- 	Τ.	1	(0.
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
c) If whole h if (22b)r				•	•			outside o) m + 0.	5 × (23b)		_	
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
d) If natural if (22b)r				•	•			loft 2b)m² x	0.5]				
24d)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(24
Effective air	change	rate - er	iter (24a	or (24b	o) or (24	c) or (24	d) in box	x (25)			•	-	
25)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57]	(25
Vindows Type Vindows Type					5.86 1.73	_	/[1/(1.4)+ /[1/(1.4)+	L	2.29				(27 (27
Nindows Type	e 1				5.86	x1.	/[1/(1.4)+	0.04] =	7.77				(27
Windows Type						=	/[1/(1.4)+	L		=			•
Windows Type					2.52	٧,	/[1/(1.4)+	L	3.34	=			(27
Floor	, T				2.52	=			3.34				(27
					2.026	_	0.13	=	0.26338	<u>.</u> [\exists	(28
Valls	34.7		12.6	3	22.11	=	0.18	= [3.98				(29
Total area of e			· · · ·		36.77			1/5/4/11	\ 0.047		,		(31
for windows and it include the area						ated using	i formula 1	/[(1/U-valu	ie)+0.04j a	is given in	n paragrapr	1 3.2	
abric heat los	ss, W/K :	= S (A x	U)	,			(26)(30)) + (32) =				20.99	(33
Heat capacity	Cm = S(Axk)						((28)	.(30) + (32	2) + (32a)	(32e) =	461.5	(34
Thermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	: Medium		250	(35
				constructi	ion are no	t known pr	ecisely the	e indicative	values of	TMP in T	able 1f		`
For design assess can be used inste				ıcina Δn	nendix k	<						1.84	(36
an be used inste		x Y) cal	culated i	aoii iu Au								1.01	(-
an be used inste hermal bridg	es : S (L				-								
an be used inste Thermal bridge details of therma	es : S (L al bridging				-			(33) +	(36) =			22.83	(37
ean be used inste Thermal bridge of details of therma Total fabric he	es : S (L al bridging at loss	are not kn	own (36) =	= 0.05 x (3	-				(36) = = 0.33 × (25)m x (5)	22.83	(37
an be used inste hermal bridge details of therma otal fabric he	es : S (L al bridging at loss	are not kn	own (36) =	= 0.05 x (3	-	Jul	Aug			25)m x (5 Nov) Dec	22.83	(37
Thermal bridger details of thermal fotal fabric head /entilation head	es : S (L al bridging at loss at loss ca	are not kn	own (36) =	= 0.05 x (3	1)	•	Aug 23.47	(38)m	= 0.33 × (1	22.83	
Fan be used instermal bridger details of thermal fotal fabric hed ventilation head 38)m= 25.09	es : S (L al bridging at loss at loss ca Feb 24.96	are not kn alculated Mar 24.83	own (36) = monthly Apr	= 0.05 x (3 / May	Jun	Jul	Ť	(38)m Sep 23.77	= 0.33 × (Oct 24.1	Nov 24.33	Dec	22.83	
can be used inste Thermal bridge f details of therma Total fabric he Jentilation hea	es : S (L al bridging at loss at loss ca Feb 24.96	are not kn alculated Mar 24.83	own (36) = monthly Apr	= 0.05 x (3 / May	Jun	Jul	Ť	(38)m Sep 23.77	= 0.33 × (Nov 24.33	Dec	22.83	(38

Heat loss para	ameter (I	HLP), W/	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.95	0.95	0.94	0.93	0.93	0.92	0.92	0.92	0.92	0.93	0.93	0.94		
	!	!							Average =	Sum(40) ₁	12 /12=	0.93	(40)
Number of day	<u> </u>	<u> </u>						-					
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	ting ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occurring TFA > 13.	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (¯	TFA -13		.7		(42)
Annual average Reduce the annual not more that 125	ge hot wa al average	hot water	usage by	5% if the c	lwelling is	designed t			se target c		.69		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage i								LOOP	1 000	1 1101			
(44)m= 82.16	79.17	76.18	73.2	70.21	67.22	67.22	70.21	73.2	76.18	79.17	82.16		
, ,				l		l	l		I Total = Su	m(44) ₁₁₂ =	-	896.28	(44)
Energy content of	f hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	m x nm x E	OTm / 3600) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 121.84	106.56	109.96	95.87	91.99	79.38	73.56	84.41	85.41	99.54	108.66	117.99		
					, ,	. 0:			Total = Su	m(45) ₁₁₂ =	= [1175.16	(45)
If instantaneous v									i	1			
(46)m= 0 Water storage	0	0	0	0	0	0	0	0	0	0	0		(46)
Storage volum) includin	ia anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	` '	•	•			Ū							()
Otherwise if no	•			•			` '	ers) ente	er '0' in ((47)			
Water storage													
a) If manufact				or is kno	wn (kWł	n/day):					0		(48)
Temperature f											0		(49)
Energy lost fro		_	-				(48) x (49)) =			0		(50)
b) If manufactHot water stor			-								0		(51)
If community h	•			- (7,					<u> </u>		(-)
Volume factor											0		(52)
Temperature f	actor fro	m Table	2b								0		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or	` , ` `	,									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = ((55) × (41)	m 				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	x H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit					•	. ,	, ,						
(modified by	1	rom Tab		here is s	i			cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss cal	culated	for each	month ((61)m –	(60) ± 3	65 v (41)	١m						
(61)m= 0	0	0	0	0 0	00) + 3	0 × (41)	0	0	0	T 0	0	1	(61)
	-											J (59)m + (61)m	(- /
(62)m= 103.56	90.58	93.47	81.49	78.19	67.47	62.52	71.74		84.61	92.36	100.3	(39)111 + (01)111	(62)
Solar DHW input of						l				1		I	(- /
(add additional									· continou	non to wat	or modung,		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(63)
Output from wa	ater hea	ter				!	<u>!</u>				!	ı	
(64)m= 103.56	90.58	93.47	81.49	78.19	67.47	62.52	71.74	72.6	84.61	92.36	100.3]	
				l .			0	utput from w	ater heate	er (annual) ₁	l12	998.89	(64)
Heat gains from	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= 25.89	22.64	23.37	20.37	19.55	16.87	15.63	17.94		21.15	23.09	25.07]	(65)
include (57)	m in cald	culation of	of (65)m	only if c	ylinder i	s in the o	dwellir	ng or hot w	ater is f	rom com	munity h	neating	
5. Internal ga					-						•		
Metabolic gain	s (Table	5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
(66)m= 85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24		(66)
Lighting gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso se	e Table 5				-	
(67)m= 13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.94	12.77	13.61		(67)
Appliances gai	ns (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), a	so see Ta	ble 5	_		•	
(68)m= 148.53	150.07	146.19	137.92	127.48	117.67	111.12	109.5	8 113.46	121.73	132.17	141.98		(68)
Cooking gains	(calcula	ted in A	opendix	L, equat	ion L15	or L15a)), also	see Table	5	•	•	•	
(69)m= 31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52		(69)
Pumps and far	ns gains	(Table 5	āa)			•		•				•	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses e.g. ev	aporatio	n (negat	ive valu	es) (Tab	le 5)	•		•		•		•	
(71)m= -68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.1	9 -68.19	-68.19	-68.19	-68.19		(71)
Water heating	gains (T	able 5)				•		•				•	
(72)m= 34.8	33.7	31.41	28.29	26.27	23.43	21.01	24.1	25.21	28.43	32.07	33.7		(72)
Total internal	gains =				(66)m + (67)m	ı + (68)ı	m + (69)m +	(70)m + (71)m + (72))m	•	
(73)m= 245.15	244.1	235.73	222.03	207.74	194.24	185.64	188.6	8 195.86	209.67	225.58	237.86		(73)
6. Solar gains	S:												
Solar gains are o	alculated	using sola	r flux from	Table 6a	and assoc	ciated equa	itions to	convert to th	ne applica	ble orienta	tion.		
Orientation: A		actor	Area		Flu			g_ Table Ch	-	FF		Gains	
_	able 6d		m²			ble 6a		Table 6b	_ ' 	able 6c		(W)	-
Northeast _{0.9x}	0.77	X	1.7	'3	x	11.28	x	0.63	x	0.7	=	5.97	(75)
Northeast _{0.9x}	0.77	Х	2.5	52	X	11.28	x	0.63	X	0.7	=	8.69	(75)
Northeast _{0.9x}	0.77	X	1.7	73	x	22.97	×	0.63	×	0.7	=	12.14	(75)
Northeast _{0.9x}	0.77	X	2.5	52	x	22.97	x	0.63	x	0.7	=	17.69	(75)
Northeast _{0.9x}	0.77	X	1.7	' 3	X	41.38	x	0.63	x	0.7	=	21.88	(75)

Northeast _{0.9x}	0.77	1 🗸	0.50	1 ,	44.20	1 ,	0.00	l	0.7	1 _	24.07	(75)
Northeast 0.9x	0.77] X]	2.52] X]	41.38] x]	0.63	X	0.7] = 1	31.87	= '
Northeast 0.9x	0.77] X]	1.73	X 1	67.96] X]	0.63	X	0.7] = 1	35.93	(75)
Northeast 0.9x	0.77] X]	2.52] X]	67.96] X]	0.63	X	0.7] = 1	52.34	(75)
Northeast 0.9x	0.77	X	1.73	X	91.35] X]	0.63	X	0.7] = 1	48.3	(75)
Northeast 0.9x	0.77	X	2.52	X	91.35] X]	0.63	X	0.7] = 1	70.35	(75)
<u> </u>	0.77	X	1.73	X	97.38] X	0.63	X	0.7] = 1	51.49	(75)
Northeast 0.9x	0.77] X]	2.52	X 1	97.38] X]	0.63	X	0.7] = 1	75	(75)
Northeast 0.9x	0.77	X	1.73	X	91.1] X	0.63	X	0.7] = 1	48.17	(75)
Northeast 0.9x	0.77] X	2.52	X	91.1] X]	0.63	X	0.7] =	70.16	(75)
Northeast 0.9x	0.77	X	1.73	X	72.63] X	0.63	X	0.7] =	38.4	(75)
Northeast 0.9x	0.77	X	2.52	X	72.63	X	0.63	X	0.7] =	55.93	(75)
Northeast _{0.9x}	0.77	X	1.73	X	50.42	X	0.63	X	0.7] =	26.66	(75)
Northeast _{0.9x}	0.77	X	2.52	X	50.42	X	0.63	X	0.7] =	38.83	(75)
Northeast _{0.9x}	0.77	X	1.73	X	28.07	X	0.63	X	0.7	=	14.84	(75)
Northeast _{0.9x}	0.77	X	2.52	X	28.07	X	0.63	X	0.7	=	21.62	(75)
Northeast _{0.9x}	0.77	X	1.73	X	14.2	Х	0.63	X	0.7	=	7.51	(75)
Northeast _{0.9x}	0.77	X	2.52	X	14.2	X	0.63	X	0.7	=	10.93	(75)
Northeast _{0.9x}	0.77	X	1.73	X	9.21	X	0.63	X	0.7	=	4.87	(75)
Northeast _{0.9x}	0.77	X	2.52	X	9.21	X	0.63	X	0.7	=	7.1	(75)
Southeast _{0.9x}	0.54	X	5.86	X	36.79	X	0.63	X	0.7] =	46.21	(77)
Southeast _{0.9x}	0.77	X	2.52	X	36.79	X	0.63	X	0.7] =	28.34	(77)
Southeast _{0.9x}	0.54	X	5.86	X	62.67	X	0.63	X	0.7	=	78.71	(77)
Southeast 0.9x	0.77	X	2.52	X	62.67	X	0.63	X	0.7	=	48.27	(77)
Southeast _{0.9x}	0.54	X	5.86	x	85.75	X	0.63	X	0.7	=	107.7	(77)
Southeast _{0.9x}	0.77	X	2.52	X	85.75	X	0.63	X	0.7	=	66.04	(77)
Southeast _{0.9x}	0.54	X	5.86	X	106.25	X	0.63	X	0.7	=	133.45	(77)
Southeast 0.9x	0.77	X	2.52	x	106.25	X	0.63	x	0.7] =	81.83	(77)
Southeast 0.9x	0.54	X	5.86	x	119.01	X	0.63	x	0.7	=	149.47	(77)
Southeast 0.9x	0.77	X	2.52	x	119.01	X	0.63	x	0.7	=	91.66	(77)
Southeast 0.9x	0.54	X	5.86	x	118.15	x	0.63	x	0.7	=	148.39	(77)
Southeast 0.9x	0.77	X	2.52	x	118.15	x	0.63	x	0.7	=	90.99	(77)
Southeast 0.9x	0.54	X	5.86	x	113.91	x	0.63	x	0.7	=	143.06	(77)
Southeast 0.9x	0.77	X	2.52	x	113.91	x	0.63	x	0.7] =	87.73	(77)
Southeast 0.9x	0.54	X	5.86	x	104.39	X	0.63	X	0.7	=	131.11	(77)
Southeast _{0.9x}	0.77	X	2.52	x	104.39	X	0.63	x	0.7] =	80.4	(77)
Southeast 0.9x	0.54	x	5.86	x	92.85	x	0.63	x	0.7	=	116.62	(77)
Southeast 0.9x	0.77	x	2.52	x	92.85	x	0.63	x	0.7] =	71.51	(77)
Southeast 0.9x	0.54	x	5.86	x	69.27	x	0.63	x	0.7] =	87	(77)
Southeast 0.9x	0.77	x	2.52	x	69.27	x	0.63	x	0.7] =	53.35	(77)
Southeast 0.9x	0.54	x	5.86	x	44.07	x	0.63	x	0.7] =	55.35	(77)
Southeast 0.9x	0.77	x	2.52	x	44.07	x	0.63	x	0.7	=	33.94	(77)
_		-		-		-		•		-		_

