# **Regulations Compliance Report**

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.58 *Printed on 21 October 2022 at 12:33:23* 

Project Informatio	n:				
Assessed By:	Ben Marsh (STRC	0005374)	Building Type:	Detached House	
Dwelling Details:					
NEW DWELLING	DESIGN STAGE		Total Floor Area: 1	05.94m²	
Site Reference :	New Project		Plot Reference:	Plot 8	
Address :	Plot 8				
Client Details:					
Name:					
Address :					
•	s items included w te report of regulat	rithin the SAP calculations. tions compliance.			
1a TER and DER					
Fuel for main heati	ng system: Mains g	as			
Fuel factor: 1.00 (n					
•	xide Emission Rate ioxide Emission Ra	· · · ·	17.41 kg/m² 15.69 kg/m²		ок
1b TFEE and DF			10.00 Kg/m		UN
	gy Efficiency (TFEE	E)	53.7 kWh/m²		
Dwelling Fabric En	ergy Efficiency (DF	EE)	46.2 kWh/m <sup>2</sup>		
					ОК
2 Fabric U-value	S	•	U" alt a st		
Element External v	vall	<b>Average</b> 0.17 (max. 0.30)	<b>Highest</b> 0.17 (max. 0.70)		ок
Floor	vali	0.17 (max. 0.30) 0.14 (max. 0.25)	0.17 (max. 0.70) 0.14 (max. 0.70)		OK
Roof		0.11 (max. 0.20)	0.11 (max. 0.35)		ОК
Openings		1.40 (max. 2.00)	1.40 (max. 3.30)		ОК
2a Thermal bridg	ging				
		rom linear thermal transmitta	nces for each junction		
3 Air permeabilit			5 00 ( 1	````	
Air permeat Maximum	pility at 50 pascals		5.00 (design valı 10.0	ue)	ок
					•
4 Heating efficier Main Heatin		Database: (rev 507, produ	ct index 017953):		
Main Healin	ig system.	· · ·	ors or underfloor heating - ma	ains das	
		Brand name: Vaillant	ine en anderneen needing me	une gae	
		Model: ecoTEC exclusive			
		Model qualifier: VUW 356/ (Combi)	5-7 (H-GB)		
		Efficiency 89.7 % SEDBUł	<2009		
		Minimum 88.0 %			ок
Secondary I	neating system:	None			

# **Regulations Compliance Report**

5 Cylinder insulation			
Hot water Storage:	No cylinder		
6 Controls			
Space heating controls	TTZC by plumbing and	electrical services	ОК
Hot water controls:	No cylinder thermostat		
	No cylinder		
Boiler interlock:	Yes		ОК
7 Low energy lights			
Percentage of fixed lights wi	th low-energy fittings	100.0%	
Minimum		75.0%	ОК
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (South Eas	t England):	Not assessed	?
10 Key features			
Roofs U-value		0.11 W/m²K	

# **Thermal Bridge Report**

Property Details: Plot 8					
Address: Located in: Region: Thermal bridges:	Plot 8 England South East Eng	gland			
Thermal bridges:		User-defined = UD Default = D Approved = A User-defined (individ	ual PSI-values)	Y-Value = 0.0722	
External Junctions Details:					
Junction Type Other lintels (including other steel lintels)		<b>PSI-Value</b> 0.3	<b>Length</b> 11.94	Reference	Type [A]
Sill		0.04	9	E3	[A]

Sill	0.04	9	E3	[A]
Jamb	0.05	26.79	E4	[A]
Ground floor (normal)	0.16	29.9	E5	[A]
Intermediate floor within a dwelling	0.07	29.9	E6	[A]
Gable (insulation at ceiling level)	0.24	12	E12	[A]
Eaves (insulation at ceiling level)	0.06	20.66	E10	[A]
Corner (normal)	0.09	19.2	E16	[A]



Plot 8

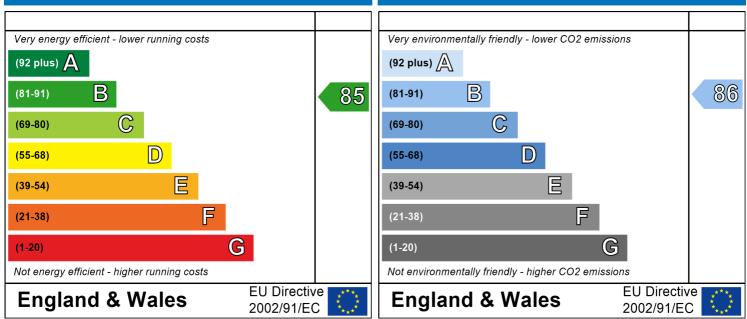
Dwelling type: Date of assessment: Produced by: Total floor area: Detached House 12 October 2022 Ben Marsh 105.94 m<sup>2</sup>

