Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.41 *Printed on 09 June 2021 at 10:01:40*

Project Information:

Assessed By: Ben Tunningley (STRO027495) Building Type: Detached House

Dwelling Details:

NEW DWELLING AS BUILT

Site Reference: Albany Farm

Total Floor Area: 74.1m²

Plot Reference: Plot 036

Address: 23 Buttercup Road, Bishops Waltham, SOUTHAMPTON, SO32 1RF

Client Details:

Name: Bargate Homes

Address: The New Barn, Vicarage Farm Business Par, Winchester Road, Fair Oak, SO50 7HD

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

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 19.94 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.44 kg/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 57.2 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 50.5 kWh/m²

OK

2 Fabric U-values

Element Highest Average External wall 0.24 (max. 0.30) 0.24 (max. 0.70) OK Floor 0.11 (max. 0.25) 0.11 (max. 0.70) **OK** Roof 0.11 (max. 0.20) 0.11 (max. 0.35) OK **Openings** 1.40 (max. 2.00) 1.40 (max. 3.30) OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 4.59
Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Database: (rev 478, product index 017929):

Boiler systems with radiators or underfloor heating - mains gas

Brand name: Ideal Model: LOGIC COMBI Model qualifier: ESP1 35

(Combi)

Efficiency 89.6 % SEDBUK2009

Minimum 88.0 %

Secondary heating system: None

OK

Regulations Compliance Report

Cylinder insulation			
Hot water Storage:	No cylinder		
6 Controls			
Space heating controls	Programmer, room therm	ostat and TRVs	ОК
Hot water controls:	No cylinder thermostat		
	No cylinder		
Boiler interlock:	Yes		OK
7 Low energy lights			
Percentage of fixed lights wi	th low-energy fittings	100.0%	
Minimum		75.0%	OK
8 Mechanical ventilation			
Continuous extract system (decentralised)		
Specific fan power:	,	0.16 0.18	
Maximum		0.7	OK
Summertime temperature			
Overheating risk (South Eng	land):	Slight	ОК
ased on:		-	
Overshading:		Very Little	
Windows facing: North West		3.06m ²	
Windows facing: South East		6.51m²	
Ventilation rate:		4.00	
Blinds/curtains:		None	
10 Key features		2.22.11/	
Thermal bridging		0.035 W/m²K	
Roofs U-value		0.11 W/m²K	
Floors U-value		0.11 W/m²K	
Photovoltaic array			

		User Details:		
Assessor Name:	Ben Tunningley	Stroma Nur	nber: STR	O027495
Software Name:	Stroma FSAP 2012	Software Ve	ersion: Vers	ion: 1.0.5.41
	Pro	operty Address: Plot 0	36	
Address :	23 Buttercup Road , Bishops	Waltham, SOUTHAM	PTON , SO32 1RF	
1. Overall dwelling dime	ensions:			
		Area(m²)	Av. Height(m)	Volume(m³)
Ground floor		37.05 (1a) x	2.4 (2a) =	88.92 (3a)
First floor		37.05 (1b) x	2.67 (2b) =	98.92 (3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1n)	74.1 (4)		
Dwelling volume		(3a)+(3	(3c)+(3c)+(3d)+(3e)+(3n) =	187.84 (5)
2. Ventilation rate:				
	main secondary heating heating	other	total	m³ per hour
Number of chimneys	0 + 0	+ 0 =	0 x 40 =	0 (6a)
Number of open flues	0 + 0	+ 0 =	0 x 20 =	0 (6b)
Number of intermittent fa	ns		0 x 10 =	0 (7a)
Number of passive vents			0 x 10 =	0 (7b)
Number of flueless gas fi	res		0 x 40 =	0 (7c)
				changes per hour
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7a	u)+(7b)+(7c) =		
•	peen carried out or is intended, proceed		0	0 (8)
Number of storeys in the				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0	.25 for steel or timber frame or 0	0.35 for masonry cons	truction	0 (11)
if both types of wall are po deducting areas of openir	resent, use the value corresponding to t nas): if eaual user 0.35	the greater wall area (after		
=	floor, enter 0.2 (unsealed) or 0.1	(sealed), else enter ()	0 (12)
If no draught lobby, en	ter 0.05, else enter 0			0 (13)
Percentage of windows	s and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷	100] =	0 (15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	0 (16)
Air permeability value,	q50, expressed in cubic metres	per hour per square i	metre of envelope area	4.59000015258789 (17)
If based on air permeabil	ity value, then $(18) = [(17) \div 20] + (8)$, otherwise (18) = (16)		0.23 (18)
	es if a pressurisation test has been done	e or a degree air permeabilit	y is being used	
Number of sides sheltere	ed	(20) – 1 [0.075 v	/40\1	2 (19)
Shelter factor	Para al alter factor	(20) = 1 - [0.075 x]		0.85 (20)
Infiltration rate incorporat		$(21) = (18) \times (20) =$	=	0.2 (21)
Infiltration rate modified f		,, , , , , , ,		
Jan Feb	Mar Apr May Jun	Jul Aug Sep	Oct Nov Dec	
Monthly average wind sp	eed from Table 7			_

4.9

4.4

4.3

3.8

3.8

3.7

4.3

4.5

4.7

5

Wind Factor (2	22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
Adjusted infiltr	ration 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	0.19	0.19	0.18	0.2	0.21	0.22	0.23]	
Calculate effe		_	rate for t	he appli	cable ca	se		•			•	<u>-</u>	
If mechanical If exhaust air h			andiv N (2	3h) - (23a	a) v Emy (4	aguation (N5N othe	arwica (23h	n) – (23a)			0.5	(23a)
If balanced with		0		, ,	,	. `	,, .	,)) = (23a)			0.5	(23b)
a) If balance		-	•	_					2h\m + (23h) v [1 _ (23c	0) ÷ 1001	(23c)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	$\frac{1 - (230)}{0}$) - 100]]	(24a)
b) If balance					heat red	covery (I	MV) (24t	n)m = (2)		23b)	1	_	,
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24b)
c) If whole h	nouse ex	tract ver	ntilation c	or positiv	e input	ventilatio	on from (utside		<u> </u>	1	J	
	m < 0.5 ×			-	-				.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		(24c)
d) If natural												_	
<u> </u>	m = 1, the	<u> </u>	<u> </u>		· `			- 			-	7	(0.4-1)
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air			<u> </u>	` `	´``	ŕ `		- ` 	1 05		1 05	7	(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												
	o and ne	eat loss p	paramete	er:									
ELEMENT	Gros area	SS	oaramete Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/		k-valu kJ/m²·		A X k kJ/K
ELEMENT Doors	Gros	SS	Openin	gs									
	Gros area	SS	Openin	gs	A ,r	m² x	W/m2	2K =	(W/				kJ/K
Doors	Gros area e 1	SS	Openin	gs	A ,r	m² x x1	W/m2	2K = = + 0.04] =	(W/ 2.94				kJ/K (26)
Doors Windows Type	Gros area e 1	SS	Openin	gs	A ,r 2.1 3.06	m² x x1 x1	W/m2 1.4 /[1/(1.4)+	2K = = + 0.04] =	(W/ 2.94 4.06	K)		K	kJ/K (26) (27)
Doors Windows Type	Gros area e 1	ss (m²)	Openin	gs ²	A ,r 2.1 3.06 6.51	m ²	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+	2K = + 0.04] = + 0.04] = =	(W/ 2.94 4.06 8.63	K)	kJ/m²-	K 27	kJ/K (26) (27) (27)
Doors Windows Type Windows Type Floor	Gros area e 1 e 2	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.09	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+	2K = + 0.04] = + 0.04] = =	(W/ 2.94 4.06 8.63 4.0755	K)	kJ/m²-	K 27	kJ/K (26) (27) (27) (27) (28)
Doors Windows Type Windows Type Floor Walls	Gros area e 1 e 2 127.	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.09 115.8	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24	2K = + 0.04] = + 0.04] = = = =	(W/ 2.94 4.06 8.63 4.0755 27.79	K)	kJ/m²-	K 27	kJ/K (26) (27) (27) (28) (29)
Doors Windows Type Windows Type Floor Walls Roof	Gros area e 1 e 2 127. 37.0 elements	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.09 115.8	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24	2K = + 0.04] = + 0.04] = = = =	(W/ 2.94 4.06 8.63 4.0755 27.79	K)	kJ/m²-	K 27 6 3	kJ/K (26) (27) (27) (27) (28) (29) (33.45 (30)
Doors Windows Type Windows Type Floor Walls Roof Total area of e	Gros area e 1 e 2 127. 37.0 elements	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.05 115.8 37.05	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24	2K = + 0.04] = + 0.04] = = = =	(W/ 2.94 4.06 8.63 4.0755 27.79	K)	kJ/m²- 75 60 9	K 27 6 3	kJ/K (26) (27) (27) (778.75 (28) 948.6 (29) 33.45 (30) (31)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall **	Gros area e 1 e 2 127. 37.0 elements	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.06 115.8 37.06 201.5	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24	2K = + 0.04] = + 0.04] = = = =	(W/ 2.94 4.06 8.63 4.0755 27.79	K)	kJ/m²- 75 60 9	6 3 53	kJ/K (26) (27) (27) (78.75) (28) 948.6 (29) 33.45 (30) (31) (39.136) (32c)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall ** Internal wall **	Gros area e 1 e 2 127. 37.0 elements	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.09 115.8 37.09 201.5 59.9 90.09	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24	2K = + 0.04] = + 0.04] = = = =	(W/ 2.94 4.06 8.63 4.0755 27.79	K)	75 60 9 9	EX 27 6 3 3 53 811 6	kJ/K (26) (27) (27) (778.75 (28) 948.6 (29) 33.45 (30) (31) 39.136 (32c) 0.7722 (32c)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall ** Internal wall **	Gros area e 1 e 2 127. 37.0 elements	48 05 , m ²	Openin m	gs 2 7 Indow U-va	A ,r 2.1 3.06 6.51 37.06 115.8 37.06 201.5 59.9 90.06 37.06 37.06 alue calcul	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24 0.11	2K = + 0.04] = + 0.04] = = = = =	(W/ 2.94 4.06 8.63 4.0755 27.79 4.08	K)	kJ/m ² - 75 60 9 9 18 9	K 27 6 3 81 6 3	kJ/K (26) (27) (27) (27) (278.75) (28) (948.6) (29) (33.45) (30) (31) (39.136) (32c) (0.7722) (32c) (366.9) (32d)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall ** Internal floor Internal ceiling * for windows and	Gros area e 1 e 2 127. 37.0 elements * * droof windas on both	48 05 05, m ² ows, use e	Openin m 11.67	gs 2 7 Indow U-va	A ,r 2.1 3.06 6.51 37.06 115.8 37.06 201.5 59.9 90.06 37.06 37.06 alue calcul	x1 x1 x1 x x1 x x x x x x x x x x x x x	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24 0.11	2K =	(W/ 2.94 4.06 8.63 4.0755 27.79 4.08	K)	kJ/m ² - 75 60 9 9 18 9	K 27 6 3 81 6 3	kJ/K (26) (27) (27) (78.75) (28) 948.6 (29) 33.45 (30) (31) 39.136 (32c) 0.7722 (32c) 666.9 (32d) 33.45 (32e)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall ** Internal floor Internal ceiling * for windows and ** include the area	Gros area e 1 e 2 127. 37.0 elements * * droof windas on both ss, W/K:	ows, use e sides of in= S (A x	Openin m 11.67	gs 2 7 Indow U-va	A ,r 2.1 3.06 6.51 37.06 115.8 37.06 201.5 59.9 90.06 37.06 37.06 alue calcul	x1 x1 x1 x x1 x x x x x x x x x x x x x	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24 0.11	2K =	(W/ 2.94 4.06 8.63 4.0755 27.79 4.08	K)	4J/m ² - 75 60 9 9 18 9 n paragrapa	6 3 53 810 6 3 h 3.2	kJ/K (26) (27) (27) (278.75 (28) 948.6 (29) 33.45 (30) (31) 39.136 (32c) 0.7722 (32c) 666.9 (32d) 33.45 (32e)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall ** Internal floor Internal ceiling * for windows and ** include the area Fabric heat los	Gros area e 1 e 2 127. 37.0 elements * * d roof winde as on both ss, W/K: Cm = S(ows, use e sides of in S (A x k)	Openin m 11.67 0 effective winternal wall U)	gs 7 7 Indow U-vals and part	A ,r 2.1 3.06 6.51 37.05 115.8 37.05 201.5 59.9 90.09 37.05 37.05 alue calculatitions	m ² x1 x1 5 x 1 x 5 x 8 S contact dusing	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24 0.11	2K = + 0.04 = + 0.04 = = = = = = =	(W/ 2.94 4.06 8.63 4.0755 27.79 4.08	K)	4J/m ² - 75 60 9 9 18 9 n paragrapa	53 81 81 3 h 3.2	kJ/K (26) (27) (27) (27) (27) (28) (29) (33.45 (30) (31) (31) (39.136 (32c) (32c) (366.9 (32d) (33) (33) (33) (34)

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can be used instead of a detailed calculation.