Southeast	0.9x (.54	x	5.8	6	x	3	1.49	x		0.63	x		0.7		=	39.55	(77)
Southeast	0.9x	.77	X	2.5	2	X	3	1.49	x		0.63	x	Γ	0.7		=	24.25	(77)
																		_
Solar gair	ns in watts	, calculat	ed	for each	n month	1			(83)m	= St	um(74)m .	(82)r	n					
ĭ—	9.2 156.		$\overline{}$	303.54	359.77	$\overline{}$	65.87	349.12	305.	84	253.62	176	.8	107.73	75.	77		(83)
Total gain	s – intern	al and so	lar	(84)m =	(73)m	+ (83)m	, watts	!						!			
(84)m= 33	400.	92 463.2	2	525.57	567.51	5	60.11	534.76	494.	51	449.47	386.	47	333.31	313.	.63		(84)
7. Mean	internal te	mperatu	re (heating	seasor	า)												
Tempera	ature durir	g heating	g pe	eriods in	the liv	ing	area	from Tab	ole 9,	Th	1 (°C)						21	(85)
Utilisatio	n factor fo	r gains fo	or li	ving are	a. h1.n	า (ร	ee Ta	ble 9a)			, ,							_
	Jan Fe	<u> </u>	\neg	Apr	May	T	Jun	Jul	Αι	Ja	Sep	O	ct	Nov	D	ec		
(86)m=	1 0.9	_	-	0.89	0.73	T	0.52	0.38	0.4	Ť	0.69	0.9	4	0.99	1			(86)
		!			- T4 //		-1-	0			- 0 -)				<u> </u>			
	ernal tem		$\overline{}$	_ _	•	_		i				20.	70	20.27	20.7	20	Ī	(97)
(87)m= 2	0.1 20.2	28 20.5	3	20.8	20.95	<u> </u>	20.99	21	21		20.97	20.7	6	20.37	20.0	J6		(87)
Tempera	ature durir	g heating	g pe	eriods ir	rest of	dv	velling	from Ta	ble 9), Tr	n2 (°C)							
(88)m= 20	0.13 20.1	3 20.13	3	20.14	20.14	2	20.15	20.15	20.1	15	20.15	20.1	4	20.14	20.	13		(88)
Utilisatio	n factor fo	r gains fo	or re	est of d	velling,	h2	,m (se	e Table	9a)									
(89)m=	1 0.9		$\overline{}$	0.86	0.67	$\overline{}$	0.46	0.31	0.3	5	0.61	0.9	1	0.99	1			(89)
∐ Moon int	ornal tam	001011110	t	ho root	of dural	الم	T2 /f	ollow oto		<u> </u>	in Tabl	- Oa)			<u> </u>		l	
	ernal tem 9.3 19.4		$\overline{}$	19.99	20.11	Ť	20.15	20.15	20.1		20.14	e 90) 19.9		19.59	19.2	20	I	(90)
(90)111=	9.5 19.2	19.7	<u> </u>	19.99	20.11	<u> </u>	20.13	20.15	20.	15				g area ÷ (4		20	0.54	_ ``
													_1 V 11 1	g area + (-	+) -		0.51	(91)
Mean int	ernal tem	perature	(for	the wh	ole dwe	ellin	g) = f	LA × T1	+ (1 -	– fL	A) × T2							
(92)m= 19	9.71 19.8	20.14	1	20.4	20.54	2	20.58	20.58	20.5	58	20.56	20.3	36	19.98	19.6	86		(92)
Apply ad	justment :	to the me	an	internal	tempe	ratu	ire fro	m Table	4e, \	whe	re appro	priat	е				•	
(93)m= 19	9.71 19.8	39 20.14	1	20.4	20.54	2	20.58	20.58	20.5	58	20.56	20.3	36	19.98	19.6	86		(93)
8. Space	heating r	equireme	ent															
	the mean					nec	at st	ep 11 of	Table	e 9b	o, so tha	t Ti,n	า=(76)m an	d re-	calc	culate	
	ation facto	$\overline{}$	\neg			_			Γ.			_					1	
	Jan Fe		_	Apr	May		Jun	Jul	Αι	ng	Sep	O	ct	Nov	D	ec		
	n factor fo		\neg	i		_							_				1	(0.4)
` ′	0.99 0.9			0.87	0.7		0.49	0.35	0.3	9	0.65	0.9	2	0.99	1			(94)
	ains, hmG		ÌТ	<u> </u>		Τ.				1							1	(05)
` '	395.		_	456.57	395.53		75.34	184.56	193.	23	291.61	355.	04	329.04	312.	.46		(95)
	average e		mp	1		_		100	T 40	. 1	444	40	_				1	(00)
` '	4.9			8.9	11.7		14.6	16.6	16.		14.1	10.	6	7.1	4.2			(96)
	s rate for		_			_		- ` 		'	<u> </u>		4.	00= 01	700		l	(07)
	88.29 716.			541.11	414.8		77.36	184.76	193.		301.1	458.		607.61	733.	.65		(97)
	eating req		$\overline{}$	i		VVr		I		Ť		i — —	_				1	
(98)m= 30	1.83 215.	87 153.6	9	60.87	14.34		0	0	0		0	76.7		200.57	313.			٦.
										Total	per year	(kWh/	/ear) = Sum(9	8)15,9	12 =	1337.24	(98)
Space he	eating req	uirement	in	kWh/m²	/year												26.48	(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	ELm (ca	lculated	using 25	5°C inter	nal temp	erature	and exte	ernal ten	nperatur	e from T	able 10)		
(100)m=	0	0	0	0	0	436.08	343.3	351.82	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.98	0.99	0.99	0	0	0	0		(101)
Usefu	ıl loss, h	mLm (V	/atts) = (100)m x	(101)m									
(102)m=	0	0	0	0	0	428.46	341.03	348.1	0	0	0	0		(102)
Gains	(solar	gains cal	lculated	for appli	cable we	eather re	gion, se	e Table	10)					
(103)m=	0	0	0	0	0	738.07	706.53	658.92	0	0	0	0		(103)
•						lwelling,	continu	ous (kW	h = 0.0	24 x [(10	03)m – (102)m] :	x (41)m	
set (1	04)m to	zero if (104)m <	3 × (98)m									
(104)m=	0	0	0	0	0	222.92	271.94	231.25	0	0	0	0		
									Total	= Sum(104)	=	726.11	(104)
	fraction	-							f C =	cooled	area ÷ (4	4) =	1	(105)
Interm	ittency f	actor (Ta	able 10b)									1	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
									Total	' = Sum(104)	=	0	(106)
Space	cooling	requirer	nent for	month =	(104)m	× (105)	× (106)r	n				· · · · · · · · · · · · · · · · · · ·		_
(107)m=	0	0	0	0	0	55.73	67.98	57.81	0	0	0	0		
									Total	= Sum(107)	=	181.53	(107)
Space	cooling	requiren	nent in k	:Wh/m²/y	/ear				(107)	÷ (4) =			3.59	(108)
8f. Fab	ric Ene	rgy Effici	ency (ca	lculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabri	c Energy	y Efficier	псу						(99)	+ (108) =	=		30.07	(109)
Targe	et Fabri	c Energ	y Efficie	ncy (TF	EE)								34.59	(109)

				N - (- ') -						
			User D							
Assessor Name:	Ross Boulton			Strom					0028068	
Software Name:	Stroma FSAP			Softwa				Versio	on: 1.0.4.18	
	DOA 400 04 EL			Address)2-01				
Address:	B2A-102-01, Fla	at Type 2-11	A, Wimi	oledon, L	ondon					
1. Overall dwelling dim	ensions:		۸ro	o(m²)		۸۰٬ ۵۰	iaht/m\		Volumo/m3	31
Ground floor				a(m²) 50.5	(1a) x		2.6	(2a) =	Volume(m ³	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)	+(1e)+(1r	n)	50.5	(4)			•		_
Dwelling volume					(3a)+(3b)+(3c)+(3c	d)+(3e)+	.(3n) =	131.3	(5)
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m³ per hou	ır
Number of chimneys		+ 0] + [0] = [0	X 4	40 =	0	(6a)
Number of open flues	0	+ 0	+ [0	=	0	x 2	20 =	0	(6b)
Number of intermittent fa	ans					2	x -	10 =	20	(7a)
Number of passive vent	S				F	0	x ·	10 =	0	(7b)
Number of flueless gas	fires				F	0	X	40 =	0	(7c)
· ·					L					`
								Air ch	nanges per ho	our
Infiltration due to chimne	eys, flues and fans	= (6a)+(6b)+(7a)	7a)+(7b)+((7c) =	Γ	20		÷ (5) =	0.15	(8)
If a pressurisation test has		tended, procee	d to (17),	otherwise (continue fr	rom (9) to	(16)			_
Number of storeys in the Additional infiltration	the dwelling (ns)							41.04	0	(9)
	O OF for atool or tim	har frama ar	. 0 2E fo	r maaan		u otion	[(9)	-1]x0.1 =	0	(10)
Structural infiltration: (if both types of wall are p					•	uction			0	(11)
deducting areas of open			g		- (
If suspended wooden	,	•	.1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, er	·								0	(13)
Percentage of window	s and doors draug	ht stripped							0	(14)
Window infiltration				0.25 - [0.2	. ,	-	. (45)		0	(15)
Infiltration rate		. 1.2		(8) + (10)					0	(16)
Air permeability value If based on air permeab	•		•	•	•	etre of e	envelope	area	5	(17)
Air permeability value appli	-					is heina u	sed		0.4	(18)
Number of sides shelter		ot nao boon doi	10 01 a ao	groo an po	moubility	io boilig a	000		3	(19)
Shelter factor				(20) = 1 -	[0.0 75 x (1	19)] =			0.78	(20)
Infiltration rate incorpora	ating shelter factor			(21) = (18) x (20) =				0.31	(21)
Infiltration rate modified	for monthly wind sp	peed								
Jan Feb	Mar Apr N	lay Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
Monthly average wind s	peed from Table 7	•							•	
(22)m= 5.1 5	·	.3 3.8	3.8	3.7	4	4.3	4.5	4.7]	
Wind Footon (COn)	20) 4	•	•	•		•	•	•	•	
Wind Factor (22a)m = $(2^{23})^{m}$	'	08 005	0.05	0.00	4	4.00	4 40	1 10	1	
(22a)m= 1.27 1.25	1.23 1.1 1.	0.95	0.95	0.92	1	1.08	1.12	1.18	J	

Adjusted infiltr							·	,			1	1	
0.4 Calculate effe	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37		
If mechanica		-	ale for t	пс арріі	cabic ca	30						0	(2
If exhaust air he	eat pump (using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (I	N5)) , other	wise (23b) = (23a)			0	(2:
If balanced with	heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				0	(2:
a) If balance	d mecha	anical ve	entilation	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		(2
b) If balance	d mecha	anical ve	entilation	without	heat red	covery (N	ЛV) (24b)m = (22	2b)m + (23b)		_	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
c) If whole h if (22b)n				•	•		on from c c) = (22b		5 × (23b	o)			
24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(2
d) If natural if (22b)n					•		on from I 0.5 + [(2		0.5]				
24d)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(2
Effective air	change	rate - er	iter (24a) or (24k	o) or (24	c) or (24	d) in box	(25)				,	
25)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(2
/indows Type /indows Type					6.79		[1/(1.35)+ [1/(1.35)+	Ļ	2.56	_			(2
lindows Type	area	(m²)	m) *	A ,r		W/m2		(W/I	K)	kJ/m²-l	K i	kJ/K
lindows Type	2				2	x1/	[1/(1.35)+	0.04] =	2.56				(2
/indows Type	3				2.92	x 1/	[1/(1.35)+	0.04] =	3.74				(2
/indows Type	4				2.92	x 1/	[1/(1.35)+	0.04] =	3.74				(2
loor					2.026	x	0.13	=	0.26338	8			(2
/alls	34.7	' 4	14.6	3	20.11	X	0.15	= [3.02				(2
otal area of e	lements	, m²			36.77	,						_	(3
for windows and include the area						ated using	formula 1,	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	1 3.2	
abric heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				22.02	(3
eat capacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	433.5	(3
hermal mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(3
or design assess				construct	ion are no	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
an be used inste hermal bridge				ısina Ar	nendix k	<						5.52	(3
details of therma	,	,			-	`						5.52	(
otal fabric he			()	(-	,			(33) +	(36) =			27.53	(3
entilation hea	at loss ca	alculated	monthly	<u>/</u>				(38)m	= 0.33 × ((25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
8)m= 25.09	24.96	24.83	24.21	24.1	23.57	23.57	23.47	23.77	24.1	24.33	24.57		(3
		o+ \\///						(20)	= (37) + (37)	38)m ——			
eat transfer o	bemblei	II, VV/K						(39)111	=(37)+(37)	30)111			
leat transfer of 52.62	52.49	52.36	51.75	51.63	51.1	51.1	51	51.3	51.63	51.86	52.11		