Environmental Impact (CO<sub>2</sub>) Rating

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

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

#### **Energy Efficiency Rating**



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be. The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# **SAP Input**

Property Details: Pl	ot 8							
Address: Located in: Region: UPRN: Date of assessm	ent:	Sou	t 8 Jland ith East England October 2022					
Date of certificat Assessment type Transaction type Tenure type:	2:	Nev Nev	October 2022 v dwelling design stag v dwelling ner-occupied	je				
Related party dis Thermal Mass Pa Water use <= 12 PCDF Version:	arameter:	No Ind	related party icative Value Low False					
Property description	1:							
Dwelling type: Detachment: Year Completed:		Hou Det 202	ached					
Floor Location:		Flo	or area:					
					Storey height	:		
Floor 0 Floor 1			97 m² 97 m²		2.4 m 2.4 m			
Living area: Front of dwelling fa	aces:	15.! We:	58 m² (fraction 0.147 st	7)				
Opening types:								
Name:	Source:		Туре:	Glazing:		Argon:	Fram	
Front Front	Manufacturer SAP 2012	-	Solid Windows	double-glaz	ed	Yes	PVC-U PVC-U	
Rear	SAP 2012		Windows	double-glaz		Yes	PVC-U	
Side	SAP 2012		Windows	double-glaz		Yes	PVC-U	
Name:	Gap:		Frame Facto	-	U-value:	Area:	No. o	of Openings:
Front Front	mm 16mm c	or more	0.7 0.7	0 0.76	1.4 1.4	2.14 5.38	1	
Rear	16mm c		0.7	0.76	1.4	8.432	1	
Side	16mm c		0.7	0.76	1.4	0.432	1	
Name:	Type-Nam		Location:	Orient:		Width:	Heig	ht:
Front	512		Ext Walls			0	0	
Front			Ext Walls	Unspecified		0	0	
Rear			Ext Walls	Unspecified		0	0	
Side			Ext Walls	Unspecified		0	0	
Overshading:		Ave	rage or unknown					
Opaque Elements:								
Type: ( <u>External Elements</u>	Gross area:	Opening	s: Net area:	U-value:	Ru value:	Curtain	wall:	Карра:
Ext Walls	143.52	16.66	126.86	0.17	0	False		N/A
Cold Roof	51.97	0	51.97	0.11	0			N/A
Ground Floor	53.97			0.14				N/A
Internal Elements								
Party Elements								

Thermal bridges:

# **SAP Input**

Thermal bridges:	User-define <b>Length</b>	d (individual F <b>Psi-valu</b>		Y-Value = 0.0722
[Approved]	11.94	0.3	E2	Other lintels (including other steel lintels)
[Approved]	9	0.04	E3	Sill
[Approved]	, 26.79	0.04	E4	Jamb
[Approved]	29.9	0.03	E5	Ground floor (normal)
[Approved]	29.9	0.10	E6	Intermediate floor within a dwelling
[Approved]	12	0.07	E12	Gable (insulation at ceiling level)
	20.66	0.24	E12 E10	Eaves (insulation at ceiling level)
[Approved] [Approved]	19.2	0.08	E10 E16	Corner (normal)
[Approved]	19.2	0.09	LIO	
Ventilation:				
Pressure test:	Yes (As des	ianed)		
Ventilation:		tilation (extra	ct fans)	
Number of chimneys:	0	<b>,</b>		
Number of open flues:	0			
Number of fans:	3			
Number of passive stacks:	0			
Number of sides sheltered:	2			
Pressure test:	5			
Main heating system:	3			
	Dellan susta			
Main heating system:	-	and oil boilers		lerfloor heating
	Fuel: mains		,	
		: Boiler Datab	250	
				017953) Efficiency: Winter 85.0 % Summer: 90.6
	Has integra			517733) Efficiency: Winter 03.070 Summer 70.0
	Brand name			
		TEC exclusive	832	
		fier: VUW 356		2)
			ио-и (п-G	)
	(Combi boil			
	Systems wi			
		ting pump : 2		
	Design flow Boiler interl	temperature:	Unknown	
Main heating Control:				
Main heating Control:	Time and te	emperature zo	ne control	by suitable arrangement of plumbing and electrical
3	services			
	Control cod	e: 2110		
Secondary heating system:				
Secondary heating system:	None			
Water heating:				
Water heating:	From main	heating syster	n	
5	Water code			
	Fuel :mains			
	No hot wate	•		
		eat Recovery S	System:	
		(rev 507, proc	•	)
	Solar panel			, ,
Others:				
Electricity tariff:	Standard Ta	ariff		
In Smoke Control Area:	No			
Conservatory:	No conserv	atory		
5	100%			
Low energy lights:		oan / suburba	n	
Terrain type:		Jan / Suburba		
EPC language:	English			