Th a 2200	بملمئة مالم	C /I	\/\ aal	المواودة	ai.a. A.a	ا بناممم	,					Г		(os)
	_	•	,		using Ap = <i>0.05 x (</i> 3	•	^						7	(36)
	abric he		are not no	10W11 (00) -	- 0.00 x (0	')			(33) +	(36) =			58.57	(37)
Ventila	ation hea	at loss ca	alculated	d monthl	y				(38)m	= 0.33 × ((25)m x (5)	L		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	30.99	30.99	30.99	30.99	30.99	30.99	30.99	30.99	30.99	30.99	30.99	30.99		(38)
Heat to	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	89.56	89.56	89.56	89.56	89.56	89.56	89.56	89.56	89.56	89.56	89.56	89.56		
Heat lo	oss para	meter (H	HLP), W	/m²K						Average = = (39)m ÷	Sum(39) _{1.} - (4)	12 /12=	89.56	(39)
(40)m=	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21		
Numbe	er of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁ .	12 /12=	1.21	(40)
	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. Wa	ater heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
		_												
	ned occu A > 13.9			: [1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0)013 x (⁻	TFA -13		34		(42)
	A £ 13.9				(0.000	(11		,_,,	(,			
								(25 x N)		(.81		(43)
		_			ə% ii irie d /ater use, l	_	_	to achieve	a water us	se largel d)(
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat					Vd,m = fa						1101			
(44)m=	98.79	95.2	91.6	88.01	84.42	80.83	80.83	84.42	88.01	91.6	95.2	98.79		
											ım(44) ₁₁₂ =		1077.7	(44)
Energy	content of	hot water	used - cal	culated m	onthly = 4 .	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	146.5	128.13	132.22	115.27	110.61	95.45	88.44	101.49	102.7	119.69	130.65	141.88		_
lf instan	itaneous w	ater heati	na at noint	t of use (no	n hot water	r storage)	enter () in	boxes (46)		Total = Su	ım(45) ₁₁₂ =	- [1413.04	(45)
	21.98	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.41	17.95	19.6	21.28		(46)
(46)m= Water	storage		19.03	17.29	16.59	14.32	13.27	13.22	13.41	17.95	19.6	21.20		(40)
	•		includir	ng any s	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	munity h	eating a	nd no ta	ank in dw	velling, e	nter 110	litres in	(47)						
			hot wate	er (this ir	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
	storage					(1.14/1	/ I \					1		
					or is kno	wn (kvvr	n/day):					0		(48)
•	erature f							(10)				0		(49)
	•		-	e, kWh/ye cylinder	ear loss fact	or is not		(48) x (49)	=			0		(50)
•				•	le 2 (kW							0		(51)
If com	munity h	eating s	ee secti		•									
	e factor										(0		(52)
Tempe	erature f	actor fro	m Tabla											
	Jiataio i	actor no	III Table	2b							(0		(53)

٠,			•	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
Enter ((50) or (54) in (5	55)									0		(55)
Water s	storage	loss cal	culated f	for each	month			((56)m = (55) × (41)ı	m			_	
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder	r 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	lix H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)
Primary	/ circuit	loss (ar	nual) fro	m Table	e 3							0]	(58)
Primary	circuit /	loss cal	culated	for each	month (59)m = 0	(58) ÷ 36	65 × (41)	m					
(mod	lified by	factor f	rom Tab	le H5 if t	here is s	solar wat	ter heati	ng and a	cylinde	r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi l	loss cal	culated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m						
(61)m=	13.76	12.43	13.76	13.31	13.76	13.31	13.76	13.76	13.31	13.76	13.31	13.76		(61)
Total he	eat requ	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	160.26	140.56	145.98	128.59	124.36	108.76	102.2	115.25	116.02	133.45	143.96	155.64		(62)
Solar DH	IW input o	alculated	using App	endix G oı	r Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contribut	ion to wate	er heating)	•	
(add ad	dditional	lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (€)					
(63)m=	0	0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output	from wa	ater hea	ter											
(64)m=	160.26	140.56	145.98	128.59	124.36	108.76	102.2	115.25	116.02	133.45	143.96	155.64		
			-	-	-	-	-	Outp	out from wa	ater heate	r (annual)₁	12	1575.01	(64)
Heat ga	ains fror	n water	heating,	kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	((46)m	+ (57)m	+ (59)m]	
(65)m=	52.15	45.71	47.4	41.66	40.22	35.06	32.85	37.18	37.48	43.24	46.77	50.61		(65)
includ	de (57)r	n in cald	culation of	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	- neating	
5. Inte	ernal ga	ins (see	Table 5	and 5a):									
Metabo	olic gain	s (Table	5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec]	
(66)m=	140.48	140.48	140.48	140.48	140.48	140.48	140.48	140.48	140.48	140.48	140.48	140.48		(66)
Lighting	g gains	(calcula	ted in Ap	pendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5	!		!	•	
(67)m=	48.32	42.92	34.91	26.43	19.75	16.68	18.02	23.42	31.44	39.92	46.59	49.67]	(67)
Applian	nces gai	ns (calc	ulated ir	Append	dix L, eq	uation L	13 or L1	3a), alsc	see Ta	ble 5		•	•	
(68)m=	308.46	311.67	303.6	286.43	264.75	244.38	230.77	227.57	235.63	252.8	274.48	294.85]	(68)
Cooking	g gains	(calcula	ted in A	ppendix	L, equat	tion L15	or L15a), also se	ee Table	5	Į.	l.	1	
(69)m=	51.39	51.39	51.39	51.39	51.39	51.39	51.39	51.39	51.39	51.39	51.39	51.39		(69)
Pumps	and far	ns gains	(Table 5	Ба)	l		l	l		l		l	•	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	e.g. ev	aporatio	n (nega	tive valu	es) (Tab	le 5)							1	
(71)m=	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66		(71)
Water h	neatina	gains (T	able 5)		I		I	I	<u> </u>	I	<u> </u>	I .	1	
(72)m=	70.1	68.02	63.71	57.86	54.05	48.7	44.15	49.98	52.05	58.11	64.96	68.03		(72)
		gains =	<u> </u>	I .	I	<u> </u>	<u> </u>	1 + (68)m +		<u> </u>		<u> </u>	ı	
г			r	471.93	439.78	410.97	394.16	402.19	420.34	452.06	487.25	513.77]	(73)
(73)m =	528.1	523.83	503.44	471.93	433.70	410.31								

6. Solar gains:													
Solar gains are cald	culated using sol	ar flux fr	om Table 6	a and	d associ	ated equa	itions	to convert to th	ne appli	cable orienta	tion.		
Orientation: Acc	cess Factor ble 6d		ea 1²		Flu Tal	x ole 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	1 7	x	6.51	×	3	6.79	x	0.45	x	1.11	=	107.79	(77)
Southeast 0.9x	1 2	x =	6.51	×	6	2.67	x	0.45	×	1.11	=	183.6	(77)
Southeast 0.9x	1 7	x =	6.51	×	8	5.75	x	0.45	×	1.11	=	251.21	(77)
Southeast 0.9x	1 7	x =	6.51	×	10	06.25	x	0.45	x	1.11		311.26	(77)
Southeast 0.9x	1 7	x	6.51	x	1	19.01	x	0.45	x	1.11	=	348.64	(77)
Southeast 0.9x	1 7	x	6.51	x	1	18.15	x	0.45	x	1.11	=	346.12	(77)
Southeast 0.9x	1	x	6.51	x	1	13.91	x	0.45	x	1.11	=	333.7	(77)
Southeast 0.9x	1	x	6.51	x	10	04.39	x	0.45	x	1.11	=	305.81	(77)
Southeast 0.9x	1	x	6.51	X	9	2.85	x	0.45	x	1.11	=	272.01	(77)
Southeast 0.9x	1	х	6.51	X	6	9.27	x	0.45	x	1.11	=	202.92	(77)
Southeast 0.9x	1	x	6.51	X	4	4.07	x	0.45	x	1.11	=	129.1	(77)
Southeast 0.9x	1	x	6.51	X	3	1.49	x	0.45	X	1.11	=	92.24	(77)
Northwest _{0.9x}	1	х	3.06	X	1	1.28	x	0.45	x	1.11	=	15.54	(81)
Northwest _{0.9x}	1	x	3.06	X	2	2.97	x	0.45	X	1.11	=	31.63	(81)
Northwest 0.9x	1	x	3.06	X	4	1.38	X	0.45	X	1.11	=	56.98	(81)
Northwest 0.9x	1	x	3.06	X	6	7.96	x	0.45	X	1.11	=	93.58	(81)
Northwest 0.9x	1	X	3.06	X	9	1.35	X	0.45	X	1.11	=	125.78	(81)
Northwest 0.9x	1	x	3.06	X	9	7.38	x	0.45	X	1.11	=	134.1	(81)
Northwest 0.9x	1	x	3.06	×	(91.1	x	0.45	X	1.11	=	125.45	(81)
Northwest _{0.9x}	1	x	3.06	X	7	2.63	x	0.45	X	1.11	=	100.01	(81)
Northwest _{0.9x}	1	x	3.06	X	5	0.42	X	0.45	X	1.11	=	69.43	(81)
Northwest 0.9x	1	x	3.06	X	2	8.07	x	0.45	x	1.11	=	38.65	(81)
Northwest _{0.9x}	1 7	x	3.06	x		14.2	X	0.45	x	1.11	=	19.55	(81)
Northwest _{0.9x}	1	x	3.06	X	(9.21	×	0.45	X	1.11	=	12.69	(81)
Solar gains in wa	atte calculate	d for o	ach man	th			(83)m	n = Sum(74)m .	(82\n	1			
1	215.23 308.19				180.22	459.14	405		241.5	T T	104.93		(83)
Total gains – inte	ernal and sola	ar (84)r	n = (73)r	n + ((83)m	, watts	<u>!</u>	<u> </u>	<u> </u>	_!	<u> </u>		
(84)m= 651.43 7	739.05 811.63	876.7	7 914.2	2 8	391.19	853.3	808	.01 761.78	693.6	62 635.9	618.7		(84)
7. Mean interna	l temperature	e (heat	ng seaso	on)									
Temperature du	uring heating	period	s in the li	ving	area t	from Tal	ole 9	, Th1 (°C)				21	(85)
Utilisation factor	r for gains for	living	area, h1,	m (s	see Ta	ble 9a)							
Jan	Feb Mar	Ap	r Ma	у	Jun	Jul	Α	ug Sep	Oc	t Nov	Dec		
(86)m= 0.97	0.95 0.92	0.86	0.74		0.59	0.45	0.4	19 0.69	0.88	0.95	0.97		(86)
Mean internal to	emperature ir	n living	area T1	(follo	ow ste	ps 3 to 7	in T	able 9c)					
	19.75 20.07	20.4		`	20.92	20.98	20.		20.4	6 19.92	19.48		(87)
Temperature du	uring heating	period	s in rest o	of dv	velling	from Ta	able 9	9, Th2 (°C)				_	
(88)m= 19.91	19.91 19.91	19.9	1 19.91		19.91	19.91	19.	91 19.91	19.9	1 19.91	19.91		(88)

l Itilisa	ation fac	tor for a	ains for I	rest of di	welling, I	n2 m (se	e Table	9a)						
(89)m=	0.96	0.94	0.9	0.82	0.69	0.51	0.34	0.38	0.62	0.85	0.94	0.97		(89)
` ′ [<u> </u>		7 in Tabl	<u> </u>		0.0.		, ,
(90)m=	18.61	18.82	19.12	19.47	19.74	19.87	19.91	19.9	19.83	19.5	18.99	18.55		(90)
` ′ [l f	L LA = Livin	g area ÷ (4	4) =	0.2	(91)
Moon	intornal	tompor	atura (fo	r tho wh	ole dwel	ling) – fl	ΙΛ ν Τ1	ı (1 fl	۸) ب T2					
(92)m=	18.8	19.01	19.32	19.67	19.94	20.08	20.12	20.12	20.04	19.69	19.18	18.74		(92)
L									ere appro		100			(-)
(93)m=	18.65	18.86	19.17	19.52	19.79	19.93	19.97	19.97	19.89	19.54	19.03	18.59		(93)
8. Spa	ace hea	ting requ	uirement											
			ernal ter			ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
บtilisa	tion fac	tor for g	umains, hm		,		<u> </u>		'	<u>I</u>	<u> </u>	ļ.		
(94)m=	0.95	0.93	0.89	0.81	0.68	0.51	0.35	0.39	0.61	0.83	0.93	0.96		(94)
Usefu	l gains,	hmGm	, W = (9 ²	4)m x (84	4)m									
(95)m=	621.62	688.08	722.28	711.49	624.32	452.32	297.38	312.53	467.5	578.07	591.25	594.35		(95)
Month	nly avera	age exte	rnal tem	perature	from Ta	able 8				1				
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
r							-``		– (96)m					(07)
` ′ L			1134.39		724.66	477.8	302.24	319.72	518.14	800.91	1068.2	1288.63		(97)
Space (98)m=	493.78	g require 377.78	306.61	r each n 172.29	74.65	vn/mon	$\ln = 0.02$	24 X [(97))m – (95 ₀	165.8	343.41	516.54		
(90)111=	493.70	377.70	300.01	172.23	74.00	U		<u> </u>	l per year	<u> </u>	<u> </u>	<u> </u>	2450.86	(98)
Space	hoatin	a requir	ement in	k\\/h/m2	!/voar			Tota	ii pei yeai	(KVVII/yeai) = Sum(9	O)15,912 —		(99)
·		• •			•								33.08	
			its – Indi	vidual h	eating sy	/stems i	ncluding	micro-C	CHP)					
•	e heatir on of sp	_	nt from so	econdar	y/supple	mentarv	svstem						0	(201)
			at from m			,	•	(202) = 1 -	- (201) =				1	(202)
			ng from	•	` '				02) × [1 –	(203)1 =			1	(204)
			ace heat	,				(=0 :) (=	o=)[.	(200)]				(206)
	•	•					. 0/						90.5	╡```
Eilicie					y heating	-	·						0	(208)
Space	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ear
Space [493.78	377.78	306.61	172.29	d above) 74.65	0	0	0	0	165.8	343.41	516.54		
(044)						U		U	U	103.0	343.41	310.34		(0.1.1)
(211)m]	545.62)m x (20 417.44	4)] } x 1	00 ÷ (20 190.38	82.48	0	0	0	0	183.2	379.46	570.77		(211)
ļ	545.62	417.44	336.79	190.36	02.40	U			l (kWh/yea				2700.44	7(211)
O	s base"	a. f = 1 /	- اد - م م	A LAKE A	ma a 41-			iola	i (KVVII/yed	<i>ai j</i> =0uiii(2	- · · / _{15,1012}	-	2708.14	(211)
•		• '	econdar 00 ÷ (20		month									
- \[(30) (215)m=		0	00 + (20	0	0	0	0	0	0	0	0	0		
` ′ [<u> </u>		l (kWh/yea				0	(215)
											.,.			