Heat loss para	meter (l	HLP). W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 1.04	1.04	1.04	1.02	1.02	1.01	1.01	1.01	1.02	1.02	1.03	1.03		
` /				<u> </u>		<u> </u>			L Average =	: Sum(40)₁.	12 /12=	1.02	(40)
Number of day	s in mo	nth (Tab	e 1a)							, ,			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	ΓFA -13		.7		(42)
Annual averag Reduce the annua	e hot wa al average	hot water	usage by	5% if the α	lwelling is	designed t			se target o		.69		(43)
not more that 125	litres per	person per	- '	rater use, i T	not and co	<i>I</i> а)			ī				
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in	n litres pei	r day for ea	ch month	Vd,m = fa	ctor from	able 1c x	(43)		•				
(44)m= 82.16	79.17	76.18	73.2	70.21	67.22	67.22	70.21	73.2	76.18	79.17	82.16		_
Energy content of	hot water	used - cal	culated mo	onthly = 4.	190 x Vd,r	n x nm x D)Tm / 3600			ım(44) ₁₁₂ = ables 1b, 1		896.28	(44)
(45)m= 121.84	106.56	109.96	95.87	91.99	79.38	73.56	84.41	85.41	99.54	108.66	117.99		
				ı					Total = Su	ım(45) ₁₁₂ =	=	1175.16	(45)
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46) to (61)			•		
(46)m= 0	0	0	0	0	0	0	0	0	0	0	0		(46)
Water storage						-							
Storage volum	` '		•			•		ame ves	sel		0		(47)
If community h	•			•			` '		(01 ! - /	(47)			
Otherwise if no Water storage		not wate	er (tnis ir	iciuaes i	nstantar	ieous co	illod idmi	ers) ente	er o in ((47)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWł	n/dav).					0		(48)
Temperature fa				51 10 KHO	**** (1.000)	"day).							(49)
Energy lost fro				oor			(48) x (49)				0		, ,
b) If manufact		_	-		or is not		(40) X (49)	-			0		(50)
Hot water stora			-								0		(51)
If community h	eating s	ee section	on 4.3										
Volume factor	from Ta	ble 2a									0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro	m watei	storage	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter (50) or (54) in (5	55)									0		(55)
Water storage	loss cal	culated f	or each	month			((56)m = (55) × (41)	m				
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder contains	dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where ((H11) is fro	m Append	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary circuit	loss (ar	nnual) fro	m Table	e 3							0		(58)
Primary circuit	•	•			59)m = ((58) ÷ 36	65 × (41)	m					
(modified by	factor f	rom Tabl	e H5 if t	here is	olar wat	er heatii	ng and a	cylinde	r thermo	stat)			
(59)m= 0	0	0	0	0	0	0	0	0	0	0	0		(59)

Combi loss cald	nulated:	for each	month ((61)m –	(60) ± 3	65 v (41	١m						
(61)m= 0	0	0	0	0	00) + 3	03 × (41)	0	T 0	0	T 0	0	1	(61)
Total heat requi			-									[(50)m + (61)m	(- /
(62)m= 103.56	90.58	93.47	81.49	78.19	67.47	62.52	71.74		84.61	92.36	100.3	(39)111 + (01)111	(62)
Solar DHW input ca						1			<u> </u>	1		I	(- /
(add additional										non to wat	or modung,		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(63)
Output from wa	iter heat	ter				ļ	<u>.</u>	I	!		!	1	
(64)m= 103.56	90.58	93.47	81.49	78.19	67.47	62.52	71.74	4 72.6	84.61	92.36	100.3]	
L						!	0	utput from w	ater heate	er (annual) ₁	l12	998.89	(64)
Heat gains from	n water	heating,	kWh/m	onth 0.2	5 ′ [0.85	5 × (45)m	+ (61)m] + 0.8	x [(46)m	+ (57)m	+ (59)m]	-
(65)m= 25.89	22.64	23.37	20.37	19.55	16.87	15.63	17.94	` 	21.15	23.09	25.07]	(65)
include (57)m	n in calc	culation of	of (65)m	only if c	ylinder	is in the	dwellir	ng or hot w	ater is f	rom com	munity h	neating	
5. Internal gai				•	•						•		
Metabolic gains	s (Table	5), Wat	ts										
Jan	Feb	Mar	Apr	May	Jun	Jul	Au	g Sep	Oct	Nov	Dec		
(66)m= 85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	4 85.24	85.24	85.24	85.24		(66)
Lighting gains (calculat	ted in Ap	pendix	L, equati	ion L9 c	r L9a), a	lso se	e Table 5	-			-	
(67)m= 13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.94	12.77	13.61		(67)
Appliances gair	ns (calc	ulated in	Append	dix L, eq	uation L	.13 or L1	3a), a	lso see Ta	ble 5		-		
(68)m= 148.53	150.07	146.19	137.92	127.48	117.67	111.12	109.5	8 113.46	121.73	132.17	141.98		(68)
Cooking gains	(calcula	ted in Ap	pendix	L, equat	ion L15	or L15a), also	see Table	5			•	
(69)m= 31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	2 31.52	31.52	31.52	31.52		(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= -68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.1	9 -68.19	-68.19	-68.19	-68.19		(71)
Water heating of	gains (T	able 5)				-	-						
(72)m= 34.8	33.7	31.41	28.29	26.27	23.43	21.01	24.1	1 25.21	28.43	32.07	33.7		(72)
Total internal	gains =			-	(66)m + (67)m	1 + (68)	m + (69)m +	(70)m + (71)m + (72))m		
(73)m= 245.15	244.1	235.73	222.03	207.74	194.24	185.64	188.6	8 195.86	209.67	225.58	237.86		(73)
6. Solar gains:	:												
Solar gains are ca	alculated (using sola	flux from	Table 6a	and assoc	ciated equa	itions to	convert to the	ne applica		tion.		
Orientation: A		actor	Area		Flu			g_ Table 6b	-	FF		Gains	
	able 6d		m²		Ta	ble 6a	. –	Table 6b	_ '	able 6c		(W)	_
Northeast _{0.9x}	0.77	X	2	!	X	11.28	×	0.5	×	0.8	=	6.26	(75)
Northeast _{0.9x}	0.77	x	2.9)2	х	11.28	×	0.5	×	0.8	=	9.13	(75)
Northeast _{0.9x}	0.77	X	2		x	22.97	x	0.5	x	0.8	=	12.73	(75)
Northeast _{0.9x}	0.77	X	2.9)2	X	22.97	x	0.5	x	0.8	=	18.59	(75)
Northeast _{0.9x}	0.77	X	2	!	X	41.38	x	0.5	X	8.0	=	22.94	(75)

Northeast _{0.9x}	0.77	1 x	2.02	x	44.20	l x	0.5	X	0.0	1 =	22.40	(75)
Northeast 0.9x	0.77	1	2.92	! !	41.38]]	0.5	! !	0.8] 1	33.49	=
Northeast 0.9x	0.77]	2	X	67.96	l x	0.5	X	0.8] = 1 _	37.67	(75) (75)
Northeast 0.9x	0.77	」 x] x	2.92	x x	67.96	x x	0.5	x	0.8] =] =	55.01	(75)
Northeast 0.9x	0.77	1	2	! !	91.35]]	0.5	! !	0.8	J 1	50.64	(75)
Northeast 0.9x	0.77	x x	2.92	X	91.35	l x	0.5	x	0.8] =] =	73.94	(75)
Northeast 0.9x	0.77	」^] ×	2	x x	97.38	x x	0.5	^ x	0.8] =] =	53.99	(75)
Northeast 0.9x	0.77	」^] _×	2.92	^ x	97.38] ^] _x	0.5	^ x	0.8]	78.83 50.51	(75)
Northeast 0.9x		」 ^] _×)]		^ _x		x x]]		(75)
Northeast 0.9x	0.77	」^] ×	2.92	x x	91.1] ^] _x	0.5	^ x	0.8] =] =	73.74	(75)
Northeast 0.9x	0.77	」^] ×	2.92	^ x	72.63] ^] _x	0.5	^ x	0.8]	40.26	(75)
Northeast 0.9x	0.77	」^] ×		^ x	72.63] ^ x	0.5	^ x	0.8]	58.79	(75)
Northeast 0.9x	0.77	1	2	! !	50.42]]	0.5	! !	0.8] 1	27.95	(75)
Northeast 0.9x	0.77] X] _v	2.92	X	50.42	l x	0.5	X	0.8] = 1 _	40.81	(75)
Northeast 0.9x	0.77] X] _v	2	X	28.07	l x	0.5	X	0.8] = 1 _	15.56	(75)
Northeast 0.9x	0.77] X] ,	2.92	l x	28.07	l x	0.5	X	0.8] = 1 _	22.72	=
Northeast 0.9x	0.77] X] ,,	2	l x	14.2	l x	0.5	X	0.8] =	7.87	(75)
Northeast 0.9x	0.77] X] _v	2.92	X	14.2	l x	0.5	X	0.8] = 1 _	11.49	(75) (75)
Northeast 0.9x	0.77] X] ,	2	X	9.21	l x	0.5	X	0.8] =	5.11	╡`′
Southeast 0.9x	0.77] X] ,,	2.92	l x	9.21	l x	0.5	X	0.8] =	7.46	(75)
Southeast 0.9x	0.54] X] _v	6.79	X	36.79	l x	0.5	X	0.8] = 1 _	48.57	$\frac{1}{1}_{(77)}^{(77)}$
Southeast 0.9x	0.77] X] ,	2.92	l x	36.79	l x l ,	0.5	X	0.8] = 1 _	29.78	$=$ $\frac{1}{1}$ $\frac{1}$ $\frac{1}{1}$ \frac
Southeast 0.9x	0.54] X] _v	6.79	X	62.67	l x	0.5	X	0.8] =] =	82.73	(77)
Southeast 0.9x	0.77	」× T	2.92	x x	62.67	x x	0.5	x	0.8] =] =	50.73	(77)
Southeast 0.9x	0.54] x] x	6.79	! !	85.75]]	0.5	! !	0.8] =] =	113.19	(77)
Southeast 0.9x	0.77	」 ^] _×	2.92	x	85.75	x x	0.5	x	0.8] =] =	69.41	(77)
Southeast 0.9x	0.54] ^] x	2.92	^ x	106.25 106.25] ^] x	0.5	^ x	0.8]	140.25 86	(77)
Southeast 0.9x	0.54] ^] x	6.79	l x	119.01] ^] x	0.5	x	0.8]	157.09	(77)
Southeast 0.9x	0.77] ^] x	2.92	^ x	119.01] ^] x	0.5	^ x	0.8]	96.33	(77)
Southeast 0.9x	0.77] ^] x	6.79	^ x	118.15] ^] x	0.5	^ x	0.8]	155.96	(77)
Southeast 0.9x	0.77]	2.92	X	118.15] ^] x	0.5	X	0.8] =	95.63	(77)
Southeast 0.9x	0.54]	6.79	x	113.91	^ x	0.5	X	0.8] =	150.36	(77)
Southeast 0.9x	0.77] x	2.92	x	113.91] x	0.5	X	0.8]] =	92.2	(77)
Southeast 0.9x	0.54]]	6.79	l X	104.39] 	0.5	X	0.8] =	137.79	(77)
Southeast 0.9x	0.77] x	2.92	x	104.39	X	0.5	x	0.8]] =	84.5	(77)
Southeast 0.9x	0.54] x	6.79	x	92.85) x	0.5	X	0.8]] =	122.56	(77)
Southeast 0.9x	0.77] x	2.92	x	92.85	X	0.5	x	0.8] =	75.16	(77)
Southeast 0.9x	0.54]	6.79	x	69.27	^ x	0.5	X	0.8] =	91.43	(77)
Southeast 0.9x	0.77] x	2.92	x	69.27) x	0.5	x	0.8]] =	56.07	(77)
Southeast 0.9x	0.54] x	6.79	x	44.07	X	0.5	x	0.8] =	58.17	(77)
Southeast 0.9x	0.77]	2.92	x	44.07	^ x	0.5	X	0.8] =	35.67	(77)
	J.1.1	1		1	1	1	0.0	1	L	1	00.07	」 ` ′