# **SAP** Input

Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

				User I	Details:						
Assessor Name:	Ben Marsł	า			Strom	a Num	ber:		STRO	005374	
Software Name:	Stroma FS	SAP 201	2		Softwa	are Vei	rsion:		Versio	on: 1.0.5.58	
			Pi	operty	Address	: Plot 8					
Address :	Plot 8										
1. Overall dwelling dime	ensions:										
				Are	ea(m²)		Av. Hei	ight(m)	-	Volume(m <sup>3</sup> )	_
Ground floor					53.97	(1a) x	2	2.4	(2a) =	129.53	(3a)
First floor					51.97	(1b) x	2	2.4	(2b) =	124.73	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e	e)+(1n	)	105.94	(4)			_		
Dwelling volume						(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	254.26	(5)
2. Ventilation rate:											
	main		econdar	у	other		total			m <sup>3</sup> per hou	•
Number of chimneys	heating	h 	oeating	] + Г	0	7 = Г	0	x 4	40 =	0	(6a)
Number of open flues		⊣ <sub>+</sub>	-	」 L 1 + F		」 L ヿ = Г		x 2	20 =	-	
·	0		0	] . L	0	┘╴└	0			0	(6b)
Number of intermittent fa						Ĺ	3		10 =	30	(7a)
Number of passive vents	6						0	X ?	10 =	0	(7b)
Number of flueless gas f	ires						0	X 4	40 =	0	(7c)
									A *	<b>-</b>	
						_			AIT CI	anges per ho	_
Infiltration due to chimne							30		÷ (5) =	0.12	(8)
If a pressurisation test has l Number of storeys in t			ea, proceec	1 to (17),	otherwise	continue in	om (9) to (	16)		0	(9)
Additional infiltration	no awoning (n	0)						[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel o	r timber	frame or	0.35 fc	or mason	ry constr	uction			0	(11)
if both types of wall are p			ponding to	the grea	ter wall are	a (after					
deducting areas of openi If suspended wooden	• ·		ad) or 0	1 (cool	od) olco	optor 0					
If no draught lobby, en				i (Seai	eu), eise					0	(12)
Percentage of window			rinned							0	(13)
Window infiltration		augnioi	nppou		0.25 - [0.2	2 x (14) ÷ 1	00] =			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	12) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, express	ed in cub	oic metre	s per h	our per s	quare m	etre of e	nvelope	area	5	(17)
If based on air permeabi	lity value, ther	(18) = [(1	7) ÷ 20]+(8	), otherv	vise (18) = (	(16)				0.37	(18)
Air permeability value applie	es if a pressurisati	on test has	s been don	e or a de	egree air pe	rmeability	is being us	sed			_
Number of sides sheltere	ed				(00) 1	10.075(4	10)1			2	(19)
Shelter factor	Cara a basili a sta					[0.075 x (1	[9)] =			0.85	(20)
Infiltration rate incorpora	-				(21) = (18	) x (20) =				0.31	(21)
Infiltration rate modified		· ·		1. 1	Δ	0		N.L.	Det	l	
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp		1			<b>I</b>	<u> </u>			· -	I	
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind F	actor (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	j	
Adjuste			· ·	ing for sh		I	· · ·	1	<u> </u>				1	
Calcul	0.4	0.39	0.38	0.34 rate for t	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37	I	
		al ventila	-		ne appli	capie ca	3 <del>0</del>						0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b	) = (23a)			0	(23b)
lf bala	anced with	heat reco	overy: effic	ciency in %	allowing f	or in-use f	actor (from	n Table 4h	) =				0	(23c)
a) If	balance	d mech	anical ve	entilation	with hea	at recove	ery (MVI	HR) (24a	a)m = (22	2b)m + (2	23b) × [1	– (23c)	÷ 100]	
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If	balance	d mech	anical ve	entilation	without	heat rec	covery (N	MV) (24b	)m = (22	2b)m + (2	23b)			
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
,				ntilation of then (24d	•					5 × (23b	)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,				nole hous )m = (22t	•					0.5]			ſ	
(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(24d)
Effe	ctive air	change	rate - e	nter (24a	) or (24k	o) or (24	c) or (24	d) in bo	x (25)					
(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3. He	at losse	s and he	eat loss	paramete	er:									
ELEN		Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²·l		A X k kJ/K
Doors						2.14	x	1.4	=	2.996				(26)
Windov	ws Type	e 1				5.38	x1.	/[1/( 1.4 )+	0.04] =	7.13				(27)
Windov	ws Type	e 2				8.432	<u>x</u> 1,	/[1/( 1.4 )+	0.04] =	11.18				(27)
Windov	ws Type	93				0.71	x1.	/[1/( 1.4 )+	0.04] =	0.94				(27)
Floor						53.97	7 X	0.14		7.5558	ΠΓ			(28)
Walls		143.	52	16.66	6	126.8	6 x	0.17	 ] = [	21.57	Ξ Ē		<b>⊣</b> ⊢	(29)
Roof		51.9	97	0		51.97	, x	0.11	 	5.72	= ř		<b>⊣</b> ⊢	(30)
Total a	rea of e	lements	, m²			249.4	6	L						(31)
				effective wi nternal wal			ated using	g formula 1	/[(1/U-valu	e)+0.04] a	s given in	paragraph	1 3.2	
Fabric	heat los	s, W/K	= S (A x	U)				(26)(30)	) + (32) =				57.09	(33)
Heat c	apacity	Cm = S(	(Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	7546.15	(34)
Therm	al mass	parame	ter (TM	P = Cm ÷	- TFA) ir	n kJ/m²K			Indica	tive Value:	Low		100	(35)
	-	sments wh ad of a de		etails of the culation.	construct	ion are not	t known pr	recisely the	e indicative	values of	TMP in Te	able 1f		
	-	•	,	lculated u	• •		<						18.01	(36)
	of therma abric he		are not kr	10wn (36) =	= 0.05 x (3	1)			(33)	(36) =			75.00	(27)
			alculate	d monthly						(30) = = 0.33 × (2)	25)m x (5)		75.09	(37)
, on the	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