Water heating										
Output from water heater (calculate		100.70	400.0	145.05	14000	100.45	140.00	1.55.01	1	
160.26 140.56 145.98 128 Efficiency of water heater	3.59 124.36	108.76	102.2	115.25	116.02	133.45	143.96	155.64	07.2	(216)
(217)m= 89.69 89.61 89.44 89	9.1 88.47	87.3	87.3	87.3	87.3	89.04	89.53	89.74	87.3	(217)
Fuel for water heating, kWh/month	l l								l	, ,
(219) m = (64) m x $100 \div (217)$ m		404.50	447.07	122.04	122.00	440.07	400.0	470.40	1	
(219)m= 178.67 156.86 163.21 144	4.31 140.57	124.58	117.07	132.01 Tota	132.89 Il = Sum(2	149.87	160.8	173.43	1774.26	(219)
Annual totals					•		Wh/year	r	kWh/year	
Space heating fuel used, main syst	tem 1						·		2708.14	
Water heating fuel used									1774.26	
Electricity for pumps, fans and elec	ctric keep-ho	t								
mechanical ventilation - balanced	, extract or p	ositive ir	nput fror	n outside	Э			49.6		(230a)
central heating pump:								30]	(230c)
boiler with a fan-assisted flue								45		(230e)
Total electricity for the above, kWh	/year			sum	of (230a).	(230g) =			124.6	(231)
Electricity for lighting									341.37	(232)
Electricity generated by PVs									-481.92	(233)
Total delivered energy for all uses	(211)(221)	+ (231)	+ (232).	(237b)	=				4466.45	(338)
										_
10a. Fuel costs - individual heatin	g systems:									
10a. Fuel costs - individual heatin	g systems:	Fu	el			Fuel P	rice		Fuel Cost	
10a. Fuel costs - individual heatin	g systems:		el /h/year			Fuel P (Table			Fuel Cost £/year	
10a. Fuel costs - individual heatin Space heating - main system 1	g systems:	kW	-				12)	x 0.01 =		(240)
	g systems:	kW (211	/h/year			(Table	12)	x 0.01 = x 0.01 =	£/year	(240) (241)
Space heating - main system 1	g systems:	kW (211 (213	/h/year			(Table	12)		£/year 94.24	
Space heating - main system 1 Space heating - main system 2	g systems:	kW (211 (213	/h/year 1) x 3) x 5) x			(Table 3.4	12) 8	x 0.01 =	£/year 94.24	(241)
Space heating - main system 1 Space heating - main system 2 Space heating - secondary		kW (211 (213 (215	/h/year 1) x 3) x 5) x			(Table 3.4 0 13.	12) 8 19	x 0.01 = x 0.01 =	£/year 94.24 0	(241)
Space heating - main system 1 Space heating - main system 2 Space heating - secondary Water heating cost (other fuel) Pumps, fans and electric keep-hot (if off-peak tariff, list each of (230a)		kW (211 (213 (215 (219 (231 eparately	/h/year 1) x 3) x 5) x 9) 1) y as app	licable a	nd apply	(Table 3.4 0 13. 3.4 13.	12) 8 19 8 19 ce accor	x = 0.01 = 0.001 = 0	£/year 94.24 0 0 61.74 16.43	(241) (242) (247) (249)
Space heating - main system 1 Space heating - main system 2 Space heating - secondary Water heating cost (other fuel) Pumps, fans and electric keep-hot (if off-peak tariff, list each of (230a) Energy for lighting) to (230g) se	(213 (215 (219 (231	/h/year 1) x 3) x 5) x 9) 1) y as app	licable a	nd apply	(Table 3.4 0 13.4 13.4 13.4 13.4 13.4 13.4 13.4 13.4	12) 8 19 8 19 ce accor	x 0.01 = x 0.01 = x 0.01 = x 0.01 =	£/year 94.24 0 0 61.74 16.43	(241) (242) (247)
Space heating - main system 1 Space heating - main system 2 Space heating - secondary Water heating cost (other fuel) Pumps, fans and electric keep-hot (if off-peak tariff, list each of (230a)) to (230g) se	kW (211 (213 (215 (219 (231 eparately	/h/year 1) x 3) x 5) x 9) 1) y as app	licable a	nd apply	(Table 3.4 0 13. 3.4 13.	12) 8 19 8 19 ce accor	x = 0.01 = 0.001 = 0	£/year 94.24 0 0 61.74 16.43 Table 12a	(241) (242) (247) (249)
Space heating - main system 1 Space heating - main system 2 Space heating - secondary Water heating cost (other fuel) Pumps, fans and electric keep-hot (if off-peak tariff, list each of (230a) Energy for lighting) to (230g) se	kW (211 (213 (215 (219 (231 eparately (232	/h/year 1) x 3) x 5) x 9) 1) y as app		nd apply	(Table 3.4 0 13. 3.4 13.	12) 8 19 8 19 ce accor	x = 0.01 = 0.001 = 0	£/year 94.24 0 0 61.74 16.43 Table 12a 45.03	(241) (242) (247) (249) (250)
Space heating - main system 1 Space heating - main system 2 Space heating - secondary Water heating cost (other fuel) Pumps, fans and electric keep-hot (if off-peak tariff, list each of (230a) Energy for lighting Additional standing charges (Table Appendix Q items: repeat lines (25) to (230g) se : 12)	(213 (215 (215 (231 (232 (232 (232	/h/year 1) x 3) x 5) x 9) 1) y as app of (233) to		nd apply	(Table 3.4 0 13. 3.4 13. fuel prid 13.	12) 8 19 8 19 ce accor	x 0.01 = x 0.01 = x 0.01 = x 0.01 = rding to x 0.01 =	£/year 94.24 0 61.74 16.43 Table 12a 45.03	(241) (242) (247) (249) (250) (251)
Space heating - main system 1 Space heating - main system 2 Space heating - secondary Water heating cost (other fuel) Pumps, fans and electric keep-hot (if off-peak tariff, list each of (230a) Energy for lighting Additional standing charges (Table Appendix Q items: repeat lines (25 Total energy cost) to (230g) se e 12) 53) and (254) (245)((213 (215 (215 (231 (232 (232 (232	/h/year 1) x 3) x 5) x 9) 1) y as app of (233) to	o (235) x)	nd apply	(Table 3.4 0 13. 3.4 13. fuel prid 13.	12) 8 19 8 19 ce accor	x 0.01 = x 0.01 = x 0.01 = x 0.01 = rding to x 0.01 =	£/year 94.24 0 61.74 16.43 Table 12a 45.03	(241) (242) (247) (249) (250) (251)
Space heating - main system 1 Space heating - main system 2 Space heating - secondary Water heating cost (other fuel) Pumps, fans and electric keep-hot (if off-peak tariff, list each of (230a) Energy for lighting Additional standing charges (Table Appendix Q items: repeat lines (25) to (230g) se e 12) 53) and (254) (245)((213 (215 (215 (231 (231 (232 (232 (232)	/h/year 1) x 3) x 5) x 9) 1) y as app of (233) to	o (235) x)	nd apply	(Table 3.4 0 13. 3.4 13. fuel prid 13.	12) 8 19 8 19 ce accor	x 0.01 = x 0.01 = x 0.01 = x 0.01 = rding to x 0.01 =	£/year 94.24 0 0 61.74 16.43 Table 12a 45.03 120 -63.57	(241) (242) (247) (249) (250) (251) (252)
Space heating - main system 1 Space heating - main system 2 Space heating - secondary Water heating cost (other fuel) Pumps, fans and electric keep-hot (if off-peak tariff, list each of (230a) Energy for lighting Additional standing charges (Table Appendix Q items: repeat lines (25 Total energy cost) to (230g) se e 12) 53) and (254) (245)((213 (215 (215 (231 (231 (232 (232 (232)	/h/year 1) x 3) x 5) x 9) 1) y as app of (233) to	o (235) x)	nd apply	(Table 3.4 0 13. 3.4 13. fuel prid 13.	12) 8 19 8 19 ce accor	x 0.01 = x 0.01 = x 0.01 = x 0.01 = rding to x 0.01 =	£/year 94.24 0 0 61.74 16.43 Table 12a 45.03 120 -63.57	(241) (242) (247) (249) (250) (251) (252)
Space heating - main system 1 Space heating - main system 2 Space heating - secondary Water heating cost (other fuel) Pumps, fans and electric keep-hot (if off-peak tariff, list each of (230a) Energy for lighting Additional standing charges (Table Appendix Q items: repeat lines (25 Total energy cost 11a. SAP rating - individual heating) to (230g) see e 12) (3) and (254) (245)(ng systems	(213 (215 (215 (231 (231 (232 (232 (232)	/h/year I) x 3) x 5) x 9) I) y as app of (233) to	o (235) x) =	nd apply	(Table 3.4 0 13. 3.4 13. fuel prid 13.	12) 8 19 8 19 ce accor	x 0.01 = x 0.01 = x 0.01 = x 0.01 = rding to x 0.01 =	£/year 94.24 0 0 61.74 16.43 Table 12a 45.03 120 -63.57	(241) (242) (247) (249) (250) (251) (252) (255)

12a. CO2 emissions – Individual heating system	<u> </u>		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216	584.96 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	383.24 (264)
Space and water heating	(261) + (262) + (263) +	(264) =	968.2 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	64.67 (267)
Electricity for lighting	(232) x	0.519 =	177.17 (268)
Energy saving/generation technologies Item 1		0.519 =	-250.12 (269)
Total CO2, kg/year		sum of (265)(271) =	959.92 (272)
CO2 emissions per m ²		(272) ÷ (4) =	12.95 (273)
El rating (section 14)			89 (274)
El rating (section 14) 13a. Primary Energy			89 (274)
<u> </u>	Energy kWh/year	Primary factor	P. Energy kWh/year
<u> </u>		•	P. Energy
13a. Primary Energy	kWh/year	factor	P. Energy kWh/year
13a. Primary Energy Space heating (main system 1)	kWh/year (211) x	factor =	P. Energy kWh/year 3303.92 (261)
13a. Primary Energy Space heating (main system 1) Space heating (secondary)	kWh/year (211) x (215) x	factor = 1.22 = 1.22 = 1.22 = 1.22	P. Energy kWh/year 3303.92 (261) 0 (263)
13a. Primary Energy Space heating (main system 1) Space heating (secondary) Energy for water heating	kWh/year (211) x (215) x (219) x	factor = 1.22 = 1.22 = 1.22 = 1.22	P. Energy kWh/year 3303.92 (261) 0 (263) 2164.6 (264)
Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating	kWh/year (211) x (215) x (219) x (261) + (262) + (263) +	factor = 1.22 = 3.07 = 1.22 = (264) =	P. Energy kWh/year 3303.92 (261) 0 (263) 2164.6 (264) 5468.52 (265)
Space heating (main system 1) Space heating (secondary) Energy for water heating Space and water heating Electricity for pumps, fans and electric keep-hot	kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (231) x	factor 1.22 = 3.07 = 1.22 = (264) = 3.07 =	P. Energy kWh/year 3303.92 (261) 0 (263) 2164.6 (264) 5468.52 (265) 382.52 (267)

(272) ÷ (4) =

Primary energy kWh/m²/year

(273)

73.14

		User Details:		
Assessor Name:	Ben Tunningley	Stroma Nur	nber: STR	O027495
Software Name:	Stroma FSAP 2012	Software Ve	ersion: Vers	ion: 1.0.5.41
	Pro	operty Address: Plot 0	36	
Address :	23 Buttercup Road , Bishops	Waltham, SOUTHAM	PTON , SO32 1RF	
1. Overall dwelling dime	ensions:			
		Area(m²)	Av. Height(m)	Volume(m³)
Ground floor		37.05 (1a) x	2.4 (2a) =	88.92 (3a)
First floor		37.05 (1b) x	2.67 (2b) =	98.92 (3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1n)	74.1 (4)		
Dwelling volume		(3a)+(3	(3c)+(3c)+(3d)+(3e)+(3n) =	187.84 (5)
2. Ventilation rate:				
	main secondary heating heating	other	total	m³ per hour
Number of chimneys	0 + 0	+ 0 =	0 x 40 =	0 (6a)
Number of open flues	0 + 0	+ 0 =	0 x 20 =	0 (6b)
Number of intermittent fa	ns		0 x 10 =	0 (7a)
Number of passive vents			0 x 10 =	0 (7b)
Number of flueless gas fi	res		0 x 40 =	0 (7c)
				changes per hour
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7a	u)+(7b)+(7c) =		
•	peen carried out or is intended, proceed		0	0 (8)
Number of storeys in the				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0	.25 for steel or timber frame or 0	0.35 for masonry cons	truction	0 (11)
if both types of wall are po deducting areas of openir	resent, use the value corresponding to t nas): if eaual user 0.35	the greater wall area (after		
=	floor, enter 0.2 (unsealed) or 0.1	(sealed), else enter ()	0 (12)
If no draught lobby, en	ter 0.05, else enter 0			0 (13)
Percentage of windows	s and doors draught stripped			0 (14)
Window infiltration		0.25 - [0.2 x (14) ÷	100] =	0 (15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	0 (16)
Air permeability value,	q50, expressed in cubic metres	per hour per square i	metre of envelope area	4.59000015258789 (17)
If based on air permeabil	ity value, then $(18) = [(17) \div 20] + (8)$, otherwise (18) = (16)		0.23 (18)
	es if a pressurisation test has been done	e or a degree air permeabilit	y is being used	
Number of sides sheltere	ed	(20) – 1 [0.075 v	/40\1	2 (19)
Shelter factor	Para al alter factor	(20) = 1 - [0.075 x]		0.85 (20)
Infiltration rate incorporat		$(21) = (18) \times (20) =$	=	0.2 (21)
Infiltration rate modified f		,, , , , , , ,		
Jan Feb	Mar Apr May Jun	Jul Aug Sep	Oct Nov Dec	
Monthly average wind sp	eed from Table 7			_