Southeast 0.9x	0.54	x	6.7	9	x	3	1.49	x [0.5	x		0.8		= [41.56	(77)
Southeast 0.9x	0.77	x	2.9	2	x	3	1.49	x		0.5	X		0.8		= [25.49	(77)
															_		_
Solar gains in	watts, ca	alculated	for eacl	n month				(83)m	= Sı	ım(74)m .	(82)	m					
(83)m= 93.74	164.78	239.03	318.93	378	3	84.4	366.8	321.	34	266.48	185.	78	113.21	79.6	2		(83)
Total gains –	internal a	and solar	(84)m =	(73)m ·	+ (8	33)m	, watts										
(84)m= 338.88	408.88	474.77	540.96	585.74	57	78.65	552.44	510.	02	462.34	395.	45	338.78	317.4	8		(84)
7. Mean inte	rnal temp	perature	(heating	season)												
Temperature	during h	neating p	eriods ir	the livii	ng	area f	rom Tab	ole 9,	Th1	I (°C)					Γ	21	(85)
Utilisation fa	ctor for g	ains for I	iving are	a, h1,m	(s	ee Ta	ble 9a)								L		
Jan	Feb	Mar	Apr	May	Ò	Jun	Jul	Αι	ıg	Sep	0	ct	Nov	De	С		
(86)m= 0.96	0.93	0.88	0.79	0.66	(0.51	0.39	0.4	3	0.63	0.8	4	0.93	0.96			(86)
Moon intorna	l tompor	oturo in	iving or	DO T1 /f/	ـــــــــــــــــــــــــــــــــــــ	w oto	no 2 to 7	l in T	I	. 00)							
Mean interna (87)m= 18.96	19.29	19.74	20.26	20.66	_	0.88	20.96	20.9		20.77	20.2	2/1	19.5	18.9	\neg		(87)
` ′					_			<u> </u>			20.2		19.5	10.5			(01)
Temperature					_	Ť		1		<u>`</u>					_		
(88)m= 20.05	20.05	20.05	20.06	20.06	2	0.07	20.07	20.0	8	20.07	20.0)6	20.06	20.0	ô		(88)
Utilisation fa	ctor for g	ains for ı	est of d	welling,	h2,	m (se	e Table	9a)									
(89)m= 0.95	0.92	0.86	0.76	0.62	(0.45	0.31	0.3	5	0.57	0.8	1	0.92	0.96			(89)
Mean interna	al temper	ature in t	the rest	of dwelli	na	T2 (fd	ollow ste	ns 3	to 7	in Tabl	ہ 60						
(90)m= 18.18	18.5	18.95	19.45	19.81	l	20	20.06	20.0		19.92	19.4	_	18.73	18.1	3		(90)
` /	<u> </u>	<u> </u>			<u> </u>			<u> </u>	L	f	LA = I	ivin	g area ÷ (4	1) =	╅	0.51	(91)
						` .		,,		۸\ =0					L		`'
Mean interna	'	<u> </u>						`	$\overline{}$		40.4		10.10	40.5	\Box		(00)
(92)m= 18.58	18.9	19.35	19.86	20.24		0.45	20.52	20.		20.35	19.8		19.12	18.5			(92)
Apply adjust	1				_						•		40.40	40.5	$\overline{}$		(02)
(93)m= 18.58	18.9	19.35	19.86	20.24	2	0.45	20.52	20.	5	20.35	19.8	35	19.12	18.5			(93)
8. Space hea						-1 -1	. 44 . (.	- 01	11		. /-	70)			Lata	
Set Ti to the the utilisation			•		iea	at ste	ер 11 от	rabie	90	, so tha	t II,n	n=(76)m an	a re-c	aici	лате	
Jan	Feb	Mar	Apr	May	Г	Jun	Jul	Αι	ıa T	Sep	0	ct	Nov	De	$\overline{}$		
Utilisation fa			•	May	<u> </u>	<u> </u>	0 0.1	7.0	·9 [000			1101		ٽ		
(94)m= 0.94	0.9	0.85	0.75	0.63		0.47	0.35	0.3	9	0.59	0.0	3	0.91	0.95			(94)
Useful gains	, hmGm	. W = (94	I)m x (84	4)m	<u> </u>			l	!								
(95)m= 317.44	·	402.58	408.2	366.66	2	74.65	192.71	199	.1	274.32	317	.4	307.76	300.0)5		(95)
Monthly ave	rage exte	rnal tem	perature	from Ta	abl	 е 8		!		!					_		
(96)m= 4.3	4.9	6.5	8.9	11.7	_	14.6	16.6	16.4	4	14.1	10.	6	7.1	4.2			(96)
Heat loss rat	e for me	an intern	al tempe	erature,	Lm	, W =	=[(39)m :	x [(93	 3)m-	- (96)m]						
(97)m= 751.38	1	672.8	567.27	440.8	_	98.85	200.06	209.	_	320.83	477.	44	623.58	746.1	4		(97)
Space heatir	ng require	ement fo	r each m	nonth, k	Wh	/mont	h = 0.02	24 x [((97)	m – (95))m] x	(4°	1)m	I			
(98)m= 322.85	Ť	201.04	114.53	55.16		0	0	0	Ť	0	119.	·	227.39	331.8	19		
	•								Γotal	per year	(kWh/	year) = Sum(9	8)15,912	=	1617.81	(98)
Space heatir	na reauir	ement in	kWh/m²	/vear											F	32.04	(99)
Space Heath	.g roquii			, _y oai											L	J2.04	

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	ELm (ca	lculated	using 25	5°C inter	nal temp	erature	and exte	ernal ten	nperatur	e from T	able 10)	•	
(100)m=	0	0	0	0	0	480.33	378.13	387.6	0	0	0	0		(100)
Utilisa	ation fac	tor for lo	ss hm											
(101)m=	0	0	0	0	0	0.88	0.92	0.9	0	0	0	0		(101)
Usefu	l loss, h	mLm (V	/atts) = (100)m x	(101)m									
(102)m=	0	0	0	0	0	422.14	347.16	349.03	0	0	0	0		(102)
Gains	(solar (gains cal	culated	for appli	cable we	eather re	gion, se	e Table	10)	•				
(103)m=	0	0	0	0	0	760.7	728.13	677.89	0	0	0	0		(103)
		g require zero if (lwelling,	continuo	ous (kW	h') = 0.0	24 x [(10	03)m – (102)m] :	x (41)m	
(104)m=		0	0	0	0	243.76	283.44	244.67	0	0	0	0		
(104)111=	U	U	U	U	U	243.76	203.44	244.07						¬
0 1										= Sum(•	=	771.88	(104)
	I fraction	-							f C =	cooled	area ÷ (4	1) =	1	(105)
		actor (Ta	able 10b	_				i		i	i	i	I	
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0		
									Total	I = Sum(104)	=	0	(106)
Space	cooling	requirer	nent for	month =	(104)m	× (105)	× (106)r	n		_				
(107)m=	0	0	0	0	0	60.94	70.86	61.17	0	0	0	0		
									Total	= Sum(1.0.7)	=	192.97	(107)
Space	cooling	requirer	nent in k	:Wh/m²/y	/ear				(107)	÷ (4) =			3.82	(108)
8f. Fab	ric Ene	gy Effici	ency (ca	alculated	only un	der spec	cial cond	litions, se	ee sectio	on 11)				
Fabrio	Energy	/ Efficier	псу						(99)	+ (108) =	=		35.86	(109)

			User D	etails:						
Assessor Name:	Ross Boulton			Stroma	a Num	ber:		STRO	028068	
Software Name:	Stroma FSAP	2012		Softwa	re Ve	rsion:		Versio	n: 1.0.4.18	
		Р	roperty .	Address:	B2A-10	2-01				
Address :	B2A-102-01, Fl	at Type 2-11	A, Wimb	oledon, L	ondon					
1. Overall dwelling dime	ensions:									
			Area	a(m²)		Av. He	ight(m)	_	Volume(m	³)
Ground floor			į.	50.5	(1a) x	2	2.6	(2a) =	131.3	(3
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)	+(1e)+(1r	1) (50.5	(4)					
Dwelling volume					(3a)+(3b)+(3c)+(3c	l)+(3e)+	(3n) =	131.3	(5
2. Ventilation rate:										
	main heating	secondar heating	у	other		total			m³ per hou	ur
Number of chimneys		+ 0	+	0] = [0	X	40 =	0	(6
Number of open flues	0	+ 0		0]	0	X	20 =	0	 (6
Number of intermittent fa					J L		=	10 =		\`
					Ļ	0			0	╡`
Number of passive vents	,				L	0	X	10 =	0	(7
Number of flueless gas fi	res					0	X	40 =	0	(7
								Air ch	anges per h	our
nfiltration due to chimne	us flues and fans	(6a) ((6b) (7	'a\	7c) –	Г			i		
nfiltration due to chimne If a pressurisation test has be	-				ontinuo fr	0 om (0) to (÷ (5) =	0	(8
Number of storeys in the		nonaca, proceed	<i>a to (11),</i> t	ourier wise e	onunae n	om (5) to (10)		0	(9
Additional infiltration							[(9)	-1]x0.1 =	0	—\(\)
Structural infiltration: 0	.25 for steel or tim	ber frame or	0.35 for	r masonr	y constr	uction	-, ,		0	— (1
if both types of wall are p	resent, use the value o	corresponding to	the great	er wall are	a (after					
deducting areas of openii			4 /1-		0			1		— .
If suspended wooden t	•	,	1 (seale	ed), else	enter 0				0	(1
If no draught lobby, en									0	— (1
Percentage of windows Window infiltration	s and doors draug	nt stripped		0.25 - [0.2	v (14) ± 1	001 -			0	— (1 — ,,
Infiltration rate				(8) + (10)		_	⊥ (15) –		0	— (1 — (4
	aEO avpragad in	oubio motro	a nor ha					oroo	0	(1
Air permeability value, f based on air permeabil	•		•	•	•	etre or e	invelope	area	5	(1
Air permeability value applie	-					is heina u	sad has		0.25	(1
Number of sides sheltere		si nas been don	o or a dog	gree an per	meability	is being a	sca		3	(1
Shelter factor	,			(20) = 1 -	0.075 x (1	9)] =			0.78	—\(\)(2
nfiltration rate incorporat	ting shelter factor			(21) = (18)	x (20) =				0.19	<u> </u>
nfiltration rate modified f	-	peed							<u> </u>	
Jan Feb		/lay Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp		- 1			•		•	•	ı	
22)m= 5.1 5		.3 3.8	3.8	3.7	4	4.3	4.5	4.7		
	1 1	ı	1	I			1	1	I	

1.1

1.08

0.95

0.95

0.92

1.08

1.12

1.18

1.23

(22a)m=

1.27

1.25

Adjusted infiltra	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m				_	
0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23		
Calculate effect If mechanica		•	rate for t	ne appli	cable ca	se						0.5	(23
If exhaust air he			endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	wise (23b) = (23a)			0.5	(23
If balanced with									, , ,			0.5	(23
a) If balance	d mecha	anical ve	ntilation	with he	at recove	erv (MVI	HR) (24a	ı)m = (22	2b)m + (23b) x [1 – (23c)		(
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
b) If balance	d mecha	anical ve	ntilation	without	heat rec	covery (N	иV) (24b)m = (22	2b)m + (2	23b)		J	
24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24
c) If whole h				•	•				5 × (23b))		•	
24c)m= 0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5]	(24
d) If natural if (22b)m				•	•				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= 0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		(25
3. Heat losse	s and he	at loss r	naramete	or.									
LEMENT	Gros	·	Openin		Net Ar	ea	U-valı	ıe	AXU		k-value	e e	ΑΧk
	area	_	m		A ,r		W/m2		(W/I		kJ/m²•		kJ/K
Vindows Type	: 1				6.79	x1/	[1/(1.35)+	- 0.04] =	8.7				(27
Vindows Type	2				2	x1/	[1/(1.35)+	- 0.04] =	2.56				(27
Vindows Type	: 3				2.92	x1/	[1/(1.35)+	- 0.04] =	3.74				(27
Vindows Type	4				2.92	_X 1/	[1/(1.35)+	- 0.04] =	3.74				(27
loor					2.026	x	0.13	= [0.26338	8			(28
Valls	34.7	'4	14.6	3	20.11	X	0.15	= [3.02				(29
otal area of e	lements	, m²			36.77	,							(31
for windows and * include the area						ated using	formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragrapl	1 3.2	
abric heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				22.02	(33
leat capacity	Cm = S(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	433.5	(34
hermal mass	parame	ter (TMF	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value	: Low		100	(35
For design assess				construct	ion are not	t known pr	ecisely the	indicative	values of	TMP in T	able 1f		
an be used instea Thermal bridge				ısina Ar	nendix k	<						5.52	(36
details of therma	,	•		• .	•	`						3.32	(0/
otal fabric he			()	(-	,			(33) +	(36) =			27.53	(37
entilation hea	t loss ca	alculated	monthly	/				(38)m	= 0.33 × ((25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
38)m= 21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66	21.66		(38
leat transfer o	oefficier	nt, W/K						(39)m	= (37) + (37)	38)m			
39)m= 49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2]	
									1	1			