(38)m=	48.62	48.37	48.11	46.92	46.7	45.66	45.66	45.46	46.06	46.7	47.15	47.62		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	123.72	123.46	123.2	122.01	121.79	120.75	120.75	120.56	121.15	121.79	122.24	122.71		_
Heat lo	ss para	meter (H	HLP), W/	/m²K						Average = = (39)m ÷	Sum(39) <sub>1</sub> .	12 /12=	122.01	(39)
(40)m=	1.17	1.17	1.16	1.15	1.15	1.14	1.14	1.14	1.14	1.15	1.15	1.16		
Numbe	er of day	/s in moi	nth (Tab	le 1a)					,	Average =	Sum(40)1.	12 /12=	1.15	(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	ter heat	ting enei	rgy requi	irement:								kWh/ye	ar:	
if TF				: [1 - exp	(-0.0003	849 x (TF	FA -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13.		79		(42)
Reduce	the annua	al average	hot water	ge in litre usage by r day (all w	5% if the a	welling is	designed t			se target o		5.7		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate				ach month	,			Ŭ Ŭ	Seb		NOV	Dec		
(44)m=	116.27	112.05	107.82	103.59	99.36	95.13	95.13	99.36	103.59	107.82	112.05	116.27		
										Total = Su	m(44) <sub>112</sub> =	:	1268.44	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,n	n x nm x C	)Tm / 3600	) kWh/mor	nth (see Ta	ables 1b, 1	c, 1d)		
(45)m=	172.43	150.81	155.62	135.67	130.18	112.34	104.1	119.45	120.88	140.87	153.77	166.99		_
lf instant	aneous w	ater heatii	ng at point	t of use (no	o hot water	· storage),	enter 0 in	boxes (46		Total = Su	m(45) <sub>112</sub> =	• L	1663.12	(45)
(46)m=	25.86	22.62	23.34	20.35	19.53	16.85	15.61	17.92	18.13	21.13	23.07	25.05		(46)
	storage			•							·			
-		. ,		ng any so			-		ame ves	sel		0		(47)
Otherw	vise if no	o stored		ank in dw er (this ir	•			· ·	ers) ente	er '0' in (	47)			
	storage anufact		eclared I	oss facto	or is kno	wn (kWł	n/dav):					0		(48)
			m Table				, <b>,</b> , .					0		(49)
				e, kWh/ye	ear			(48) x (49)	) =			0		(50)
b) If m	anufact	urer's de	eclared o	cylinder l	oss fact		known:					×		()
		-		rom Tabl	e 2 (kW	h/litre/da	ıy)					0		(51)
	•	from Ta	ee secti ble 2a	on 4.3								0		(52)
			m Table	2b								0		(53)
Energy	v lost fro	m water	storage	e, kWh/y€	ear			(47) x (51)	x (52) x (	53) =		0		(54)
•••		(54) in (5	-	,								0		(55)
Water	storage	loss cal	culated f	for each	month			((56)m = (	55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	orage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	٢H	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