4.9

4.4

4.3

3.8

3.8

3.7

4.3

4.5

4.7

5

Wind Factor (2	22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
Adjusted infiltr	ration 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	0.19	0.19	0.18	0.2	0.21	0.22	0.23]	
Calculate effe		_	rate for t	he appli	cable ca	se		•			•	<u>-</u>	
If mechanical If exhaust air h			andiv N (2	3h) - (23a	a) v Emy (4	aguation (N5N othe	arwica (23h	n) – (23a)			0.5	(23a)
If balanced with		0		, ,	,	. `	,, .	,)) = (23a)			0.5	(23b)
a) If balance		-	•	_					2h\m + (23h) √ [1 _ (23c	0) ÷ 1001	(23c)
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	$\frac{1 - (230)}{0}$) - 100]]	(24a)
b) If balance					heat red	covery (I	MV) (24t	n)m = (2)		23b)	1	_	,
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0	1	(24b)
c) If whole h	nouse ex	tract ver	ntilation c	or positiv	e input	ventilatio	on from (utside		<u> </u>	1	_	
	m < 0.5 ×			-	-				.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		(24c)
d) If natural												_	
<u> </u>	m = 1, the	<u> </u>	<u> </u>		· `			- 			-	7	(0.4-1)
(24d)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24d)
Effective air			<u> </u>	` `	´``	ŕ `		- ` 	1 05		1 05	7	(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												
	o and ne	eat loss p	paramete	er:									
ELEMENT	Gros area	SS	oaramete Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/		k-valu kJ/m²·		A X k kJ/K
ELEMENT Doors	Gros	SS	Openin	gs									
	Gros area	SS	Openin	gs	A ,r	m ² x	W/m2	2K =	(W/				kJ/K
Doors	Gros area e 1	SS	Openin	gs	A ,r	m² x x1	W/m2	2K = = + 0.04] =	(W/ 2.94				kJ/K (26)
Doors Windows Type	Gros area e 1	SS	Openin	gs	A ,r 2.1 3.06	m² x x1 x1	W/m2 1.4 /[1/(1.4)+	2K = = + 0.04] =	(W/ 2.94 4.06	K)		K	kJ/K (26) (27)
Doors Windows Type	Gros area e 1	ss (m²)	Openin	gs ²	A ,r 2.1 3.06 6.51	m ²	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+	2K = + 0.04] = + 0.04] = =	(W/ 2.94 4.06 8.63	K)	kJ/m²-	K 27	kJ/K (26) (27) (27)
Doors Windows Type Windows Type Floor	Gros area e 1 e 2	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.09	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+	2K = + 0.04] = + 0.04] = =	(W/ 2.94 4.06 8.63 4.0755	K)	kJ/m²-	K 27	kJ/K (26) (27) (27) (27) (28)
Doors Windows Type Windows Type Floor Walls	Gros area e 1 e 2 127.	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.09 115.8	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24	2K = + 0.04] = + 0.04] = = =	(W/ 2.94 4.06 8.63 4.0755 27.79	K)	kJ/m²-	K 27	kJ/K (26) (27) (27) (28) (29)
Doors Windows Type Windows Type Floor Walls Roof	Gros area e 1 e 2 127. 37.0 elements	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.09 115.8	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24	2K = + 0.04] = + 0.04] = = =	(W/ 2.94 4.06 8.63 4.0755 27.79	K)	kJ/m²-	K 27 6 3	kJ/K (26) (27) (27) (27) (28) (29) (33.45 (30)
Doors Windows Type Windows Type Floor Walls Roof Total area of e	Gros area e 1 e 2 127. 37.0 elements	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.05 115.8 37.05	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24	2K = + 0.04] = + 0.04] = = =	(W/ 2.94 4.06 8.63 4.0755 27.79	K)	kJ/m²- 75 60 9	K 27 6 3	kJ/K (26) (27) (27) (778.75 (28) 948.6 (29) 33.45 (30) (31)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall **	Gros area e 1 e 2 127. 37.0 elements	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.06 115.8 37.06 201.5	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24	2K = + 0.04] = + 0.04] = = =	(W/ 2.94 4.06 8.63 4.0755 27.79	K)	kJ/m²- 75 60 9	6 3 53	kJ/K (26) (27) (27) (78.75) (28) 948.6 (29) 33.45 (30) (31) (39.136) (32c)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall ** Internal wall **	Gros area e 1 e 2 127. 37.0 elements	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.09 115.8 37.09 201.5 59.9 90.09	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24	2K = + 0.04] = + 0.04] = = =	(W/ 2.94 4.06 8.63 4.0755 27.79	K)	75 60 9 9	EX 27 6 3 3 53 811 6	kJ/K (26) (27) (27) (778.75 (28) 948.6 (29) 33.45 (30) (31) 39.136 (32c) 0.7722 (32c)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall ** Internal wall **	Gros area e 1 e 2 127. 37.0 elements	48 05 , m ²	Openin m	gs 2 7 Indow U-va	A ,r 2.1 3.06 6.51 37.06 115.8 37.06 201.5 59.9 90.06 37.06 37.06 alue calcul	m ²	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24 0.11	2K = + 0.04] = + 0.04] = = = = =	(W/ 2.94 4.06 8.63 4.0755 27.79 4.08	K)	kJ/m ² - 75 60 9 9 18 9	K 27 6 3 81 6 3	kJ/K (26) (27) (27) (27) (278.75) (28) (948.6) (29) (33.45) (30) (31) (39.136) (32c) (0.7722) (32c) (366.9) (32d)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall ** Internal floor Internal ceiling * for windows and	Gros area e 1 e 2 127. 37.0 elements * * droof windas on both	48 05 05, m ² ows, use e	Openin m 11.67	gs 2 7 Indow U-va	A ,r 2.1 3.06 6.51 37.06 115.8 37.06 201.5 59.9 90.06 37.06 37.06 alue calcul	x1 x1 x1 x x1 x x x x x x x x x x x x x	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24 0.11	2K =	(W/ 2.94 4.06 8.63 4.0755 27.79 4.08	K)	kJ/m ² - 75 60 9 9 18 9	K 27 6 3 81 6 3	kJ/K (26) (27) (27) (78.75) (28) 948.6 (29) 33.45 (30) (31) 39.136 (32c) 0.7722 (32c) 666.9 (32d) 33.45 (32e)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall ** Internal floor Internal ceiling * for windows and ** include the area	Gros area e 1 e 2 127. 37.0 elements * * droof windas on both ss, W/K:	ows, use e sides of in= S (A x	Openin m 11.67	gs 2 7 Indow U-va	A ,r 2.1 3.06 6.51 37.06 115.8 37.06 201.5 59.9 90.06 37.06 37.06 alue calcul	x1 x1 x1 x x1 x x x x x x x x x x x x x	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24 0.11	2K =	(W/ 2.94 4.06 8.63 4.0755 27.79 4.08	K)	4J/m ² - 75 60 9 9 18 9 n paragrapa	6 3 53 810 6 3 h 3.2	kJ/K (26) (27) (27) (278.75 (28) 948.6 (29) 33.45 (30) (31) 39.136 (32c) 0.7722 (32c) 666.9 (32d) 33.45 (32e)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Internal wall ** Internal floor Internal ceiling * for windows and ** include the area Fabric heat los	Gros area e 1 e 2 127. 37.0 elements * * d roof winde as on both ss, W/K: Cm = S(ows, use e sides of in S (A x k)	Openin m 11.67 0 effective winternal wall U)	gs 7 7 Indow U-vals and part	A ,r 2.1 3.06 6.51 37.05 115.8 37.05 201.5 59.9 90.09 37.05 37.05 alue calculatitions	m ² x1 x1 5 x 1 x 5 x 8 S contact dusing	W/m ² 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.11 0.24 0.11	2K = + 0.04 = + 0.04 = = = = = = =	(W/ 2.94 4.06 8.63 4.0755 27.79 4.08	K)	4J/m ² - 75 60 9 9 18 9 n paragrapa	53 81 81 3 h 3.2	kJ/K (26) (27) (27) (27) (27) (28) (29) (33.45 (30) (31) (31) (39.136 (32c) (32c) (366.9 (32d) (33) (33) (33) (34)

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can be used instead of a detailed calculation.

Th a 2200	بملمئة مالم	C /I	\/\ aal	المواودة	ai.a. A.a	ا بناممم	,					Г		(os)
	_	•	,		using Ap = <i>0.05 x (</i> 3	•	^						7	(36)
	abric he		are not no	10W11 (00) -	- 0.00 x (0	')			(33) +	(36) =			58.57	(37)
Ventila	ation hea	at loss ca	alculated	d monthl	y				(38)m	= 0.33 × ((25)m x (5)	L		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	30.99	30.99	30.99	30.99	30.99	30.99	30.99	30.99	30.99	30.99	30.99	30.99		(38)
Heat to	ransfer o	coefficier	nt, W/K						(39)m	= (37) + (38)m			
(39)m=	89.56	89.56	89.56	89.56	89.56	89.56	89.56	89.56	89.56	89.56	89.56	89.56		
Heat lo	oss para	meter (H	HLP), W	/m²K						Average = = (39)m ÷	Sum(39) _{1.} - (4)	12 /12=	89.56	(39)
(40)m=	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21		
Numbe	er of day	s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁ .	12 /12=	1.21	(40)
	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. Wa	ater heat	ing ene	rgy requ	irement:								kWh/ye	ear:	
		_												
	ned occu A > 13.9			: [1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0)013 x (⁻	TFA -13		34		(42)
	A £ 13.9				(0.000	(11		,_,,	(,			
								(25 x N)		(.81		(43)
		_			ə% ii irie d ⁄ater use, l	_	_	to achieve	a water us	se largel d)(
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wat					Vd,m = fa						1101			
(44)m=	98.79	95.2	91.6	88.01	84.42	80.83	80.83	84.42	88.01	91.6	95.2	98.79		
											ım(44) ₁₁₂ =		1077.7	(44)
Energy	content of	hot water	used - cal	culated m	onthly = 4 .	190 x Vd,r	n x nm x E	OTm / 3600	kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	146.5	128.13	132.22	115.27	110.61	95.45	88.44	101.49	102.7	119.69	130.65	141.88		_
lf instan	itaneous w	ater heati	na at noint	t of use (no	n hot water	r storage)	enter () in	boxes (46)		Total = Su	ım(45) ₁₁₂ =	- [1413.04	(45)
	21.98	19.22	19.83	17.29	16.59	14.32	13.27	15.22	15.41	17.95	19.6	21.28		(46)
(46)m= Water	storage		19.03	17.29	16.59	14.32	13.27	13.22	13.41	17.95	19.6	21.20		(40)
	•		includir	ng any s	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If com	munity h	eating a	nd no ta	ank in dw	velling, e	nter 110	litres in	(47)						
			hot wate	er (this ir	ncludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in ((47)			
	storage					(1.14/1	/ I \					1		
					or is kno	wn (kvvr	n/day):					0		(48)
•	erature f							(10)				0		(49)
	•		-	e, kWh/ye cylinder	ear loss fact	or is not		(48) x (49)	=			0		(50)
•				•	le 2 (kW							0		(51)
If com	munity h	eating s	ee secti		•									
	e factor										(0		(52)
Tempe	erature f	actor fro	m Tabla											
	Jiataio i	actor no	III Table	2b							(0		(53)

Energy los	st from wate	er storage	e, kWh/y	ear			(47) x (51)) x (52) x (53) =		0]	(54)
Enter (50)	or (54) in ((55)									0	1	(55)
Water stor	age loss ca	lculated	for each	month			((56)m = (55) × (41)	m			•	
(56)m=	0 0	0	0	0	0	0	0	0	0	0	0]	(56)
If cylinder co	ntains dedicat	ed solar sto	rage, (57)	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5	7)m = (56)	m where (H11) is fro	m Append	lix H	
(57)m=	0 0	0	0	0	0	0	0	0	0	0	0		(57)
Primary ci	rcuit loss (a	nnual) fro	om Table	e 3							0		(58)
Primary ci	rcuit loss ca	lculated	for each	month ((59)m =	(58) ÷ 36	65 × (41)	m					
(modifie	d by factor	from Tab	le H5 if t	there is s	solar wa	ter heati	ng and a	cylinde	r thermo	stat)		,	
(59)m=	0 0	0	0	0	0	0	0	0	0	0	0		(59)
Combi los	s calculated	for each	month	(61)m =	(60) ÷ 30	65 × (41)m						
(61)m= 13	.76 12.43	13.76	13.31	13.76	13.31	13.76	13.76	13.31	13.76	13.31	13.76		(61)
Total heat	required fo	r water h	eating ca	alculated	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 166	0.26 140.56	145.98	128.59	124.36	108.76	102.2	115.25	116.02	133.45	143.96	155.64		(62)
Solar DHW in	nput calculated	d using App	endix G o	r Appendix	κ Η (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wat	er heating)	•	
(add addit	onal lines i	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (3)		_		_	
(63)m=	0 0	0	0	0	0	0	0	0	0	0	0		(63)
FHRS	0 0	0	0	0	0	0	0	0	0	0	0		(63) (G2)
Output fro	m water he	ater										_	
(64)m= 160	0.26 140.56	145.98	128.59	124.36	108.76	102.2	115.25	116.02	133.45	143.96	155.64		
							Outp	out from w	ater heate	r (annual)	112	1575.01	(64)
Heat gains	from wate	r heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	1] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	1	
(65)m= 52	.15 45.71	47.4	41.66	40.22	35.06	32.85	37.18	37.48	43.24	46.77	50.61		(65)
include	(57)m in ca	lculation	of (65)m	only if c	ylinder i	s in the	dwelling	or hot w	ater is fr	om com	munity h	neating	
5. Intern	al gains (se	e Table క	5 and 5a):									
Metabolic	gains (Tabl	e 5), Wa	tts									_	
J	an Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 11	7.07 117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07	117.07		(66)
Lighting ga	ains (calcul	ated in A	ppendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				_	
(67)m= 20	.12 17.87	14.53	11	8.22	6.94	7.5	9.75	13.09	16.62	19.4	20.68		(67)
Appliance	s gains (cal	culated ir	Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5		_	_	
(68)m= 200	5.67 208.82	203.41	191.91	177.38	163.73	154.61	152.47	157.87	169.38	183.9	197.55		(68)
Cooking g	ains (calcul	ated in A	ppendix	L, equa	tion L15	or L15a), also se	ee Table	5				
(69)m= 34	.71 34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71	34.71		(69)
Pumps an	d fans gain	s (Table	5a)			-	-	-	-	-			
(70)m=	3 3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.	g. evaporati	on (nega	tive valu	ies) (Tab	ole 5)							-	
(71)m= -93	3.66 -93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66	-93.66		(71)
Water hea	ting gains (Table 5)										-	
(72)m= 70	0.1 68.02	63.71	57.86	54.05	48.7	44.15	49.98	52.05	58.11	64.96	68.03		(72)
Total inte	rnal gains	=	-	-	(66))m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72)m	•	
(73)m= 358	3.01 355.83	342.78	321.89	300.78	280.5	267.39	273.32	284.14	305.23	329.38	347.38		(73)
, ,	1	1	<u> </u>	<u> </u>	1			<u> </u>			<u> </u>	J	•

6. Solar gain	ıs:											
Solar gains are		ng solar	flux from Tabl	e 6a and	d associated equ	uations	to convert to th	ne applica	able orientat	ion.		
Orientation:	Access Fac Table 6d	tor	Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Southeast 0.9x	0.77	x	6.51	х	36.79	X	0.45	х	1.11	=	83	(77)
Southeast 0.9x	0.77	x	6.51	x	62.67	×	0.45	x	1.11	=	141.37	(77)
Southeast 0.9x	0.77	x	6.51	x	85.75	X	0.45	x	1.11	=	193.43	(77)
Southeast 0.9x	0.77	×	6.51	×	106.25	x	0.45	×	1.11	=	239.67	(77)
Southeast 0.9x	0.77	X	6.51	x	119.01	x	0.45	x	1.11	=	268.45	(77)
Southeast 0.9x	0.77	X	6.51	х	118.15	X	0.45	х	1.11	=	266.51	(77)
Southeast 0.9x	0.77	X	6.51	x	113.91	X	0.45	x	1.11	=	256.95	(77)
Southeast 0.9x	0.77	x	6.51	x	104.39	X	0.45	х	1.11	=	235.48	(77)
Southeast 0.9x	0.77	X	6.51	x	92.85	X	0.45	x	1.11	=	209.45	(77)
Southeast 0.9x	0.77	X	6.51	x	69.27	x	0.45	x	1.11	=	156.25	(77)
Southeast 0.9x	0.77	X	6.51	x	44.07	X	0.45	x	1.11	=	99.41	(77)
Southeast 0.9x	0.77	X	6.51	X	31.49	X	0.45	x	1.11	=	71.03	(77)
Northwest 0.9x	0.77	X	3.06	x	11.28	X	0.45	x	1.11	=	11.96	(81)
Northwest 0.9x	0.77	X	3.06	X	22.97	X	0.45	x	1.11	=	24.35	(81)
Northwest 0.9x	0.77	X	3.06	X	41.38	X	0.45	x	1.11	=	43.87	(81)
Northwest 0.9x	0.77	X	3.06	X	67.96	X	0.45	x	1.11	=	72.05	(81)
Northwest 0.9x	0.77	X	3.06	X	91.35	X	0.45	x	1.11	=	96.85	(81)
Northwest 0.9x	0.77	X	3.06	X	97.38	X	0.45	x	1.11	=	103.26	(81)
Northwest 0.9x	0.77	X	3.06	X	91.1	X	0.45	x	1.11	=	96.59	(81)
Northwest 0.9x	0.77	X	3.06	X	72.63	X	0.45	х	1.11	=	77.01	(81)
Northwest 0.9x	0.77	X	3.06	X	50.42	X	0.45	х	1.11	=	53.46	(81)
Northwest 0.9x	0.77	X	3.06	х	28.07	X	0.45	х	1.11	=	29.76	(81)
Northwest 0.9x	0.77	X	3.06	X	14.2	X	0.45	x	1.11	=	15.05	(81)
Northwest 0.9x	0.77	X	3.06	×	9.21	X	0.45	x	1.11	=	9.77	(81)
Solar gains in	watta aala	ulotod	for each m	anth		(92\n	n = Sum(74)m	(92)m				
(83)m= 94.96	- · · · · ·	37.31			369.77 353.54			186.01	114.46	80.8]	(83)
Total gains –	internal and	l solar	(84)m = (73)	3)m + ((83)m , watts	<u> </u>	ļ.		<u>!</u>		J	
(84)m= 452.97	521.55 5	80.09	633.61 666	6.09	650.27 620.93	58	5.8 547.04	491.24	443.84	428.18]	(84)
7. Mean inte	rnal temper	ature (heating sea	ason)	·	•	•					
Temperature					area from Ta	able 9	, Th1 (°C)				21	(85)
Utilisation fa	ctor for gain	s for li	ving area, h	n1,m (s	see Table 9a))	, ,					
Jan		Mar		lay	Jun Jul		ug Sep	Oct	Nov	Dec]	
(86)m= 0.99	0.98	0.97	0.93 0.	86	0.73 0.58	0.0	63 0.83	0.95	0.98	0.99		(86)
Mean interna	al temperatu	ıre in I	iving area T	1 (follo	ow steps 3 to	7 in 7	Fable 9c)				-	
(87)m= 19.23	T - T	9.75			20.83 20.95		.93 20.72	20.21	19.63	19.17]	(87)
Temperature	during hea	ting pe	eriods in res	st of dv	velling from T	able	9, Th2 (°C)	-	ē		-	
(88)m= 19.91	 	9.91			19.91 19.91		.91 19.91	19.91	19.91	19.91]	(88)
			•		•		-		-		-	