Heat loss para	ameter (I	HLP), W	′m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97		
	•	!							Average =	Sum(40) ₁	12 /12=	0.97	(40)
Number of day	·	<u> </u>	· ·										
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Water hea	iting ene	rgy requi	irement:								kWh/ye	ar:	
Assumed occi if TFA > 13. if TFA £ 13.	.9, N = 1		[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13		.7		(42)
Annual average Reduce the annual not more that 125	al average	hot water	usage by	5% if the α	lwelling is	designed t	,		se target o		.69		(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage								<u>'</u>	!				
(44)m= 82.16	79.17	76.18	73.2	70.21	67.22	67.22	70.21	73.2	76.18	79.17	82.16		
									Total = Su	m(44) ₁₁₂ =	=	896.28	(44)
Energy content of	f hot water	used - cal	culated m	onthly $= 4$.	190 x Vd,r	n x nm x D	OTm / 3600	0 kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m= 121.84	106.56	109.96	95.87	91.99	79.38	73.56	84.41	85.41	99.54	108.66	117.99		
If instantaneous	water beati	'na at naint	of upo /pa	bot water	r otorogol	antar O in	haves (46		Total = Su	m(45) ₁₁₂ =	-	1175.16	(45)
If instantaneous v			·	1	, , , , , , , , , , , , , , , , , , ,	·	, ,	,		1	i I		(40)
(46)m= 18.28 Water storage	15.98 1088	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7		(46)
Storage volum) includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community I	` '					_							` ,
Otherwise if n	_			-			, ,	ers) ente	er '0' in ((47)			
Water storage													
a) If manufac				or is kno	wn (kWł	n/day):					0		(48)
Temperature f											0		(49)
Energy lost fro		•			!4		(48) x (49)) =		1	10		(50)
b) If manufactHot water stor			-								02		(51)
If community h	_			<u> </u>	,	.,,					UZ		(0.)
Volume factor	from Ta	ble 2a								1.	03		(52)
Temperature f	factor fro	m Table	2b							0	.6		(53)
Energy lost fro	om watei	r storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =	1.	03		(54)
Enter (50) or	(54) in (55)								1.	03		(55)
Water storage	loss cal	culated t	for each	month			((56)m = ((55) × (41)	m				
(56)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(56)
If cylinder contain	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Appendi	хН	
(57)m= 32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01		(57)
Primary circuit	t loss (ar	nual) fro	m Table	3							0		(58)
Primary circuit	`	,			59)m = ((58) ÷ 36	65 × (41))m					
(modified by				,	•	. ,	, ,		r thermo	stat)			
(59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26		(59)

Combiless	o louloto d	for oach	manth ((64)m	(CO) + 2(SE (41)	١,,,,						
Combi loss of (61)m= 0	alculated	or each	month (0 1)m =	(6U) ÷ 30	05 × (41)	0	Ιο	0	0	0]	(61)
		ļ					<u> </u>	ļ	<u> </u>	<u> </u>		(50) = . (64) = .	(01)
(62)m= 177.1		165.24	149.36	147.26	132.87	128.83	139.68	138.91	154.82	162.15	173.27	(59)m + (61)m	(62)
Solar DHW inpu		I				<u> </u>							(02)
(add addition									ii continbut	ion to wate	er rieatiriy)		
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(63)
Output from	L water hea	ıter				ļ					!	l	
(64)m= 177.1		165.24	149.36	147.26	132.87	128.83	139.68	138.91	154.82	162.15	173.27		
				l .		!	Out	put from w	ater heate	r (annual)₁	12	1826	(64)
Heat gains fr	om water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 ;	x [(46)m	+ (57)m	+ (59)m	1	
(65)m= 84.73	1	80.78	74.67	74.81	69.19	68.68	72.29	71.19	77.32	78.92	83.45]	(65)
include (57	7)m in cal	culation of	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is f	om com	munity h	neating	
5. Internal	gains (see	e Table 5	and 5a):									
Metabolic ga													
Jan	T '	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24		(66)
Lighting gain	s (calcula	ted in Ap	pendix	L, equati	on L9 o	r L9a), a	lso see	Table 5				•	
(67)m= 13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.94	12.77	13.61		(67)
Appliances of	ains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	•	•	•	
(68)m= 148.5	3 150.07	146.19	137.92	127.48	117.67	111.12	109.58	113.46	121.73	132.17	141.98		(68)
Cooking gair	ns (calcula	ated in A	ppendix	L, equat	ion L15	or L15a)	, also s	ee Table	5			•	
(69)m= 31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52		(69)
Pumps and f	ans gains	(Table 5	5a)					-				-	
(70)m= 0	0	0	0	0	0	0	0	0	0	0	0		(70)
Losses e.g.	evaporatio	n (negat	tive valu	es) (Tab	le 5)		=	-	-		-		
(71)m= -68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19		(71)
Water heatin	g gains (1	Table 5)		_		-	-				-		
(72)m= 113.8	9 112.16	108.58	103.71	100.55	96.09	92.31	97.16	98.88	103.92	109.62	112.17		(72)
Total interna	al gains =	•			(66))m + (67)m	+ (68)m	+ (69)m +	(70)m + (7	'1)m + (72))m		
(73)m= 324.2	4 322.57	312.91	297.44	282.02	266.91	256.94	261.73	269.53	285.17	303.12	316.33		(73)
6. Solar gai	ns:												
Solar gains are		•	r flux from	Table 6a			tions to co	onvert to th	ne applicat		tion.		
Orientation:	Access F Table 6d		Area m²		Flu	ıx ble 6a	7	g_ able 6b	т	FF able 6c		Gains	
					Tal	ole da	, –	able ob	_ '	able 60		(W)	1
Northeast 0.9		X	2	!	x 1	1.28	X	0.5	x	0.8	=	6.26	(75)
Northeast 0.9	-	X	2.9	92	X 1	1.28	X	0.5	x	0.8	=	9.13	(75)
Northeast 0.9	U 1111	X	2	2	x 2	22.97	X	0.5	x	0.8	=	12.73	(75)
Northeast 0.9		X	2.9	92	x 2	22.97	x	0.5	x	0.8	=	18.59	(75)
Northeast 0.9	0.77	X	2	!	X 4	11.38	X	0.5	х	0.8	=	22.94	(75)

Northeast _{0.9x}	0.77	1 x	2.02	x	44.20	l x	0.5	x	0.0	1 =	22.40	(75)
Northeast 0.9x	0.77	1	2.92	! !	41.38]]	0.5	! !	0.8] 1	33.49	=
Northeast 0.9x	0.77]	2	X	67.96	l x	0.5	X	0.8] = 1 _	37.67	(75) (75)
Northeast 0.9x	0.77	」 x] x	2.92	x x	67.96	x x	0.5	x	0.8] =] =	55.01	(75)
Northeast 0.9x	0.77	1	2	! !	91.35]]	0.5	! !	0.8	J 1	50.64	(75)
Northeast 0.9x	0.77	x x	2.92	X	91.35	l x	0.5	x	0.8] =] =	73.94	(75)
Northeast 0.9x	0.77	」^] ×	2	x x	97.38	x x	0.5	^ x	0.8] =] =	53.99	(75)
Northeast 0.9x	0.77	」^] _×	2.92	^ x	97.38] ^] _x	0.5	^ x	0.8]	78.83 50.51	(75)
Northeast 0.9x		」 ^] _×)]		^ _x		x x]]		(75)
Northeast 0.9x	0.77	」^] ×	2.92	x x	91.1] ^] _x	0.5	^ x	0.8] =] =	73.74	(75)
Northeast 0.9x	0.77	」^] ×	2.92	^ x	72.63] ^] _x	0.5	^ x	0.8]	40.26	(75)
Northeast 0.9x	0.77	」^] ×		^ x	72.63] ^ x	0.5	^ x	0.8]	58.79	(75)
Northeast 0.9x	0.77	1	2	! 	50.42]]	0.5	! !	0.8] 1	27.95	(75)
Northeast 0.9x	0.77] X] _v	2.92	X	50.42	l x	0.5	X	0.8] = 1 _	40.81	(75)
Northeast 0.9x	0.77] X] _v	2	X	28.07	l x	0.5	X	0.8] = 1 _	15.56	(75)
Northeast 0.9x	0.77] X] ,	2.92	l x	28.07	l x	0.5	X	0.8] = 1 _	22.72	=
Northeast 0.9x	0.77] X] ,,	2	l x	14.2	l x	0.5	X	0.8] =	7.87	(75)
Northeast 0.9x	0.77] X] _v	2.92	X	14.2	l x	0.5	X	0.8] = 1 _	11.49	(75) (75)
Northeast 0.9x	0.77] X] ,	2	X	9.21	l x	0.5	X	0.8] =	5.11	╡`′
Southeast 0.9x	0.77] X] ,,	2.92	l x	9.21	l x	0.5	X	0.8] =	7.46	(75)
Southeast 0.9x	0.54] X] _v	6.79	X	36.79	l x	0.5	X	0.8] = 1 _	48.57	$\frac{1}{1}_{(77)}^{(77)}$
Southeast 0.9x	0.77] X] ,	2.92	l x	36.79	l x l ,	0.5	X	0.8] = 1 _	29.78	$=$ $\frac{1}{1}$ $\frac{1}$ $\frac{1}{1}$ \frac
Southeast 0.9x	0.54] X] _v	6.79	X	62.67	l x	0.5	X	0.8] =] =	82.73	(77)
Southeast 0.9x	0.77	」× T	2.92	x x	62.67	x x	0.5	x	0.8] =] =	50.73	(77)
Southeast 0.9x	0.54] x] x	6.79	! !	85.75]]	0.5	! !	0.8] =] =	113.19	(77)
Southeast 0.9x	0.77	」 ^] _×	2.92	x	85.75	x x	0.5	x	0.8] =] =	69.41	(77)
Southeast 0.9x	0.54] ^] x	2.92	^ x	106.25 106.25] ^] x	0.5	^ x	0.8]	140.25 86	(77)
Southeast 0.9x	0.54] ^] x	6.79	l x	119.01] ^] x	0.5	x	0.8]	157.09	(77)
Southeast 0.9x	0.77] ^] x	2.92	^ x	119.01] ^] x	0.5	^ x	0.8]	96.33	(77)
Southeast 0.9x	0.77] ^] x	6.79	^ x	118.15] ^] x	0.5	^ x	0.8]	155.96	(77)
Southeast 0.9x	0.77]	2.92	X	118.15] ^] x	0.5	X	0.8] =	95.63	(77)
Southeast 0.9x	0.54]	6.79	x	113.91	^ x	0.5	X	0.8] =	150.36	(77)
Southeast 0.9x	0.77] x	2.92	x	113.91] x	0.5	X	0.8]] =	92.2	(77)
Southeast 0.9x	0.54]]	6.79	l X	104.39] 	0.5	X	0.8] =	137.79	(77)
Southeast 0.9x	0.77] x	2.92	x	104.39	X	0.5	x	0.8]] =	84.5	(77)
Southeast 0.9x	0.54] x	6.79	x	92.85) x	0.5	X	0.8]] =	122.56	(77)
Southeast 0.9x	0.77] x	2.92	x	92.85	X	0.5	x	0.8] =	75.16	(77)
Southeast 0.9x	0.54]	6.79	x	69.27	^ x	0.5	X	0.8] =	91.43	(77)
Southeast 0.9x	0.77] x	2.92	x	69.27) x	0.5	x	0.8]] =	56.07	(77)
Southeast 0.9x	0.54] x	6.79	x	44.07	X	0.5	x	0.8] =	58.17	(77)
Southeast 0.9x	0.77]	2.92	x	44.07	^ x	0.5	X	0.8] =	35.67	(77)
	J.1.1	1		1	1	1	0.0	1	L	1	00.07	」 ` ′