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a) (89)m= 0.99 0.98 0.96 0.91 0.82 0.65 0.46 0.51 0.76 0.93 0.98 0.99 (89) Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c) (90)m= 18.31 18.5 18.82 19.23 19.59 19.82 19.89 19.88 19.74 19.28 18.71 18.25 (90) Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 - fLA) × T2 (92)m= 18.49 18.69 19.01 19.42 19.79 20.03 20.11 20.1 19.94 19.47 18.9 18.44 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 18.34 18.54 18.86 19.27 19.64 19.88 19.96 19.95 19.79 19.32 18.75 18.29 (93) 8. Space heating requirement Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.98 0.97 0.95 0.9 0.81 0.64 0.46 0.51 0.75 0.92 0.97 0.99 (94) Useful gains, hmGm, W = (94)m x (84)m (95)m= 44.5 3 506.9 551.03 571.23 536.7 418.68 288.67 300.26 411.58 451.57 431.49 422.14 (95) Monthly average external temperature from Table 8 (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96) Heat loss rate for mean internal temperature, Lm, W = ((39)m x ((93)m-(96)m)
(90)m= 18.31 18.5 18.82 19.23 19.59 19.82 19.89 19.88 19.74 19.28 18.71 18.25 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 18.49 18.69 19.01 19.42 19.79 20.03 20.11 20.1 19.94 19.47 18.9 18.44 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 18.34 18.54 18.86 19.27 19.64 19.88 19.96 19.95 19.79 19.32 18.75 18.29 (93) 8. Space heating requirement Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.98 0.97 0.95 0.9 0.81 0.64 0.46 0.51 0.75 0.92 0.97 0.99 (94) Useful gains, hmGm, W = (94)m x (84)m (95)m= 445.3 506.9 551.03 571.23 536.7 418.68 288.67 300.26 411.58 451.57 431.49 422.14 (95) Monthly average external temperature from Table 8 (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)
(90)m= 18.31 18.5 18.82 19.23 19.59 19.82 19.89 19.88 19.74 19.28 18.71 18.25 (90) Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 18.49 18.69 19.01 19.42 19.79 20.03 20.11 20.1 19.94 19.47 18.9 18.44 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 18.34 18.54 18.86 19.27 19.64 19.88 19.96 19.95 19.79 19.32 18.75 18.29 (93) 8. Space heating requirement Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.98 0.97 0.95 0.9 0.81 0.64 0.46 0.51 0.75 0.92 0.97 0.99 (94) Useful gains, hmGm, W = (94)m x (84)m (95)m= 445.3 506.9 551.03 571.23 536.7 418.68 288.67 300.26 411.58 451.57 431.49 422.14 (95) Monthly average external temperature from Table 8 (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)
Mean internal temperature (for the whole dwelling) = fLA x T1 + (1 - fLA) x T2 (92)m= 18.49 18.69 19.01 19.42 19.79 20.03 20.11 20.1 19.94 19.47 18.9 18.44 (92) Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 18.34 18.54 18.86 19.27 19.64 19.88 19.96 19.95 19.79 19.32 18.75 18.29 (93) 8. Space heating requirement Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.98 0.97 0.95 0.9 0.81 0.64 0.46 0.51 0.75 0.92 0.97 0.99 (94) Useful gains, hmGm, W = (94)m x (84)m (95)m= 445.3 506.9 551.03 571.23 536.7 418.68 288.67 300.26 411.58 451.57 431.49 422.14 (95) Monthly average external temperature from Table 8 (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)
(92)m=
(92)m=
Apply adjustment to the mean internal temperature from Table 4e, where appropriate (93)m= 18.34 18.54 18.86 19.27 19.64 19.88 19.96 19.95 19.79 19.32 18.75 18.29 8. Space heating requirement Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.98 0.97 0.95 0.9 0.81 0.64 0.46 0.51 0.75 0.92 0.97 0.99 Useful gains, hmGm , W = (94)m x (84)m (95)m= 445.3 506.9 551.03 571.23 536.7 418.68 288.67 300.26 411.58 451.57 431.49 422.14 (95) Monthly average external temperature from Table 8 (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)
(93)m= 18.34 18.54 18.86 19.27 19.64 19.88 19.96 19.95 19.79 19.32 18.75 18.29 (93) 8. Space heating requirement Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.98 0.97 0.95 0.9 0.81 0.64 0.46 0.51 0.75 0.92 0.97 0.99 (94) Useful gains, hmGm , W = (94)m x (84)m (95)m= 445.3 506.9 551.03 571.23 536.7 418.68 288.67 300.26 411.58 451.57 431.49 422.14 (95) Monthly average external temperature from Table 8 (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)
Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
the utilisation factor for gains using Table 9a Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.98 0.97 0.95 0.9 0.81 0.64 0.46 0.51 0.75 0.92 0.97 0.99 Useful gains, hmGm , W = (94)m x (84)m (95)m= 445.3 506.9 551.03 571.23 536.7 418.68 288.67 300.26 411.58 451.57 431.49 422.14 Monthly average external temperature from Table 8 (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Utilisation factor for gains, hm: (94)m= 0.98 0.97 0.95 0.9 0.81 0.64 0.46 0.51 0.75 0.92 0.97 0.99 (94) Useful gains, hmGm , W = (94)m x (84)m (95)m= 445.3 506.9 551.03 571.23 536.7 418.68 288.67 300.26 411.58 451.57 431.49 422.14 (95) Monthly average external temperature from Table 8 (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)
(94)m= 0.98 0.97 0.95 0.9 0.81 0.64 0.46 0.51 0.75 0.92 0.97 0.99 Useful gains, hmGm, W = (94)m x (84)m (95)m= 445.3 506.9 551.03 571.23 536.7 418.68 288.67 300.26 411.58 451.57 431.49 422.14 Monthly average external temperature from Table 8 (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)
Useful gains, hmGm , W = (94)m x (84)m (95)m=
(95)m= 445.3 506.9 551.03 571.23 536.7 418.68 288.67 300.26 411.58 451.57 431.49 422.14 Monthly average external temperature from Table 8 (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)
Monthly average external temperature from Table 8 (96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)
(96)m= 4.3 4.9 6.5 8.9 11.7 14.6 16.6 16.4 14.1 10.6 7.1 4.2 (96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]
(07)
(97)m= 1257.89 1221.87 1107.37 928.62 711.03 472.63 300.82 317.74 509.43 780.85 1043.16 1261.92 (97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m - (95)m] x (41)m (98)m= 604.57 480.46 413.91 257.33 129.7 0 0 0 0 244.99 440.4 624.79
Total per year (kWh/year) = Sum(98) _{159,.12} = 3196.15 (98)
Space heating requirement in kWh/m²/year 43.13 (99)
9a. Energy requirements – Individual heating systems including micro-CHP)
Space heating:
Fraction of space heat from secondary/supplementary system 0 (201)
Fraction of space heat from main system(s) $ (202) = 1 - (201) = $ 1 (202)
Fraction of total heating from main system 1 $(204) = (202) \times [1 - (203)] = 1$ (204)
Efficiency of main space heating system 1 90.5 (206)
Efficiency of secondary/supplementary heating system, %
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec kWh/year
Space heating requirement (calculated above)
604.57 480.46 413.91 257.33 129.7 0 0 0 0 244.99 440.4 624.79
$(211)m = \{[(98)m \times (204)] \} \times 100 \div (206) $ (211)
668.03 530.9 457.36 284.34 143.31 0 0 0 0 270.71 486.63 690.38
Total (kWh/year) = Sum(211) _{15,1012} = 3531.66 (211)
Space heating fuel (secondary), kWh/month
$= \{[(98)m \times (201)]\} \times 100 \div (208)$
(215)m= 0 0 0 0 0 0 0 0 0 0 0 0
Total (kWh/year) =Sum(215) _{15,1012} = 0 (215)

Water heating								
Output from water heater (calculated above) 160.26	108.76 102.2	115.25	116.02	133.45	143.96	155.64]	
Efficiency of water heater		1				1	87.3	(216)
(217)m= 89.81 89.76 89.64 89.41 88.9	87.3 87.3	87.3	87.3	89.35	89.69	89.84		」 (217)
Fuel for water heating, kWh/month	•		•	•	•	•	•	
(219) m = (64) m x $100 \div (217)$ m (219)m = 178.44 156.6 162.84 143.82 139.88 1	124.58 117.07	132.01	132.89	149.36	160.51	173.23]	
	I	Tota	l = Sum(2	19a) ₁₁₂ =	<u> </u>	!	1771.25	(219)
Annual totals				k'	Wh/yea	r	kWh/year	- 1
Space heating fuel used, main system 1							3531.66	_
Water heating fuel used							1771.25	
Electricity for pumps, fans and electric keep-hot								
mechanical ventilation - balanced, extract or pos	sitive input fro	m outside	Э			49.6		(230a)
central heating pump:						30		(230c)
boiler with a fan-assisted flue						45		(230e)
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =			124.6	(231)
Electricity for lighting							355.33	(232)
, 5 5							333.33]` ′
Electricity generated by PVs							-481.92	(233)
	- (231) + (232)	(237b)	=					<u></u>
Electricity generated by PVs	. , , , ,	` ′					-481.92	(233)
Electricity generated by PVs Total delivered energy for all uses (211)(221) +	. , , , ,	` ′		Emiss kg CO	ion fac 2/kWh	tor	-481.92	(233)
Electricity generated by PVs Total delivered energy for all uses (211)(221) +	ns including m	` ′			2/kWh	tor =	-481.92 5300.92 Emissions	(233)
Electricity generated by PVs Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system	ns including m Energy kWh/year	` ′		kg CO	2/kWh		-481.92 5300.92 Emissions kg CO2/yea	(233) (338)
Electricity generated by PVs Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1)	Energy kWh/year	` ′		kg CO	2/kWh	=	-481.92 5300.92 Emissions kg CO2/yea	(233) (338) r (261)
Electricity generated by PVs Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary)	Energy kWh/year (211) x (215) x	icro-CHF		0.2 0.5	2/kWh	=	-481.92 5300.92 Emissions kg CO2/yea 762.84	(233) (338) r (261) (263)
Electricity generated by PVs Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/year (211) x (215) x (219) x	icro-CHF		0.2 0.5	2/kWh 16 19 16	=	-481.92 5300.92 Emissions kg CO2/yea 762.84 0	(233) (338) r (261) (263)
Electricity generated by PVs Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating	Energy kWh/year (211) x (215) x (219) x (261) + (262)	icro-CHF		0.2 0.5 0.2	2/kWh 16 19 16	= = =	-481.92 5300.92 Emissions kg CO2/yea 762.84 0 382.59 1145.43	[(233)] ((338)] ((261)] ((263)] ((264)] ((265)]
Electricity generated by PVs Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot	Energy kWh/year (211) x (215) x (219) x (261) + (262) (231) x	icro-CHF		0.2 0.5 0.5	2/kWh 16 19 16 19 19	= = =	-481.92 5300.92 Emissions kg CO2/yea 762.84 0 382.59 1145.43 64.67	(233) (338) (338) (261) (263) (264) (265) (267)
Electricity generated by PVs Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Energy saving/generation technologies	Energy kWh/year (211) x (215) x (219) x (261) + (262) (231) x	icro-CHF	(264) =	0.2 0.5 0.5 0.5	2/kWh 16 19 16 19 19	= = = = = = = = = = = = = = = = = = = =	-481.92 5300.92 Emissions kg CO2/yea 762.84 0 382.59 1145.43 64.67 184.42	(233) (338) r (261) (263) (264) (265) (267) (268)
Electricity generated by PVs Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating Space and water heating Electricity for pumps, fans and electric keep-hot Electricity for lighting Energy saving/generation technologies Item 1	Energy kWh/year (211) x (215) x (219) x (261) + (262) (231) x	icro-CHF	(264) = sum o	0.2 0.5 0.5 0.5 0.5	2/kWh 16 19 16 19 19	= = = = = = = = = = = = = = = = = = = =	-481.92 5300.92 Emissions kg CO2/yea 762.84 0 382.59 1145.43 64.67 184.42	(233) (338) (338) (261) (263) (264) (265) (267) (268)

		User Details:				
Accesser Name	Pon Tunninglay		mh ar	STDO	027495	
Assessor Name: Software Name:	Ben Tunningley Stroma FSAP 2012	Stroma Nui Software V			n: 1.0.5.41	
Software Name.	Ottoma i OAI 2012	Property Address: Plot (V G13101	11. 1.0.5.41	
Address :	23 Buttercup Road Bish	nops Waltham, SOUTHAM		IRF		
1. Overall dwelling dime		iopo waitham, eee mixii	11 1011, 0002			
<u> </u>		Area(m²)	Av. Height(n	n)	Volume(m³)
Ground floor		37.05 (1a) x	2.4	(2a) =	88.92	(3a)
First floor		37.05 (1b) x	2.67	(2b) =	98.92	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+	.(1n) 74.1 (4)				_
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+	+(3n) =	187.84	(5)
2. Ventilation rate:				L		
	main secon heating heati		total		m³ per hou	r
Number of chimneys	0 + 0	-	0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	x 20 =	0	(6b)
Number of intermittent far	ns		3	x 10 =	30	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fin	res		0	x 40 =	0	(7c)
				Air ch	anges per ho	Mir
Infiltration due to chimne	/s, flues and fans = (6a)+(6b	b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.16	\tag{8}
•	een carried out or is intended, pro			+ (0) =	0.16	
Number of storeys in the	ne dwelling (ns)			ſ	0	(9)
Additional infiltration			I	(9)-1]x0.1 =	0	(10)
	25 for steel or timber frame	•	struction		0	(11)
if both types of wall are pr deducting areas of openin	esent, use the value correspondii as): if equal user 0.35	ng to the greater wall area (after				
=	loor, enter 0.2 (unsealed) o	or 0.1 (sealed), else enter	0	Г	0	(12)
If no draught lobby, ent	er 0.05, else enter 0			Ī	0	(13)
Percentage of windows	and doors draught strippe	ed		Ĭ	0	(14)
Window infiltration		0.25 - [0.2 x (14) -	÷ 100] =	Ì	0	(15)
Infiltration rate		(8) + (10) + (11) +	(12) + (13) + (15) =	. [0	(16)
Air permeability value,	q50, expressed in cubic m	etres per hour per square	metre of envelo	pe area	5	(17)
If based on air permeabili	ty value, then $(18) = [(17) \div 2]$	0]+(8), otherwise (18) = (16)		Ì	0.41	(18)
Air permeability value applies	s if a pressurisation test has been	done or a degree air permeabili	ty is being used	L		
Number of sides sheltere	d				2	(19)
Shelter factor		(20) = 1 - [0.075 x]	(19)] =	[0.85	(20)
Infiltration rate incorporati	ing shelter factor	$(21) = (18) \times (20)$	=		0.35	(21)
Infiltration rate modified for	or monthly wind speed					
Jan Feb	Mar Apr May Ju	ın Jul Aug Ser	Oct No	v Dec		
Jan Teb	mai 7.p. may 00	in our Aug oc	7 001 110	V Dec		

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

vviila i actor (22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18]	
Adjusted infilt	ration rate	e (allowi	ing for sh	nelter an	d wind s	speed) =	(21a) x	(22a)m					
0.44	0.44	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41]	
Calculate effe		_	rate for t	he appli	cable ca	se	•			•			(220)
If exhaust air h			endix N (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) othe	rwise (23h	n) = (23a)			0	(23a)
If balanced wit									, (2 00)			0	(23b)
a) If balance		-	-	_					2b)m + (23b) x [1 – (23c)		(230)
(24a)m = 0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If balance	ed mecha	anical ve	entilation	without	heat rec	covery (N	иV) (24b	p)m = (2)	2b)m + (23b)		1	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
c) If whole I	nouse ex	tract ver	ntilation o	r positiv	e input v	ventilatio	n from o	outside	•	•	•	•	
if (22b)	m < 0.5 ×	(23b), t	then (24d	c) = (23b); other	vise (24	c) = (22l	b) m + 0	.5 × (23b) '		1	
(24c)m = 0	0	0	0	0	0	0	0	0	0	0	0]	(24c)
d) If natural	ventilation $m = 1$, the								0.51				
(24d)m = 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.5 + [(2	0.56	0.57	0.58	0.58	1	(24d)
Effective air		<u> </u>				<u> </u>			0.07	0.00	0.00	J	()
(25)m= 0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	1	(25)
						l .		ı	1	1		J	
3. Heat losse	es and ne	eat loss i	naramata										
	Gros				Not Ar	02	Haval	шо	A Y I I		k-valu	2	ΛΥν
ELEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/	K)	k-value kJ/m²-		A X k kJ/K
ELEMENT Doors		SS	Openin	gs						K)			
	area	SS	Openin	gs	A ,r	m² x	W/m2	2K =	(W/	K)			kJ/K
Doors	area e 1	SS	Openin	gs	A ,r	m² x x1.	W/m2	2K = -0.04] =	(W/	K)			kJ/K (26)
Doors Windows Typ	area e 1	SS	Openin	gs	A ,r 2.1 3.06	m ² x x10 x10	W/m2 1 /[1/(1.4)+	2K = -0.04] =	2.1 4.06				kJ/K (26) (27)
Doors Windows Typ Windows Typ	area e 1	ss (m²)	Openin	gs ²	A ,r 2.1 3.06 6.51	x1.	W/m2 1 /[1/(1.4)+ /[1/(1.4)+	2K = -0.04] = -0.04] =	(W/ 2.1 4.06 8.63				kJ/K (26) (27) (27)
Doors Windows Typ Windows Typ Floor	area e 1 e 2	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.05	x1. x1. x . x . x . x . x . x . x . x .	W/m2 1 /[1/(1.4)+ /[1/(1.4)+	2K = -0.04] = -0.04] = = = =	(W// 2.1 4.06 8.63 4.8165				kJ/K (26) (27) (27) (28)
Doors Windows Typ Windows Typ Floor Walls	area e 1 e 2 127.	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.05	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13	2K = -0.04] = -0.04] = = = = =	(W// 2.1 4.06 8.63 4.8165 20.85				kJ/K (26) (27) (27) (28) (29)
Doors Windows Typ Windows Typ Floor Walls Roof	area e 1 e 2 127. 37.0 elements	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.05 115.8	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13	2K = -0.04] = -0.04] = = = = =	(W// 2.1 4.06 8.63 4.8165 20.85				kJ/K (26) (27) (27) (28) (29) (30)
Doors Windows Typ Windows Typ Floor Walls Roof Total area of 6	area e 1 e 2 127. 37.0 elements	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.05 115.8 37.05	x1. x1. x x x x x x x x x x x x x x x x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13	2K = -0.04] = -0.04] = = = = =	(W// 2.1 4.06 8.63 4.8165 20.85				kJ/K (26) (27) (27) (28) (29) (30) (31)
Doors Windows Typ Windows Typ Floor Walls Roof Total area of c Internal wall *	area e 1 e 2 127. 37.0 elements	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.05 115.8 37.05 201.5	x1. x1. x x x x x x x x x x x x x x x x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13	2K = -0.04] = -0.04] = = = = =	(W// 2.1 4.06 8.63 4.8165 20.85				kJ/K (26) (27) (27) (28) (29) (30) (31) (32c)
Doors Windows Typ Windows Typ Floor Walls Roof Total area of of Internal wall * Internal wall *	area e 1 e 2 127. 37.0 elements *	ss (m²)	Openin m	gs ²	A ,r 2.1 3.06 6.51 37.05 115.8 37.05 201.5 59.9 90.09	x10 x10 x x x x x x x x x x x x x x x x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13	2K = -0.04] = -0.04] = = = = =	(W// 2.1 4.06 8.63 4.8165 20.85				kJ/K (26) (27) (27) (28) (29) (30) (31) (32c)
Doors Windows Typ Windows Typ Floor Walls Roof Total area of of Internal wall * Internal floor Internal ceiling * for windows and	area e 1 e 2 127. 37.0 elements *	48 95 , m ²	Openin m 11.67	gs 2 7	A ,r 2.1 3.06 6.51 37.05 115.8 37.05 201.5 59.9 90.09 37.05 37.05 alue calculut	x1 x1 x1 x1 x1 x2 x2 x2 x3 x4	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13	2K = -0.04] = -0.04] = = = = = =	(W// 2.1 4.06 8.63 4.8165 20.85 4.82		kJ/m²-	K	kJ/K (26) (27) (27) (28) (29) (30) (31) (32c) (32c)
Doors Windows Typ Windows Typ Floor Walls Roof Total area of of Internal wall * Internal floor Internal ceiling	area e 1 e 2 127. 37.0 elements * *	48 05 , m ² ows, use e	Openin m 11.67	gs 2 7	A ,r 2.1 3.06 6.51 37.05 115.8 37.05 201.5 59.9 90.09 37.05 37.05 alue calculut	x1 x1 x1 x1 x1 x2 x2 x2 x3 x4	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13	2K = -0.04] = -0.04] = = = = = = =	(W// 2.1 4.06 8.63 4.8165 20.85 4.82		kJ/m²-	K	kJ/K (26) (27) (27) (28) (29) (30) (31) (32c) (32c) (32d)
Doors Windows Typ Windows Typ Floor Walls Roof Total area of of Internal wall * Internal floor Internal ceiling * for windows and ** include the are	area e 1 e 2 127. 37.0 elements * * d roof windereas on both ss, W/K =	48 05 , m ² ows, use e sides of ir = S (A x	Openin m 11.67	gs 2 7	A ,r 2.1 3.06 6.51 37.05 115.8 37.05 201.5 59.9 90.09 37.05 37.05 alue calculut	x1 x1 x1 x1 x1 x2 x2 x2 x3 x4	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13	2K = -0.04] = -0.04] = = = = = = = = = = = = = = = = = = =	(W// 2.1 4.06 8.63 4.8165 20.85 4.82	as given in	kJ/m²-	K	kJ/K (26) (27) (27) (28) (29) (30) (31) (32c) (32c) (32d) (32e)
Doors Windows Typ Windows Typ Floor Walls Roof Total area of of Internal wall * Internal floor Internal ceiling * for windows and ** include the are Fabric heat lo	area e 1 e 2 127. 37.0 elements * * d roof winder as on both ss, W/K = Cm = S(ows, use esides of ire	Openin m 11.67 0 effective winternal wall U)	gs 2 7 Indow U-vals and part	A ,r 2.1 3.06 6.51 37.05 115.8 37.05 201.5 59.9 90.09 37.05 37.05 alue calculatitions	x1 x1 x x x x x x x x x x x x x x x x x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13	2K = -0.04] = -0.04] = -0.04] = = = = = = = = = = = = = = = = = = =	(W/ 2.1 4.06 8.63 4.8165 20.85 4.82	as given in (2) + (32a).	kJ/m²-	K	(26) (27) (27) (28) (29) (30) (31) (32c) (32c) (32c) (32d) (32e)

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can be used instead of a detailed calculation.

	endix K	(9.03	(36)
if details of thermal bridging are not known (36) = $0.05 \times (31)$)								_
Total fabric heat loss				. ,	(36) =			54.29	(37)
Ventilation heat loss calculated monthly	-				= 0.33 × (25)m x (5)		1	
Jan Feb Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m= 37.1 36.87 36.63 35.54 35.34	34.39	34.39	34.21	34.75	35.34	35.75	36.18		(38)
Heat transfer coefficient, W/K				(39)m	= (37) + (38)m			
(39)m= 91.4 91.16 90.93 89.84 89.63	88.68	88.68	88.5	89.05	89.63	90.04	90.48		
Heat loss parameter (HLP), W/m²K					Average = = (39)m ÷	Sum(39) _{1.} · (4)	12 /12=	89.83	(39)
(40)m= 1.23 1.23 1.23 1.21 1.21	1.2	1.2	1.19	1.2	1.21	1.22	1.22		
	•			,	Average =	Sum(40) ₁ .	12 /12=	1.21	(40)
Number of days in month (Table 1a)	. 1		. 1		_		_	1	
Jan Feb Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		(44)
(41)m= 31 28 31 30 31	30	31	31	30	31	30	31		(41)
4. Water heating energy requirement:							kWh/ye	ear:	
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.00034 if TFA £ 13.9, N = 1	19 x (TF	A -13.9))2)] + 0.0	0013 x (ΓFA -13		34		(42)
Annual average hot water usage in litres per day	/ Vd.ave	erage =	(25 x N)	+ 36		89	81]	(43)
Reduce the annual average hot water usage by 5% if the dw	velling is c	designed t			e target o		.01		(1.0)
not more that 125 litres per person per day (all water use, ho	ot and col	(d)						-	
Jan Feb Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = fact	tor from T	able 1c x	(43)					_	
(44)m= 98.79 95.2 91.6 88.01 84.42	80.83	80.83							
			84.42	88.01	91.6	95.2	98.79		
Figure a contact of last contact contact and contact of manufacture.	00 \/-/				Γotal = Su	m(44) ₁₁₂ =	:	1077.7	(44)
Energy content of hot water used - calculated monthly = 4.15	· · ·		Tm / 3600	kWh/mon	Total = Su th (see Ta	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1077.7	(44)
Energy content of hot water used - calculated monthly = 4.19 (45)m=	90 x Vd,m	n x nm x D 88.44		kWh/mon	Fotal = Su th (see Ta 119.69	m(44) ₁₁₂ = ables 1b, 1	c, 1d)		`
(45)m= 146.5 128.13 132.22 115.27 110.61	95.45	88.44	0Tm / 3600 101.49	kWh/mon 102.7	Fotal = Su th (see Ta 119.69	m(44) ₁₁₂ = ables 1b, 1	c, 1d)	1077.7	(44)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water s	95.45 storage), e	88.44 enter 0 in	7m / 3600 101.49 boxes (46)	102.7 to (61)	Fotal = Su th (see Ta 119.69	m(44) ₁₁₂ = ables 1b, 1. 130.65 m(45) ₁₁₂ =	141.88		(45)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water seconds) (46)m= 21.98 19.22 19.83 17.29 16.59	95.45	88.44	0Tm / 3600 101.49	kWh/mon 102.7	Fotal = Su th (see Ta 119.69	m(44) ₁₁₂ = ables 1b, 1	c, 1d)		`
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water s	95.45 storage), 6	88.44 enter 0 in 13.27	DTm / 3600 101.49 boxes (46) 15.22	102.7 to (61)	Total = Su th (see Ta 119.69 Total = Su 17.95	m(44) ₁₁₂ = m(44) ₁₁₂ = m(44) ₁₁₂ = 19.6	141.88		(45)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water start) (46)m= 21.98 19.22 19.83 17.29 16.59 Water storage loss: Storage volume (litres) including any solar or W	95.45 storage), 6	88.44 enter 0 in 13.27 storage	101.49 boxes (46) 15.22 within sa	102.7 to (61)	Total = Su th (see Ta 119.69 Total = Su 17.95	m(44) ₁₁₂ = m(44) ₁₁₂ = m(44) ₁₁₂ = 19.6	141.88 21.28		(45)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water starting at point of use starting at point of use (no hot water starting at point of use) Water storage loss:	95.45 storage), 6 14.32 WHRS stater 110	88.44 enter 0 in 13.27 storage	boxes (46) 15.22 within sa	102.7 102.7 1 to (61) 15.41	Total = Su th (see Ta 119.69 Total = Su 17.95	m(44) ₁₁₂ = ables 1b, 1 130.65 m(45) ₁₁₂ =	141.88 21.28		(45)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water starting to the startin	95.45 storage), 6 14.32 WHRS stater 110	88.44 enter 0 in 13.27 storage	boxes (46) 15.22 within sa	102.7 102.7 1 to (61) 15.41	Total = Su th (see Ta 119.69 Total = Su 17.95	m(44) ₁₁₂ = ables 1b, 1 130.65 m(45) ₁₁₂ =	141.88 21.28		(45)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water second seco	95.45 storage), 6 14.32 WHRS start 110 stantan	88.44 enter 0 in 13.27 storage litres in eous co	boxes (46) 15.22 within sa	102.7 102.7 1 to (61) 15.41	Total = Su th (see Ta 119.69 Total = Su 17.95	m(44) ₁₁₂ = ables 1b, 1 130.65 m(45) ₁₁₂ = 19.6	141.88 21.28		(45)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water starting	95.45 storage), 6 14.32 WHRS start 110 stantan	88.44 enter 0 in 13.27 storage litres in eous co	boxes (46) 15.22 within sa	102.7 102.7 1 to (61) 15.41	Total = Su th (see Ta 119.69 Total = Su 17.95	m(44) ₁₁₂ = ables 1b, 1 130.65 m(45) ₁₁₂ = 19.6	21.28		(45) (46) (47)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water second seco	95.45 storage), 6 14.32 WHRS sater 110 stantan vn (kWh	88.44 enter 0 in 13.27 storage values in eous coulday):	boxes (46) 15.22 within sa	102.7 102.7 10 to (61) 15.41 15.41 15.41 15.41	Total = Su th (see Ta 119.69 Total = Su 17.95	m(44) ₁₁₂ = ables 1b, 1 130.65 m(45) ₁₁₂ = 19.6	21.28		(45) (46) (47)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water starting at point of use (no hot water starting at point of use) (46)m= 21.98 19.22 19.83 17.29 16.59 Water storage loss: Storage volume (litres) including any solar or WN of the storage loss: Otherwise if no stored hot water (this includes in Water storage loss: a) If manufacturer's declared loss factor is known Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor	95.45 storage), 6 14.32 WHRS start 110 stantan vn (kWh	88.44 enter 0 in 13.27 storage in eous co //day):	101.49 boxes (46) 15.22 within sa (47) mbi boile	102.7 102.7 10 to (61) 15.41 15.41 15.41 15.41	Total = Su th (see Ta 119.69 Total = Su 17.95	m(44) ₁₁₂ = ables 1b, 1 130.65 m(45) ₁₁₂ = 19.6	21.28 0		(45) (46) (47) (48) (49) (50)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water starting at point of use) (46)m= 21.98 19.22 19.83 17.29 16.59 Water storage loss: Storage volume (litres) including any solar or WN If community heating and no tank in dwelling, en Otherwise if no stored hot water (this includes in Water storage loss: a) If manufacturer's declared loss factor is known Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor Hot water storage loss factor from Table 2 (kWh).	95.45 storage), 6 14.32 WHRS start 110 stantan vn (kWh	88.44 enter 0 in 13.27 storage in eous co //day):	101.49 boxes (46) 15.22 within sa (47) mbi boile	102.7 102.7 10 to (61) 15.41 15.41 15.41 15.41	Total = Su th (see Ta 119.69 Total = Su 17.95	m(44) ₁₁₂ = ables 1b, 1 130.65 m(45) ₁₁₂ = 19.6	21.28		(45) (46) (47) (48) (49)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water starting at point of use) (46)m= 21.98 19.22 19.83 17.29 16.59 Water storage loss: Storage volume (litres) including any solar or Water storage in storage and no tank in dwelling, en Otherwise if no stored hot water (this includes in Water storage loss: a) If manufacturer's declared loss factor is known Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor Hot water storage loss factor from Table 2 (kWh/lif community heating see section 4.3	95.45 storage), 6 14.32 WHRS start 110 stantan vn (kWh	88.44 enter 0 in 13.27 storage in eous co //day):	101.49 boxes (46) 15.22 within sa (47) mbi boile	102.7 102.7 10 to (61) 15.41 15.41 15.41 15.41	Total = Su th (see Ta 119.69 Total = Su 17.95	m(44) ₁₁₂ = ables 1b, 1 130.65 m(45) ₁₁₂ = 19.6	21.28 0		(45) (46) (47) (48) (49) (50) (51)
(45)m= 146.5 128.13 132.22 115.27 110.61 If instantaneous water heating at point of use (no hot water storage loss: Storage volume (litres) including any solar or WN If community heating and no tank in dwelling, en Otherwise if no stored hot water (this includes in Water storage loss: a) If manufacturer's declared loss factor is known Temperature factor from Table 2b Energy lost from water storage, kWh/year b) If manufacturer's declared cylinder loss factor Hot water storage loss factor from Table 2 (kWh).	95.45 storage), 6 14.32 WHRS start 110 stantan vn (kWh	88.44 enter 0 in 13.27 storage in eous co //day):	101.49 boxes (46) 15.22 within sa (47) mbi boile	102.7 102.7 10 to (61) 15.41 15.41 15.41 15.41	Total = Su th (see Ta 119.69 Total = Su 17.95	m(44) ₁₁₂ = ables 1b, 1 130.65 m(45) ₁₁₂ = 19.6	21.28 0		(45) (46) (47) (48) (49) (50)