Southe	ast _{0.9x}	0.54	x	6.7	9	x	3	1.49	х	0.5	x	0.8	=	41.56	(77)
Southe	ast _{0.9x}	0.77	x	2.9	2	X	3	1.49	x	0.5	_ x _	0.8	=	25.49	(77)
	_						•								
Solar	gains in v	watts, ca	alculated	for eacl	n month	1			(83)m =	Sum(74)m .	(82)m				
(83)m=	93.74	164.78	239.03	318.93	378	3	84.4	366.8	321.34	266.48	185.78	113.21	79.62		(83)
Total g	gains – ir	nternal a	nd solar	(84)m =	(73)m	+ (8	83)m ,	watts	•	•		•		l	
(84)m=	417.97	487.35	551.94	616.38	660.02	6	51.31	623.74	583.07	536.02	470.94	416.33	395.95		(84)
7. Me	ean interi	nal temp	erature	(heating	season	n)									
Temp	perature	during h	eating p	eriods ir	the livi	ng	area f	rom Tab	ole 9, T	h1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for I	iving are	ea, h1,m	ı (s	ee Ta	ble 9a)							
	Jan	Feb	Mar	Apr	May		Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.93	0.89	0.83	0.73	0.6	(0.45	0.34	0.37	0.56	0.77	0.89	0.93		(86)
Mear	internal	l temper	ature in l	living are	ea T1 (fo	ollo	w ste	os 3 to 7	in Tab	le 9c)				'	
(87)m=	19.36	19.65	20.04	20.45	20.76	2	20.92	20.97	20.97	20.85	20.44	19.82	19.28		(87)
Temr	oerature	during h	eating n	eriods ir	rest of	dw	ellina	from Ta	hle 9			!		l	
(88)m=	20.1	20.1	20.1	20.1	20.1	1	20.1	20.1	20.1	20.1	20.1	20.1	20.1		(88)
, ,									ļ						
	ation fac	tor for ga	0.81	est of d	welling, 0.55	_	m (se _{0.4}	e Table 0.27	9a) 0.31	0.5	0.74	0.88	0.93		(89)
(89)m=	0.92	0.00	0.61	0.7	0.55		0.4	0.27	0.51	0.5	0.74	0.00	0.93		(00)
Mear			1			Ť	·		i –	7 in Tabl	· ·			ı	
(90)m=	17.93	18.33	18.88	19.45	19.84	2	20.03	20.09	20.08	19.96	19.45	18.59	17.81		(90)
										1	fLA = Livin	g area ÷ (4	1) =	0.51	(91)
Mear	n internal	l temper	ature (fo	r the wh	ole dwe	ellin	g) = fL	_A × T1	+ (1 – f	LA) × T2					
(92)m=	18.66	19	19.47	19.96	20.31	2	20.49	20.54	20.53	20.41	19.96	19.22	18.56		(92)
Apply	/ adjustn	nent to tl	ne mean	internal	temper	atu	re fro	m Table	4e, wh	ere appro	opriate				
(93)m=	18.66	19	19.47	19.96	20.31	2	20.49	20.54	20.53	20.41	19.96	19.22	18.56		(93)
8. Sp	ace hea	ting requ	uirement												
						ned	at ste	p 11 of	Table 9	b, so tha	t Ti,m=(76)m an	d re-calc	culate	
the u	tilisation	Feb				Т	lun	Jul	۸۰۰۵	Con	Oct	Nov	Dec		
l Itilie	Jan ation fac		Mar ains hm	Apr	May		Jun	Jui	Aug	Sep	Oct	Nov	Dec		
(94)m=	0.9	0.86	0.79	0.7	0.56		0.42	0.3	0.34	0.52	0.74	0.86	0.91		(94)
	ul gains,									1 ***	• • • •				` '
(95)m=	375.2	417.75	438.69	428.75	372.62	27	73.55	189.25	196.9	280.14	346.18	357.49	359.71		(95)
	hly avera								<u> </u>			<u> </u>			
(96)m=	4.3	4.9	6.5	8.9	11.7	$\overline{}$	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	for mea	an intern	al tempe	erature,	Lm	ı ı , W =	=[(39)m :	х [(93)r	n— (96)m	<u> </u>]	!			
(97)m=	706.33	693.81	638.04	544.07	423.56	28	89.53	193.8	203.23	310.59	460.3	596.06	706.4		(97)
Spac	e heating	g require	ement fo	r each n	nonth, k	Wh	/mont	h = 0.02	24 x [(9	7)m – (95)m] x (4	1)m		1	
	246.36	185.51	148.32	83.03	37.9		0	0	0	0	84.9	171.77	257.94		
(98)m=															
(98)m=	2.0.00						_		Tot	al per year	(kWh/yea) = Sum(9	8) _{15,912} =	1215.73	(98)
	e heating	g require	ement in	kWh/m²	/year				Tot	al per year	(kWh/year	r) = Sum(9	8)15,912 =	1215.73 24.07	(98) (99)
Spac		• •			•	SC	heme		Tot	al per year	(kWh/year	r) = Sum(9	8) _{15,912} =		=

This part is used for space heating, space cooling or water heating provided by a community scheme.

	-		_
Fraction of space heat from secondary/supplementary heating (Ta	able 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)
The community scheme may obtain heat from several sources. The procedure allowed includes boilers, heat pumps, geothermal and waste heat from power stations. See		e latter	
Fraction of heat from Community CHP		0.67	(303a)
Fraction of community heat from heat source 2		0.33	(303b)
Fraction of total space heat from Community CHP	(302) x (303a) =	0.67	(304a)
Fraction of total space heat from community heat source 2	(302) x (303b) =	0.33	(304b)
Factor for control and charging method (Table 4c(3)) for communication	ty heating system	1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating	r	kWh/year	, –
Annual space heating requirement		1215.73	╛
Space heat from Community CHP	(98) x (304a) x (305) x (306) =	850.16	(307a)
Space heat from heat source 2	(98) x (304b) x (305) x (306) =	426.36	(307b)
Efficiency of secondary/supplementary heating system in % (from	Table 4a or Appendix E)	0	(308
Space heating requirement from secondary/supplementary system	n (98) x (301) x 100 ÷ (308) =	0	(309)
Water heating	Г	1006	¬
Annual water heating requirement If DHW from community scheme:	L	1826	_
Water heat from Community CHP	(64) x (303a) x (305) x (306) =	1276.92	(310a)
Water heat from heat source 2	(64) x (303b) x (305) x (306) =	640.38	(310b)
Electricity used for heat distribution	0.01 × [(307a)(307e) + (310a)(310e)] =	31.94	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from our	utside [62.47	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	62.47	(331)
Energy for lighting (calculated in Appendix L)	_ [233.85	(332)
Electricity generated by PVs (Appendix M) (negative quantity)	_ [-254.41	(333)
Electricity generated by wind turbine (Appendix M) (negative quan	itity)	0	(334)
12b. CO2 Emissions – Community heating scheme	L		
Electrical efficiency of CHP unit		32	(361)
Heat efficiency of CHP unit		50.4	(362)
	Energy Emission factor E kWh/year kg CO2/kWh	Emissions kg CO2/year	
Space heating from CHP) $(307a) \times 100 \div (362) =$	1686.82 × 0.22	364.35	(363)

less credit emissions for electricity	$-(307a) \times (361) \div (362) =$	539.78 ×	0.52		-280.15	(364)
Water heated by CHP	(310a) × 100 ÷ (362) =	2533.57 ×	0.22		547.25	(365)
less credit emissions for electricity	$-(310a) \times (361) \div (362) =$	810.74 ×	0.52		-420.78	(366)
Efficiency of heat source 2 (%)	If there is CHP us	ing two fuels repeat (363) to (3	866) for the second	l fuel	95	(367b)
CO2 associated with heat source 2	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	242.54	(368)
Electrical energy for heat distribution	n	[(313) x	0.52	=	16.58	(372)
Total CO2 associated with commun	nity systems	(363)(366) + (368)(372)		=	469.8	(373)
CO2 associated with space heating	(secondary)	(309) x	0	=	0	(374)
CO2 associated with water from im	mersion heater or instantar	neous heater (312) x	0.22	=	0	(375)
Total CO2 associated with space a	nd water heating	(373) + (374) + (375) =			469.8	(376)
CO2 associated with electricity for p	oumps and fans within dwe	lling (331)) x	0.52	=	32.42	(378)
CO2 associated with electricity for I	ighting	(332))) x	0.52	=	121.37	(379)
Energy saving/generation technologitem 1	gies (333) to (334) as appli).52 × 0.01	1 =	-132.04	(380)
Total CO2, kg/year	sum of (376)(382) =				491.55	(383)
Dwelling CO2 Emission Rat	e $(383) \div (4) =$				9.73	(384)
El rating (section 14)					93.1	(385)

			User D	otoila:						
Assessor Name: Software Name:	Ross Boulton Stroma FSAP 201			Stroma Softwa	re Ve	sion:			0028068 on: 1.0.4.18	
Address :	B2A-102-01, Flat Ty			Address: oledon, L)2-01				
1. Overall dwelling dime	•	, , , , , , , , , , , , , , , , , , , ,	.,							
			Area	a(m²)		Av. He	ight(m)		Volume(m ³	")
Ground floor			ţ	50.5	(1a) x	2	2.6	(2a) =	131.3	(3a)
Total floor area TFA = (1	a)+(1b)+(1c)+(1d)+(1e	e)+(1n	1) [50.5	(4)					
Dwelling volume					(3a)+(3b))+(3c)+(3c	d)+(3e)+	(3n) =	131.3	(5)
2. Ventilation rate:										
		econdar leating	У	other		total			m³ per hou	ır
Number of chimneys	0 +	0	+	0] = [0	X 4	40 =	0	(6a)
Number of open flues	0 +	0	+	0	=	0	x 2	20 =	0	(6b)
Number of intermittent fa	ans				, <u> </u>	2	x -	10 =	20	(7a)
Number of passive vents	3				F	0	x ·	10 =	0	(7b)
Number of flueless gas f	ires					0	x	40 =	0	(7c)
Ç					L					` ′
								Air ch	nanges per ho	our
Infiltration due to chimne	•					20		÷ (5) =	0.15	(8)
	been carried out or is intende	ed, proceed	d to (17), d	otherwise o	ontinue fr	om (9) to	(16)		_	— (0)
Number of storeys in t Additional infiltration	ne aweiling (ns)						[(0)]	-1]x0.1 =	0	(9) (10)
	0.25 for steel or timber	frame or	0.35 for	r masonr	v constr	uction	[(3)	-1]XU.1 =	0	(10)
if both types of wall are p	present, use the value corres				•	aotion			0	(11)
deducting areas of open	• / .	ad\ ar 0	1 (000)	\d\ alaa	ontor O				_	7,40
If no draught lobby, er	floor, enter 0.2 (unseal	ea) or 0.	i (seale	ea), eise	enter 0				0	(12)
•	rs and doors draught st	rinned							0	(14)
Window infiltration	o and doors araugin of	прроц		0.25 - [0.2	x (14) ÷ 1	00] =			0	(15)
Infiltration rate				(8) + (10)	+ (11) + (1	2) + (13)	+ (15) =		0	(16)
Air permeability value,	, q50, expressed in cub	ic metre	s per ho	our per s	quare m	etre of e	envelope	area	5	(17)
If based on air permeabi	lity value, then $(18) = [(1$	7) ÷ 20]+(8	3), otherwi	ise (18) = (16)				0.4	(18)
	es if a pressurisation test has	s been don	e or a deg	gree air pe	meability	is being u	sed			_
Number of sides shelter	ed			(20) = 1 -	n 075 v (1	Q)1 —			3	(19)
Shelter factor Infiltration rate incorpora	ting chalter factor			(20) = 13 (21) = (18)		3)] =			0.78	(20)
Infiltration rate modified	•	1		(21) = (10)	X (20) =				0.31	(21)
Jan Feb	Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
Monthly average wind sp		l oan	Oui	₁ //ug	ОСР	000	1100	1 200		
(22)m= 5.1 5	4.9 4.4 4.3	3.8	3.8	3.7	4	4.3	4.5	4.7	1	
	1 1			1	· ·	I	1		J	
Wind Factor (22a)m = (2	'						1		1	
(22a)m= 1.27 1.25	1.23 1.1 1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		

Adjusted infiltr	ation rat	e (allowi	ng for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37]	
Calculate effe		•	rate for t	he appli	cable ca	se				!			
If mechanica			or disciplination	OL) (OO-			MEW - de -) (00-)			0	(23a
If exhaust air h) = (23a)			0	(23b
If balanced with		•	•	J		,		,				0	(23c
a) If balance	i				1	- 	, 	í `	, 		' ') ÷ 100] 1	(0.4 -
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24a
b) If balance						, 	, 	í `	r ´ `		1	1	(0.4)
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	J	(24b
c) If whole h if (22b)r					•		on from (c) = (22b		.5 × (23b	o)		_	
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(240
d) If natural if (22b)r				•			on from I 0.5 + [(2		0.5]			_	
(24d)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57]	(24d
Effective air	change	rate - er	nter (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)				_	
(25)m= 0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3. Heat losse	s and he	at loss r	naramete	⊃r·									
ELEMENT	Gros	•	Openin		Net Ar	ea	U-valı	ue	AXU		k-value	e.	ΑΧk
	area	_	m		A ,r		W/m2		(W/	K)	kJ/m²•	-	kJ/K
Windows Type	e 1				5.86	x1.	/[1/(1.4)+	0.04] =	7.77				(27)
Windows Type	e 2				1.73	x1.	/[1/(1.4)+	0.04] =	2.29	$\overline{}$			(27)
Windows Type	e 3				2.52	x1.	/[1/(1.4)+	0.04] =	3.34				(27)
Windows Type	e 4				2.52	x1,	/[1/(1.4)+	0.04] =	3.34				(27)
Floor					2.026	3 x	0.13	i	0.2633	<u></u>			(28)
Walls	34.7	' 4	12.6	3	22.11	x	0.18	╡┇	3.98	F i		-	(29)
Total area of e					36.77	, 							(31)
* for windows and			effective wi	ndow U-va			g formula 1	/[(1/U-valu	ıe)+0.04] a	as given in	paragrapl	h 3.2	,
** include the area				ls and pan	titions							•	
Fabric heat los		•	U)				(26)(30)) + (32) =				20.99	(33)
Heat capacity	,	,						((28)	(30) + (32	2) + (32a).	(32e) =	461.5	(34)
Thermal mass	•	•		•					tive Value			250	(35)
For design assess				construct	ion are no	t known pr	recisely the	e indicative	values of	TMP in T	able 1f		
Thermal bridge				usina Ac	pendix l	<						1.84	(36)
if details of therma	,	,			•							1.01	()
Total fabric he			, ,	·	,			(33) +	(36) =			22.83	(37)
Ventilation hea	at loss ca	alculated	l monthly	y				(38)m	= 0.33 × ((25)m x (5))		
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(38)m= 25.09	24.96	24.83	24.21	24.1	23.57	23.57	23.47	23.77	24.1	24.33	24.57]	(38)
•	coefficier	nt W/K						(39)m	= (37) + (38)m		-	
Heat transfer of		10, 00/10											
Heat transfer (39) m= 47.91	47.78	47.65	47.04	46.92	46.39	46.39	46.29	46.6	46.92	47.16	47.4]	

Heat loss para	meter (I	HLP), W/	m²K					(40)m	= (39)m ÷	- (4)			
(40)m= 0.95	0.95	0.94	0.93	0.93	0.92	0.92	0.92	0.92	0.93	0.93	0.94		
Ni wala an af day	:		l- 4-\					,	Average =	Sum(40) _{1.}	12 /12=	0.93	(40)
Number of day 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		ļ				
4. Water heat	ing ene	rgy requi	rement:								kWh/ye	ear:	
Assumed occu	inancv	N								1	.7		(42)
if TFA > 13.9 if TFA £ 13.9	9, N = 1		[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (TFA -13		.,		(42)
Annual averag	e hot wa										.69		(43)
Reduce the annua not more that 125							to achieve	a water us	se target o)†			
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in				<u></u>									
(44)m= 82.16	79.17	76.18	73.2	70.21	67.22	67.22	70.21	73.2	76.18	79.17	82.16		
_						_				m(44) ₁₁₂ =		896.28	(44)
Energy content of									· ·				
(45)m= 121.84	106.56	109.96	95.87	91.99	79.38	73.56	84.41	85.41	99.54	108.66	117.99	=	
If instantaneous w	ater heati	ng at point	of use (no	hot water	storage),	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	=	1175.16	(45)
(46)m= 18.28	15.98	16.49	14.38	13.8	11.91	11.03	12.66	12.81	14.93	16.3	17.7		(46)
Water storage	loss:												
Storage volum	e (litres)) includin	g any s	olar or W	/WHRS	storage	within sa	ame ves	sel		150		(47)
If community h	•			•			` '	\	(0) : ((A 7)			
Otherwise if no Water storage		not wate	er (unis ir	iciudes i	nstantar	ieous co	ווטט וטוווו	ers) ente	er o in ((47)			
a) If manufact		eclared l	oss facto	or is kno	wn (kWł	n/day):				1.	39		(48)
Temperature fa	actor fro	m Table	2b							0.	54		(49)
Energy lost fro		-	-				(48) x (49)) =		0.	75		(50)
b) If manufactHot water stora			-										(54)
If community h	-			e z (KVV	ii/iiiie/ua	iy <i>)</i>					0		(51)
Volume factor	_										0		(52)
Temperature fa	actor fro	m Table	2b								0		(53)
Energy lost fro		_	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) or (. , .	•								0.	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	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	/)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	•	•									0		(58)
Primary circuit				,	•	. ,	, ,		rthorns-	otot)			
(modified by (59)m= 23.26	21.01	23.26	22.51	23.26	22.51	23.26	ng and a	22.51	23.26	22.51	23.26		(59)
(33)111= 23.20	21.01	23.20	22.01	23.20	22.01	23.20	23.20	22.01	23.20	22.01	23.20		(00)

On male: James		f l-		(04)	(00) - 0	OF (44)	\						
Combi loss (61)m= 0	calculated	for each	montn ((61)m =	(60) ÷ 30	05 × (41))m 0	0	0	0	0	1	(61)
										ļ		(50) (04)	(01)
		156.56	140.96	138.58	124.47	n montn 120.15	(62)m =	130.51	(45)m +	(46)m + 153.75	(57)m + 164.59	(59)m + (61)m l	(62)
` ′													(02)
Solar DHW inp									r contribut	ion to wate	er neating)		
(63)m= 0	0	0	0	0	applies 0	, see Ap	0	0	0	0	0	1	(63)
			Ů	Ů								J	(00)
Output from (64)m= 168.4		156.56	140.96	138.58	124.47	120.15	131	130.51	146.14	153.75	164.59]	
. /		<u> </u>		<u> </u>		<u> </u>		<u>I</u> put from w	L ater heate	ļ		1723.78	(64)
Heat gains f	rom water	heating.	kWh/me	onth 0.2	5 ′ [0.85	× (45)m	+ (61)r	nl + 0.8 x	k [(46)m	+ (57)m	+ (59)m	1	_
(65)m= 77.79		73.84	67.95	67.86	62.47	61.73	65.34	64.47	70.37	72.2	76.51	ĺ	(65)
include (5	 7)m in cal	culation o	of (65)m	only if c	vlinder i	s in the o	dwellina	or hot w	rater is f	rom com	munity h	ı neating	
5. Internal			. ,		y		z					.oag	
Metabolic ga				,									
Jar		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 85.24	4 85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24	85.24		(66)
Lighting gair	ns (calcula	ted in Ap	pendix	L, equati	on L9 o	r L9a), a	lso see	Table 5				•	
(67)m= 13.24	4 11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.94	12.77	13.61		(67)
Appliances (gains (calc	ulated in	Append	dix L, eq	uation L	13 or L1	3a), als	see Ta	ble 5	•	•	•	
(68)m= 148.5	53 150.07	146.19	137.92	127.48	117.67	111.12	109.58	113.46	121.73	132.17	141.98		(68)
Cooking gai	ns (calcula	ated in A	ppendix	L, equat	ion L15	or L15a), also s	ee Table	5	•	•	•	
(69)m= 31.52	2 31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52	31.52		(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.	evaporation	n (nega	tive valu	es) (Tab	le 5)		•		•	•	•	•	
(71)m= -68.1	9 -68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19	-68.19		(71)
Water heatir	ng gains (1	rable 5)				•			•	•	•	•	
(72)m= 104.5	55 102.83	99.24	94.37	91.21	86.76	82.97	87.82	89.55	94.59	100.28	102.83]	(72)
Total intern	al gains =				(66))m + (67)m	n + (68)m	+ (69)m +	(70)m + (7	'1)m + (72))m	•	
(73)m= 317.9	9 316.24	306.57	291.11	275.68	260.57	250.6	255.39	263.2	278.83	296.79	310		(73)
6. Solar ga	ins:	•				•			•	•	•		
Solar gains ar	e calculated	using sola	r flux from	Table 6a	and assoc	iated equa	itions to c	onvert to th	ne applicat	ole orientat	tion.		
Orientation:			Area		Flu		-	g_ Fabla Ch	_	FF		Gains	
	Table 6d		m²		Tai	ble 6a	. —	Table 6b	_ '	able 6c		(W)	,
Northeast 0.9		X	1.7	73	x 1	1.28	х	0.63	x	0.7	=	5.97	(75)
Northeast 0.9		X	2.5	52	X 1	1.28	х	0.63	x	0.7	=	8.69	(75)
Northeast 0.9	<u> </u>	X	1.7	73	x 2	22.97	x	0.63	x	0.7	=	12.14	(75)
Northeast 0.9		X	2.5	52	x 2	22.97	х	0.63	x	0.7	=	17.69	(75)
Northeast 0.9	× 0.77	X	1.7	73	X 4	11.38	X	0.63	х	0.7	=	21.88	(75)

Northeast _{0.9x}	0.77	1 x	2.52	l x	44.20] _x	0.62	x	0.7	1 =	24.07	(75)
Northeast 0.9x	0.77	1	2.52]]	41.38]]	0.63] 1	31.87	=
Northeast 0.9x	0.77] X] _v	1.73	l x l v	67.96] X] v	0.63	X	0.7] =] _	35.93	(75) (75)
Northeast 0.9x	0.77	」 x] x	2.52	x x	67.96] x] x	0.63	X	0.7] =] =	52.34	(75)
Northeast 0.9x	0.77	1	1.73]]	91.35]]	0.63		0.7] 1	48.3	(75)
Northeast 0.9x	0.77	x x	2.52	l x l v	91.35] X] v	0.63	X	0.7] =] =	70.35	(75)
Northeast 0.9x	0.77	」^] ×	1.73	x x	97.38] x] x	0.63	X	0.7] =] =	51.49	(75)
Northeast 0.9x	0.77	」^] _×	1.73] ^] _x	97.38] ^] _x	0.63	X	0.7] -] =	75 48.17	(75)
Northeast 0.9x		」 ^] _×)]] ^] _x		X]]		(75)
Northeast 0.9x	0.77	」^] ×	2.52	x x	91.1] ^] x	0.63	X	0.7] =] =	70.16	(75)
Northeast 0.9x	0.77	」^] ×	1.73] ^] _x	72.63] ^] x	0.63	X] =	38.4	(75)
Northeast 0.9x	0.77	」^] ×	2.52] ^] x	72.63] ^] x	0.63	X	0.7] -] =	55.93	(75)
Northeast 0.9x	0.77	1	1.73]]	50.42]]	0.63		0.7] -] =	26.66	(75)
Northeast 0.9x	0.77] X] _v	2.52	l x l v	50.42] X] v	0.63	X	0.7] 1	38.83	(75)
Northeast 0.9x	0.77] X] ,,	1.73	l x	28.07	l x	0.63	X	0.7] =] _	14.84	╡゛゛
Northeast 0.9x	0.77] X] ,	2.52	l X l	28.07] X] ,	0.63	X	0.7] = 1 _	21.62	(75)
Northeast 0.9x	0.77] X]	1.73	X 	14.2] X]	0.63	X	0.7] =]	7.51	(75)
Northeast 0.9x	0.77] X]	2.52	X I	14.2] X]	0.63	X	0.7] =]	10.93	(75)
Northeast 0.9x	0.77] X]	1.73	X 1	9.21] X]	0.63	X	0.7] = 1	4.87	(75)
Southeast 0.9x	0.77] X]	2.52	X 1	9.21	X 1	0.63	X	0.7] = 1	7.1	(75)
Southeast 0.9x	0.54] X]	5.86	X I	36.79	X 1	0.63	X	0.7] = 1	46.21	(77)
Southeast 0.9x	0.77	X	2.52	l X	36.79	X	0.63	X	0.7] = 1	28.34	(77)
Southeast 0.9x	0.54	X	5.86	X	62.67	X	0.63	X	0.7] = 1	78.71	(77)
Southeast 0.9x	0.77] X]	2.52	X I	62.67	X 1	0.63	X	0.7] = 1	48.27	(77)
Southeast 0.9x	0.54	X	5.86	X	85.75	X	0.63	X	0.7] = 1	107.7	(77)
Southeast 0.9x	0.77	X	2.52	X	85.75	X	0.63	X	0.7] = 1	66.04	(77)
Southeast 0.9x	0.54] X]	5.86	X 	106.25	X 1	0.63	X	0.7] = 1	133.45	(77)
Southeast 0.9x	0.77	X	2.52	X	106.25	X	0.63	X	0.7] = 1	81.83	(77)
Southeast 0.9x	0.54] X]	5.86	X 1	119.01	X 1	0.63	X	0.7] = 1	149.47	(77)
Southeast 0.9x	0.77] X]	2.52	X 1	119.01	X 	0.63	X	0.7] = 1	91.66	(77)
Southeast 0.9x	0.54] X]	5.86	X	118.15	X]	0.63	Χ	0.7] = 1	148.39	(77)
Southeast 0.9x	0.77] X]	2.52	X 	118.15	X I	0.63	X	0.7] = 1	90.99	(77)
Southeast 0.9x	0.54] X]	5.86	X 	113.91] X]	0.63	X	0.7] = 1	143.06	(77)
Southeast 0.9x	0.77] X]	2.52	X 	113.91	X 	0.63	X	0.7] =]	87.73	(77)
Southeast 0.9x	0.54] X]	5.86	X 1	104.39	X 1	0.63	X	0.7] = 1	131.11	(77)
<u> </u>	0.77	X	2.52	X	104.39	X	0.63	X	0.7] = 1	80.4	(77)
Southeast 0.9x	0.54] X]	5.86	X 	92.85] X]	0.63	X	0.7] =]	116.62	(77)
Southeast 0.9x	0.77] X]	2.52	X 	92.85	X 	0.63	X	0.7] =]	71.51	(77)
<u> </u>	0.54] X]	5.86	X 1	69.27	X 1	0.63	Χ	0.7] = 1	87	(77)
Southeast o.gx	0.77] X]	2.52	X 1	69.27	X]	0.63	X	0.7] = 1	53.35	(77)
Southeast o.gx	0.54] X]	5.86	X I	44.07	X 1	0.63	X	0.7] = 1	55.35	(77)
Southeast _{0.9x}	0.77	X	2.52	X	44.07	X	0.63	X	0.7] =	33.94	(77)