Enter (50) o	rom water	_	, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0	(54)
Water storage	` , ` `	,	for each	month			((56)m = (55) × (41)ı	m		0	(55)
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0	(56)
If cylinder conta			rage, (57)				-	-	_	-	_	` '
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0	(57)
Primary circu	uit loss (ar	nual) fro	m Table	3	•						0	(58)
Primary circu					59)m = ((58) ÷ 36	55 × (41)	m				•
(modified	by factor fr	rom Tab	le H5 if t	here is s	solar 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 o	alculated	for each	month ((61)m =	(60) ÷ 36	65 × (41))m					
(61)m= 50.34	43.82	46.68	43.4	43.02	39.86	41.19	43.02	43.4	46.68	46.95	50.34	(61)
Total heat re	quired for	water h	eating ca	alculated	for eacl	h month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m
(62)m= 196.8	4 171.95	178.9	158.68	153.63	135.31	129.63	144.51	146.11	166.37	177.6	192.22	(62)
Solar DHW inpu									r contributi	on to wate	er heating)	
(add addition		ı —	r	ı —	· · ·	·						(63)
(63)m= 0	0	0	0	0	0	0	0	0	0	0	0	(63) (G.
FHRS 0	0	0	0	0	0	0	0	0	0	0	0	(03) (0.
Output from (64)m= 196.8		ter 178.9	158.68	153.63	135.31	129.63	144.51	146.11	166.37	177.6	192.22	
(64)m= 196.8	4 171.95	170.9	130.00	155.65	133.31	129.03			ater heater		<u> </u>	1951.74 (64)
Heat gains fi	rom water	heating	k\//h/m/	onth 0.2	5 ′ [N 95	v (45)m	·			,		· · ·
(65)m= 61.3		55.63	49.18	47.53	41.7	39.7	44.5	45	51.47	55.18	59.76	(65)
include (5		ļ.	<u> </u>	ļ	ļ	ļ			ļ.			
,	•	Jaiation	o. (oo)	O , o				or not w	ater is tr			eating
		Table 5	and 5a):	,		aweiling	or not w	ater is tr	OIII COIII	munity n	leating
Metabolic da	· ·		and 5a):			aweiling	or not w	ater is ir	om com	munity n	eating
Metabolic ga	ins (Table): May	Jun	Jul	Aug		Oct	Nov	Dec	leating
	ains (Table Feb	5), Wat	ts			Jul 117.07		Sep				leating (66)
Jan	ins (Table Feb 7 117.07	5), Wat Mar 117.07	ts Apr 117.07	May 117.07	Jun 117.07	117.07	Aug 117.07	Sep 117.07	Oct	Nov	Dec	
(66)m= 117.0	rins (Table Feb 1 117.07	5), Wat Mar 117.07	ts Apr 117.07	May 117.07	Jun 117.07	117.07	Aug 117.07	Sep 117.07	Oct	Nov	Dec	
Jan (66)m= 117.0 Lighting gair	rains (Table Feb 117.07 ras (calcula 17.87	• 5), Wat Mar 117.07 ted in Ap	Apr 117.07 opendix	May 117.07 L, equat 8.22	Jun 117.07 ion L9 or	117.07 r L9a), a 7.5	Aug 117.07 Iso see	Sep 117.07 Table 5	Oct 117.07	Nov 117.07	Dec 117.07	(66)
Jan (66)m= 117.0 Lighting gair (67)m= 20.12	rains (Table Feb 7 117.07 ns (calcular 2 17.87 gains (calc	• 5), Wat Mar 117.07 ted in Ap	Apr 117.07 opendix	May 117.07 L, equat 8.22	Jun 117.07 ion L9 or	117.07 r L9a), a 7.5	Aug 117.07 Iso see	Sep 117.07 Table 5	Oct 117.07	Nov 117.07	Dec 117.07	(66)
Jan (66)m= 117.0 Lighting gair (67)m= 20.12 Appliances g	rains (Table Feb 7 117.07 ns (calcula 2 17.87 gains (calc 7 208.82	5), Wat Mar 117.07 ted in Ap 14.53 ulated in 203.41	Apr 117.07 ppendix 11 Appendix 191.91	May 117.07 L, equat 8.22 dix L, eq 177.38	Jun 117.07 ion L9 or 6.94 uation L	117.07 r L9a), a 7.5 13 or L1 154.61	Aug 117.07 Iso see 9.75 3a), also	Sep 117.07 Table 5 13.09 see Ta 157.87	Oct 117.07 16.62 ble 5 169.38	Nov 117.07	Dec 117.07	(66) (67)
Jan (66)m= 117.0 Lighting gair (67)m= 20.12 Appliances Q (68)m= 206.6	rains (Table Feb 117.07 ras (calcular 17.87 gains (calcular 208.82 ras (calcular	5), Wat Mar 117.07 ted in Ap 14.53 ulated in 203.41	Apr 117.07 ppendix 11 Appendix 191.91	May 117.07 L, equat 8.22 dix L, eq 177.38	Jun 117.07 ion L9 or 6.94 uation L	117.07 r L9a), a 7.5 13 or L1 154.61	Aug 117.07 Iso see 9.75 3a), also	Sep 117.07 Table 5 13.09 see Ta 157.87	Oct 117.07 16.62 ble 5 169.38	Nov 117.07	Dec 117.07	(66) (67)
Jan (66)m= 117.0 Lighting gair (67)m= 20.12 Appliances g (68)m= 206.6 Cooking gair	rains (Table Feb 117.07 Ins (calcular 217.87 Igains (calcular 7208.82 Ins (calcular 34.71	5), Wat Mar 117.07 ted in Ap 14.53 ulated in 203.41 tted in A	Apr 117.07 opendix 11 Appendix 191.91 opendix 34.71	May 117.07 L, equat 8.22 dix L, eq 177.38 L, equat	Jun 117.07 ion L9 or 6.94 uation L 163.73	117.07 r L9a), a 7.5 13 or L1 154.61 or L15a)	Aug 117.07 Iso see 9.75 3a), also 152.47	Sep 117.07 Table 5 13.09 see Ta 157.87 ee Table	Oct 117.07 16.62 ble 5 169.38	Nov 117.07 19.4 183.9	Dec 117.07 20.68	(66) (67) (68)
Jan (66)m= 117.0 Lighting gair (67)m= 20.12 Appliances (68)m= 206.6 Cooking gair (69)m= 34.7	rains (Table Feb 117.07 Ins (calcular 217.87 Igains (calcular 7208.82 Ins (calcular 34.71	5), Wat Mar 117.07 ted in Ap 14.53 ulated in 203.41 tted in A	Apr 117.07 opendix 11 Appendix 191.91 opendix 34.71	May 117.07 L, equat 8.22 dix L, eq 177.38 L, equat	Jun 117.07 ion L9 or 6.94 uation L 163.73	117.07 r L9a), a 7.5 13 or L1 154.61 or L15a)	Aug 117.07 Iso see 9.75 3a), also 152.47	Sep 117.07 Table 5 13.09 see Ta 157.87 ee Table	Oct 117.07 16.62 ble 5 169.38	Nov 117.07 19.4 183.9	Dec 117.07 20.68	(66) (67) (68)
Jan (66)m= 117.0 Lighting gair (67)m= 20.12 Appliances g (68)m= 206.6 Cooking gair (69)m= 34.7 Pumps and f	rains (Table Feb Tel Tilton Ti	117.07 ted in Ap 14.53 ulated ir 203.41 tted in A 34.71 (Table \$	Apr 117.07 opendix 11 Append 191.91 opendix 34.71 5a)	May 117.07 L, equat 8.22 dix L, eq 177.38 L, equat 34.71	Jun 117.07 ion L9 or 6.94 uation L 163.73 tion L15 34.71	117.07 r L9a), a 7.5 13 or L1 154.61 or L15a) 34.71	Aug 117.07 Iso see 9.75 3a), also 152.47 , also se 34.71	Sep 117.07 Table 5 13.09 see Ta 157.87 ee Table 34.71	Oct 117.07 16.62 ble 5 169.38 5 34.71	Nov 117.07 19.4 183.9	Dec 117.07 20.68 197.55	(66) (67) (68) (69)
Jan (66)m= 117.0 Lighting gair (67)m= 20.12 Appliances G (68)m= 206.6 Cooking gair (69)m= 34.7 Pumps and f (70)m= 3	rains (Table Feb Teb Til 117.07 Tes (calcular Til 17.87 Tes (calcular Til 208.82 Tes (calcular Til 34.71 Teans gains Teans gains Tes (calcular Teans gains Tes (calcular Teans gains	117.07 ted in Ap 14.53 ulated ir 203.41 tted in A 34.71 (Table \$	Apr 117.07 opendix 11 Append 191.91 opendix 34.71 5a)	May 117.07 L, equat 8.22 dix L, eq 177.38 L, equat 34.71	Jun 117.07 ion L9 or 6.94 uation L 163.73 tion L15 34.71	117.07 r L9a), a 7.5 13 or L1 154.61 or L15a) 34.71	Aug 117.07 Iso see 9.75 3a), also 152.47 , also se 34.71	Sep 117.07 Table 5 13.09 see Ta 157.87 ee Table 34.71	Oct 117.07 16.62 ble 5 169.38 5 34.71	Nov 117.07 19.4 183.9	Dec 117.07 20.68 197.55	(66) (67) (68) (69)
Jan (66)m= 117.0 Lighting gair (67)m= 20.12 Appliances Q (68)m= 206.6 Cooking gair (69)m= 34.7 Pumps and f (70)m= 3 Losses e.g.	rains (Table Feb Tel Times (calcula	117.07 ted in Ap 14.53 ulated in 203.41 tted in A 34.71 (Table 5 3 on (negar	Apr 117.07 ppendix 11 Appendix 191.91 ppendix 34.71 5a) 3	May 117.07 L, equat 8.22 dix L, eq 177.38 L, equat 34.71 3 es) (Tab	Jun 117.07 ion L9 or 6.94 uation L 163.73 tion L15 34.71	117.07 r L9a), a 7.5 13 or L1 154.61 or L15a) 34.71	Aug 117.07 Iso see 9.75 3a), also 152.47 , also se 34.71	Sep 117.07 Table 5 13.09 see Ta 157.87 ee Table 34.71	Oct 117.07 16.62 ble 5 169.38 5 34.71	Nov 117.07 19.4 183.9 34.71	Dec 117.07 20.68 197.55 34.71	(66) (67) (68) (69) (70)
Jan (66)m= 117.0 Lighting gair (67)m= 20.12 Appliances g (68)m= 206.6 Cooking gair (69)m= 34.7 Pumps and f (70)m= 3 Losses e.g. (71)m= -93.6	ains (Table Feb The Interpretation of the In	117.07 ted in Ap 14.53 ulated in 203.41 tted in A 34.71 (Table 5 3 on (negar	Apr 117.07 ppendix 11 Appendix 191.91 ppendix 34.71 5a) 3	May 117.07 L, equat 8.22 dix L, eq 177.38 L, equat 34.71 3 es) (Tab	Jun 117.07 ion L9 or 6.94 uation L 163.73 tion L15 34.71	117.07 r L9a), a 7.5 13 or L1 154.61 or L15a) 34.71	Aug 117.07 Iso see 9.75 3a), also 152.47 , also se 34.71	Sep 117.07 Table 5 13.09 see Ta 157.87 ee Table 34.71	Oct 117.07 16.62 ble 5 169.38 5 34.71	Nov 117.07 19.4 183.9 34.71	Dec 117.07 20.68 197.55 34.71	(66) (67) (68) (69) (70)
Jan (66)m= 117.0 Lighting gair (67)m= 20.12 Appliances G (68)m= 206.6 Cooking gair (69)m= 34.7 Pumps and f (70)m= 3 Losses e.g. G (71)m= -93.6 Water heating	ains (Table Feb Teb Til.7.07 Tes (calcula Til.87 Tes (calcula Til.	117.07 ted in Ap 14.53 ulated in 203.41 tted in A 34.71 (Table 5 3 on (nega) -93.66 Table 5) 74.78	Apr 117.07 opendix 11 Append 191.91 opendix 34.71 5a) 3 tive valu	May 117.07 L, equat 8.22 dix L, eq 177.38 L, equat 34.71 3 es) (Tab	Jun 117.07 ion L9 or 6.94 uation L 163.73 tion L15 34.71 3 ole 5) -93.66	117.07 r L9a), a 7.5 13 or L1 154.61 or L15a) 34.71 3	Aug 117.07 Iso see 9.75 3a), also 152.47 , also se 34.71 3	Sep 117.07 Table 5 13.09 see Ta 157.87 ee Table 34.71 3	Oct 117.07 16.62 ble 5 169.38 5 34.71 3	Nov 117.07 19.4 183.9 34.71 3 -93.66	Dec 117.07 20.68 197.55 34.71 3 -93.66	(66) (67) (68) (69) (70) (71)