Southeast 0.9x	0.54	х	5.8	36	x	3	1.49	х	0.63		х	0.7	=	39.55	(77)
Southeast _{0.9x}	0.77	×	2.5	52	x	3	1.49	х	0.63		×	0.7	_	24.25	(77)
ı								_			. L				
Solar gains in	watts, ca	alculated	I for eac	h month	ı			(83)m =	Sum(74)	m	(82)m				
(83)m= 89.2	156.81	227.49	303.54	359.77	$\overline{}$	55.87	349.12	305.8	4 253.6	52	176.8	107.73	75.77		(83)
Total gains – i	internal a	and solar	(84)m =	= (73)m	+ (8	33)m	, watts							l	
(84)m= 407.1	473.05	534.06	594.65	635.45	62	26.45	599.72	561.2	3 516.8	31	455.63	404.52	385.76		(84)
7. Mean inte	rnal temp	perature	(heating	season)				•	·					
Temperature						area f	rom Tab	ole 9,	Th1 (°C))				21	(85)
Utilisation fac	•	•			_				` ,						
Jan	Feb	Mar	Apr	May	r	Jun	Jul	Aug	Se	п	Oct	Nov	Dec		
(86)m= 0.99	0.98	0.94	0.84	0.66	+).47	0.34	0.38	0.61		0.88	0.98	0.99		(86)
` /	<u> </u>	<u> </u>							l		0.00	0.00	0.00		` '
Mean interna		1		· · ·	1									I	(07)
(87)m= 20.23	20.41	20.64	20.86	20.97		21	21	21	20.9	9	20.84	20.5	20.2		(87)
Temperature	during h	neating p	eriods ir	rest of	dwe	elling	from Ta	ble 9,	Th2 (°C	2)				<u>.</u>	
(88)m= 20.13	20.13	20.13	20.14	20.14	20	0.15	20.15	20.15	20.1	5	20.14	20.14	20.13		(88)
Utilisation fac	ctor for a	ains for i	rest of d	welling,	h2,ı	m (se	e Table	9a)							
(89)m= 0.99	0.97	0.92	0.8	0.61	1).41	0.27	0.31	0.54	ı	0.85	0.97	0.99		(89)
Moon intorno	l tompor	atura in i	the rest	of dwall	ina.	 T2 (f	ollow etc	nc 2 t	. 7 in T	—L abla	00)				
Mean interna (90)m= 19.12	19.37	19.69	19.99	20.12	Ť	0.15	20.15	20.15	1	-	19.97	19.51	19.08		(90)
13.12	15.57	13.03	13.33	20.12		0.10	20.10	20.10	20.1			g area ÷ (4	<u> </u>	0.51	(91)
												g aroa . (., –	0.51	(91)
Mean interna		<u> </u>			$\overline{}$			<u> </u>		_		,	,	İ	
(92)m= 19.69	19.9	20.17	20.43	20.55	<u> </u>	0.58	20.58	20.58			20.41	20.01	19.65		(92)
Apply adjusti	1	1		· ·	_					·	oriate			ı	
(93)m= 19.69	19.9	20.17	20.43	20.55	20	0.58	20.58	20.58	20.5	7	20.41	20.01	19.65		(93)
8. Space hea															
Set Ti to the			•		ned	at ste	ep 11 of	Table	9b, so t	that	Ti,m=(76)m an	d re-cald	culate	
the utilisation	Feb	Mar			Г	Jun	Jul	Λ	g Se		Oct	Nov	Dec		
Utilisation fac	I		Apr	May	<u> </u>	Juli	Jui	Au) Se	РΙ	OCI	NOV	Dec		
(94)m = 0.99	0.97	0.93	0.81	0.63	Ι ο).44	0.31	0.34	0.57	,	0.86	0.97	0.99		(94)
Useful gains	ļ						0.0.	0.0.	1 0.01		0.00	0.01	0.00		` '
(95)m= 401.45	1	494.18	484.35	403.4	27	76.3	184.66	193.4	5 296.4	14	392.36	391.9	381.64		(95)
Monthly aver									1						` ,
(96)m= 4.3	4.9	6.5	8.9	11.7	_	4.6	16.6	16.4	14.1		10.6	7.1	4.2		(96)
Heat loss rat															` ,
(97)m= 737.21	716.58	651.42	542.59	415.31	_	7.44	184.77	193.6		Ť	460.33	608.82	732.25		(97)
Space heating					<u> </u>							l .			, ,
(98)m= 249.8	173.57	116.98	41.94	8.86	T	0	0	0	0	Ť	50.57	156.18	260.86		
. ,	<u> </u>	<u> </u>			<u> </u>			T	ntal per ve) = Sum(9	8) _{1 59 12} =	1058.75	(98)
On the late of the			130/1-7	M					nai poi ye)	.vviii y oai) = G am(G	O /15,912 —		닠``
Space heatir	ng require	ement in	KVVh/m²	year										20.97	(99)
9a. Energy re		nts – Indi	vidual h	eating s	yste	ems ii	ncluding	micro	-CHP)						
Space heati	na:														
Fraction of s	•			, .			_							0	(201)

Fraction of space heat from main system(s)			(202) = 1 -	- (201) =				1	(202)
Fraction of total heating from main system 1			(204) = (20	02) x [1 –	(203)] =			1	(204)
Efficiency of main space heating system 1								93.5	(206)
Efficiency of secondary/supplementary heating s	system	, %						0	(208)
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space heating requirement (calculated above) 249.8 173.57 116.98 41.94 8.86	<u>, I</u>	0	0	0	F0 F7	156.10	260.96	1	
	0	0	0	0	50.57	156.18	260.86		(244)
$ (211)m = \{[(98)m \times (204)] \} \times 100 \div (206) $ $ 267.17 185.63 125.12 44.85 9.48 $	0	0	0	0	54.08	167.04	278.99]	(211)
	!		Tota	l (kWh/yea	ar) =Sum(2	L 211) _{15,1012}	<u> </u>	1132.36	(211)
Space heating fuel (secondary), kWh/month									
= {[(98)m x (201)] } x 100 ÷ (208)					,		•	1	
(215)m= 0 0 0 0 0	0	0	0	0	0	0	0		7
Materia			rota	i (kwn/yea	ar) =Sum(2	215) _{15,1012}	F	0	(215)
Water heating Output from water heater (calculated above)									
· · · · · · · · · · · · · · · · · · ·	24.47	120.15	131	130.51	146.14	153.75	164.59		
Efficiency of water heater								79.8	(216)
` '	79.8	79.8	79.8	79.8	82.3	84.86	86.04		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m									
` '	55.98	150.56	164.16	163.54	177.56	181.19	191.3	1	
(210)111-111-1111-1111-1111-1111-1111-111	33.30	130.30	104.10	103.54	177.50	101.19			
(210)1112 100:10 174:41 100:27 171:00 172:40 1	33.30	130.30		I = Sum(2		101.19	101.0	2085.41	(219)
Annual totals	33.30	130.30			19a) ₁₁₂ =	Wh/year	l	kWh/yea	
Annual totals Space heating fuel used, main system 1	33.30	130.30			19a) ₁₁₂ =	<u>I</u>	l		
Annual totals	33.30	130.30			19a) ₁₁₂ =	<u>I</u>	l	kWh/yea	
Annual totals Space heating fuel used, main system 1	33.30	130.30			19a) ₁₁₂ =	<u>I</u>	l	kWh/yea 1132.36	
Annual totals Space heating fuel used, main system 1 Water heating fuel used	30.30	130.30			19a) ₁₁₂ =	<u>I</u>	l	kWh/yea 1132.36	
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot	30.30	130.30			19a) ₁₁₂ =	<u>I</u>		kWh/yea 1132.36	(230c)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump:	30.30	130.30	Tota	I = Sum(2	19a) ₁₁₂ =	Wh/year	30	kWh/yea 1132.36	(230c)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue	30.30	130.30	Tota	I = Sum(2	19a) ₁₁₂ = k 1	Wh/year	30	kWh/yea 1132.36 2085.41	(230c) (230e)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year			Tota	I = Sum(2:	19a) ₁₁₂ = k 1	Wh/year	30	kWh/yea 1132.36 2085.41	(230c) (230e) (231)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting	ns inclu	ding mi	Tota	I = Sum(2:	19a) ₁₁₂ = k 1	Wh/year	30 45	kWh/yea 1132.36 2085.41 75 233.85	(230c) (230e) (231) (232)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting	ns inclu		Tota	I = Sum(2:	19a) ₁₁₂ = k 1	Wh/year	30 45	kWh/yea 1132.36 2085.41	(230c) (230e) (231) (232)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting	ns inclu	iding mid ergy h/year	Tota	I = Sum(2:	19a) ₁₁₂ = k¹(230g) =	ion fac	30 45	kWh/yea 1132.36 2085.41 75 233.85	(230c) (230e) (231) (232)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 12a. CO2 emissions – Individual heating systems	ns inclu End kW	ergy h/year	Tota	I = Sum(2:	19a) ₁₁₂ = k¹(230g) =	ion fac 2/kWh	30 45 tor	kWh/yea 1132.36 2085.41 75 233.85 Emissions kg CO2/ye	(230c) (230e) (231) (232)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 12a. CO2 emissions — Individual heating system Space heating (main system 1) Space heating (secondary)	es inclu End kW (211	ergy h/year) ×	Tota	I = Sum(2:	19a) ₁₁₂ = k1(230g) = Emiss kg CO: 0.2	ion fac 2/kWh	30 45 tor	kWh/yea 1132.36 2085.41 75 233.85 Emissions kg CO2/ye 244.59 0	(230c) (230e) (231) (232) (232) (261) (263)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 12a. CO2 emissions — Individual heating system Space heating (main system 1) Space heating (secondary) Water heating	Ene kW (211 (215 (219	ergy h/year) ×) ×	Tota	I = Sum(2:	19a) ₁₁₂ = k1(230g) = Emiss kg CO:	ion fac 2/kWh	30 45 tor =	kWh/yea 1132.36 2085.41 75 233.85 Emissions kg CO2/ye 244.59 0 450.45	(230c) (230e) (231) (232) (232) (261) (263) (264)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating Space and water heating	End kW (211 (215 (219 (261	ergy h/year) x) x) x) + (262)	sum	I = Sum(2:	19a) ₁₁₂ = k1 (230g) = Emiss kg CO: 0.2 0.5	ion fac 2/kWh	30 45 tor = =	kWh/yea 1132.36 2085.41 75 233.85 Emissions kg CO2/ye 244.59 0 450.45 695.04	(230c) (230e) (231) (232) (232) (261) (263) (264) (265)
Annual totals Space heating fuel used, main system 1 Water heating fuel used Electricity for pumps, fans and electric keep-hot central heating pump: boiler with a fan-assisted flue Total electricity for the above, kWh/year Electricity for lighting 12a. CO2 emissions — Individual heating system Space heating (main system 1) Space heating (secondary) Water heating	Ene kW (211 (215 (219	ergy h/year) x) x) + (262) -	sum	I = Sum(2:	19a) ₁₁₂ = k1(230g) = Emiss kg CO: 0.2	ion fac 2/kWh 16 19	30 45 tor =	kWh/yea 1132.36 2085.41 75 233.85 Emissions kg CO2/ye 244.59 0 450.45	(230c) (230e) (231) (232) (232) (261) (263) (264)

Total CO2, kg/year sum of (265)...(271) = 855.33 (272)

 $TER = 16.94 \tag{273}$