6. Solar gair	ns:													
Solar gains are	calculated using	solar	flux from Table 6	a an	d assoc	iated equa	tions	to convert to t	he appl	icable orient	ation.			
Orientation:	Access Factor Table 6d	•	Area m²		Flu Tal	x ole 6a		g_ Table 6b)	FF Table 60	;		Gains (W)	
Southeast 0.9x	0.77	X	6.51	x	3	6.79	x	0.63	X	0.7		=	73.2	(77)
Southeast 0.9x	0.77	X	6.51	×	6	2.67	x	0.63	×	0.7		=	124.69	(77)
Southeast 0.9x	0.77	X	6.51	×	8	5.75	x	0.63	×	0.7		=	170.61	(77)
Southeast 0.9x	0.77	X	6.51	×	1	06.25	x	0.63	×	0.7		=	211.39	(77)
Southeast 0.9x	0.77	X	6.51	×	1	19.01	х	0.63	×	0.7		=	236.78	(77)
Southeast 0.9x	0.77	X	6.51	×	1	18.15	x	0.63	X	0.7		=	235.06	(77)
Southeast 0.9x	0.77	X	6.51	×	1	13.91	x	0.63	×	0.7		=	226.63	(77)
Southeast 0.9x	0.77	X	6.51	×	1	04.39	x	0.63	X	0.7		=	207.69	(77)
Southeast 0.9x	0.77	X	6.51	×	9	2.85	x	0.63	X	0.7		=	184.73	(77)
Southeast 0.9x	0.77	X	6.51	×	6	9.27	x	0.63	×	0.7		=	137.81	(77)
Southeast 0.9x	0.77	X	6.51	×	4	4.07	x	0.63	X	0.7		=	87.68	(77)
Southeast 0.9x	0.77	X	6.51	×	3	1.49	x	0.63	X	0.7		=	62.65	(77)
Northwest 0.9x	0.77	X	3.06	×	1	1.28	x	0.63	X	0.7		=	10.55	(81)
Northwest 0.9x	0.77	X	3.06	X	2	2.97	x	0.63	X	0.7		=	21.48	(81)
Northwest 0.9x	0.77	X	3.06	X	4	1.38	x	0.63	×	0.7		=	38.7	(81)
Northwest 0.9x	0.77	X	3.06	x	6	7.96	x	0.63	X	0.7		=	63.55	(81)
Northwest 0.9x	0.77	X	3.06	X	9	1.35	x	0.63	×	0.7		=	85.42	(81)
Northwest 0.9x	0.77	X	3.06	×	9	7.38	X	0.63	X	0.7		=	91.07	(81)
Northwest 0.9x	0.77	X	3.06	×	!	91.1	X	0.63	X	0.7		=	85.2	(81)
Northwest 0.9x	0.77	X	3.06	X	7	2.63	X	0.63	X	0.7		=	67.92	(81)
Northwest 0.9x	0.77	X	3.06	×	5	0.42	X	0.63	X	0.7		=	47.15	(81)
Northwest 0.9x	0.77	X	3.06	×	2	8.07	x	0.63	X	0.7		=	26.25	(81)
Northwest 0.9x	0.77	X	3.06	×		14.2	X	0.63	X	0.7		=	13.28	(81)
Northwest 0.9x	0.77	X	3.06	X		9.21	X	0.63	X	0.7		=	8.62	(81)
Color going in	vuotta aalaula	+ o d	for each man	4h			(02\ w	- Cum(74)m	(02)	•				
(83)m= 83.75	1 watts, calcula 146.17 209		274.94 322.2		326.14	311.82	275	n = Sum(74)m $1.61 = 231.88$	164.	1	71.	26]	(83)
	internal and so								1					, ,
(84)m= 454.06		_	607.28 632.8	_	615.85	588.43	558	.76 526.47	480.	36 442.02	2 430	.94]	(84)
7. Mean inte	ernal temperatu	ıre (heating seaso	on)					•		,			
	e during heatin				area	from Tab	ole 9	, Th1 (°C)					21	(85)
Utilisation fa	ctor for gains f	or li	ving area, h1,	m (s	see Ta	ble 9a)								
Jan	Feb Ma	ar	Apr Ma	y T	Jun	Jul	Α	ug Sep	0	t Nov	, D	ес		
(86)m= 1	1 0.9	9	0.97 0.92		0.79	0.63	0.6	0.89	0.9	3 1	1			(86)
Mean intern	al temperature	in li	ving area T1	(follo	ow ste	ps 3 to 7	7 in T	able 9c)						
(87)m= 19.66	19.81 20.0	5	20.38 20.69		20.9	20.98	20.	96 20.81	20.4	2 19.98	19.	64		(87)
Temperature	e during heatin	g pe	eriods in rest o	of dv	welling	from Ta	able 9	9, Th2 (°C)					_	
(88)m= 19.89	19.9 19.	9	19.91 19.91		19.92	19.92	19.	92 19.92	19.9	19.91	19	.9		(88)

Litilica	tion fac	tor for a	aine for I	rest of d	welling, I	n2 m (se	o Table	02)						
(89)m=	1	0.99	0.99	0.96	0.88	0.7	0.49	0.54	0.82	0.97	0.99	1		(89)
L									7 in Tabl	<u> </u>	0.00	·		, ,
(90)m=	18.12	18.33	18.68	19.17	19.59	19.85	19.91	19.91	19.76	19.23	18.6	18.09		(90)
(00)		10.00	15.55		10100				!	LA = Livin			0.2	(91)
	. ,					\		/4 (1	A\			'		
г	18.43	18.63	ature (fo	r the wh	ole dwel	ling) = fi 20.07	20.13	<u> </u>		10.40	10.00	10.4		(92)
(92)m= L								20.13	19.98	19.48	18.88	18.4		(92)
(93)m=	18.43	18.63	18.96	19.41	19.81	20.07	20.13	20.13	19.98	19.48	18.88	18.4		(93)
			uirement		13.01	20.01	20.13	20.13	13.30	13.40	10.00	10.4		(00)
					e obtain	ed at ste	ep 11 of	Table 9l	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
the uti	lisation		or gains		ble 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
г			ains, hm									- 1		(5.1)
(94)m=	1	0.99	0.98	0.95	0.88	0.72	0.52	0.57	0.83	0.96	0.99	1		(94)
Г			, W = (94	<u> </u>		440.44	000.40	040.00	405.00	400 77	100 17	400.44		(OE)
(95)m=	452.01	509.3	552.91	579.33	557.19	442.14	306.12	318.89	435.22	462.77	438.17	429.41		(95)
Г	_{4.3}	age exte	rnai tem	perature 8.9	from Ta	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
(96)m= L									14.1 _ (96)m		7.1	4.2		(90)
			1133.33		727.16	484.8	313.08	329.69	523.36	795.69	1060.86	1285.16		(97)
` ')m – (95			1200.10		(0.)
(98)m=	624.63	498.92	431.84	262.93	126.46	0	0	0	0	247.69	448.34	636.68		
` ′ L			ļ				<u> </u>	<u>I</u> Tota	l per year	<u>l</u> (kWh/vear) = Sum(9	8) ₁₅₉₁₂ =	3277.48	(98)
Space	heatin	a require	ement in	kWh/m²	/vear					(**************************************	,(-		44.23	` (99)
·	·	•			eating sy	reteme i	ncluding	micro-C	'HDI					
	heatir		ito — iriui	Mudai II	calling sy	/Sterris i	ricidaling	TIIIOIO-C) III <i>)</i>					
•		_	nt from so	econdary	y/supple	mentary	system					[0	(201)
Fraction	on of sp	ace hea	at from m	nain syst	em(s)		•	(202) = 1 -	- (201) =				1	(202)
Fraction	on of to	tal heati	ng from	main sys	stem 1			(204) = (2	02) x [1 –	(203)] =			1	(204)
Efficie	ncy of r	main spa	ace heat	ing syste	em 1							İ	93.4	(206)
Efficie	ncy of s	seconda	ry/suppl	ementar	y heating	g system	າ, %						0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	- ar
Space	heatin	g require	ement (c	alculated	d above)									
	624.63	498.92	431.84	262.93	126.46	0	0	0	0	247.69	448.34	636.68		
(211)m	= {[(98])m x (20	4)] } x 1	00 ÷ (20	06)									(211)
	668.77	534.17	462.35	281.51	135.4	0	0	0	0	265.19	480.02	681.67		
_	-		-	-	-		_	Tota	I (kWh/yea	ar) =Sum(2	211),,,,5,10,12	=	3509.08	(211)
Space	heating	g fuel (s	econdar	y), kWh/	month							'		
= {[(98 <u>)</u>	m x (20)1)]}x1	00 ÷ (20	8)						-				
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		_
								Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)

196.84 171.95 178.9 158.68 153.63 1	135.31 129.	3 144.51	146.11	166.37	177.6	192.22		
Efficiency of water heater	ļ .						80.3	(2
217)m= 87.76 87.58 87.19 86.31 84.57	80.3 80.	80.3	80.3	86.05	87.29	87.84		」 (2
uel for water heating, kWh/month	•	•	•			•	l	
(64) m x (64) m x (217) m (219) m= $(224.31 \ 196.34 \ 205.19 \ 183.84 \ 181.66 \ (217)$ m (219) m= $(224.31 \ 196.34 \ 205.19 \ 183.84 \ 181.66 \ (217)$ m	168.5 161.	4 179.96	181.95	193.34	203.47	218.84		
			al = Sum(2				2298.84	7(2
Annual totals				k\	Wh/yeaı	, ,	kWh/year	┛`
Space heating fuel used, main system 1					-		3509.08	
Vater heating fuel used							2298.84	7
Electricity for pumps, fans and electric keep-hot								_
central heating pump:						30		(23
boiler with a fan-assisted flue						45		(23
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =			75	(23
Total electricity for the above, kWh/year Electricity for lighting		sum	of (230a).	(230g) =				╡
Electricity for lighting	(231) + (23			(230g) =			355.33] (23
Electricity for lighting Fotal delivered energy for all uses (211)(221) +	. , .	2)(237b)	=	(230g) =				(23 (23 (33
Total electricity for the above, kWh/year Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system	ns including	2)(237b)	=			tor	355.33 6238.25	(23
Electricity for lighting Fotal delivered energy for all uses (211)(221) +	. , .	2)(237b) micro-CHF	=		ion fac	tor	355.33	(23
Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system	ns including Energy	2)(237b) micro-CHF	=	Emiss	ion fac 2/kWh	tor =	355.33 6238.25 Emissions	(23
Electricity for lighting Fotal delivered energy for all uses (211)(221) +	Energy kWh/ye	2)(237b) micro-CHF	=	Emiss kg CO	ion fac 2/kWh		355.33 6238.25 Emissions kg CO2/yea](23](33
Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary)	Energy kWh/ye	2)(237b) micro-CHF	=	Emiss kg CO2 0.2 0.5	ion fac 2/kWh 16	=	355.33 6238.25 Emissions kg CO2/yea 757.96	(2 ²) (3 ³) (3 ³) (3 ³) (2 ⁴)
Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Water heating	Energy kWh/ye (211) x (215) x (219) x	2)(237b) micro-CHF	=	Emiss kg CO2	ion fac 2/kWh 16	=	355.33 6238.25 Emissions kg CO2/yea 757.96 0 496.55	(23) (33) (34)
Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1) Space heating (secondary) Vater heating Space and water heating	Energy kWh/ye (211) x (215) x (219) x (261) + (20	2)(237b) micro-CHF ar	=	Emiss kg CO2 0.2 0.5 0.2	ion fac 2/kWh 16 19 16	=	355.33 6238.25 Emissions kg CO2/yea 757.96 0 496.55	(2: (3: (3: (2: (2: (2:
Electricity for lighting Total delivered energy for all uses (211)(221) + 12a. CO2 emissions – Individual heating system Space heating (main system 1)	Energy kWh/ye (211) x (215) x (219) x	2)(237b) micro-CHF ar	=	Emiss kg CO2 0.2 0.5	ion fac 2/kWh 16 19	= = =	355.33 6238.25 Emissions kg CO2/yea 757.96 0 496.55	(2 ²) (3 ³) (3 ³) (3 ³) (2 ⁴)

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