Primar	v circui	t loss (ar	nual) fro	om Table	e 3							0		(58)
	•	t loss cal	,			59)m = (	(58) ÷ 36	65 × (41)	m					
(mo	dified 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	loss ca	lculated	for each	month (	(61)m =	(60) ÷ 30	65 × (41	)m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat req	uired for	water h	eating ca	alculated	for eac	h month	(62)m =	0.85 × 0	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	172.43	150.81	155.62	135.67	130.18	112.34	104.1	119.45	120.88	140.87	153.77	166.99		(62)
Solar DI	-IW input	calculated	using App	endix G or	· Appendix	H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	I lines if	FGHRS	and/or \	WWHRS	applies	, see Ap	pendix (	G)			-		
(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	t from w	ater hea	ter	-	-	-	-	-	-	-	-	-		
(64)m=	172.43	150.81	155.62	135.67	130.18	112.34	104.1	119.45	120.88	140.87	153.77	166.99		_
								Out	out from w	ater heate	r (annual)₁	12	1663.12	(64)
Heat g	ains fro	m water	heating	, kWh/m	onth 0.2	5 ´ [0.85	× (45)m	+ (61)n	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	]	
(65)m=	57.33	50.14	51.74	45.11	43.29	37.35	34.61	39.72	40.19	46.84	51.13	55.52		(65)
inclu	ıde (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal g	ains (see	e Table 5	5 and 5a	):									
Metab	olic gair	ns (Table	e 5), Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	167.29	167.29	167.29	167.29	167.29	167.29	167.29	167.29	167.29	167.29	167.29	167.29		(66)
Lightin	g gains	(calcula	ted in Ap	opendix	L, equat	ion L9 o	r L9a), a	lso see	Table 5				-	
(67)m=	63.8	56.66	46.08	34.89	26.08	22.02	23.79	30.92	41.5	52.7	61.51	65.57		(67)
Applia	nces ga	ins (calc	ulated ir	n Append	dix L, eq	uation L	13 or L1	3a), also	see Ta	ble 5	-	-		
(68)m=	396.4	400.51	390.15	368.08	340.23	314.04	296.55	292.44	302.81	324.87	352.73	378.91		(68)
Cookir	ng gains	(calcula	ted in A	ppendix	L, equa	tion L15	or L15a	), also se	e Table	5				
(69)m=	54.52	54.52	54.52	54.52	54.52	54.52	54.52	54.52	54.52	54.52	54.52	54.52		(69)
Pumps	and fa	ns gains	(Table	5a)		•	•	•	•					
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses	s e.g. ev	/aporatic	n (nega	tive valu	es) (Tab	le 5)		-	-	-				
(71)m=	-111.53	-111.53	-111.53	-111.53	-111.53	-111.53	-111.53	-111.53	-111.53	-111.53	-111.53	-111.53		(71)
Water	heating	gains (T	able 5)											
(72)m=	77.06	74.62	69.55	62.66	58.18	51.88	46.52	53.38	55.82	62.96	71.01	74.63		(72)
Total i	nterna	gains =		•		(66)	m + (67)m	n + (68)m ·	⊦ (69)m +	(70)m + (7	1)m + (72)	m		
(73)m=	650.54	645.08	619.06	578.9	537.76	501.22	480.15	490.03	513.41	553.81	598.53	632.39		(73)
6. So	lar gain	s:				•	•	•	•			•		
Solar g	gains are	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	itions to co	onvert to th	ne applicat	ole orientat	ion.		
Orienta		Access F		Area		Flu		-	g	-	FF		Gains	
		Table 6d		m²		Ia	ble 6a	Т	able 6b	E	able 6c		(VV)	
-		watts, ca	1	1		1		I	um(74)m .	1	-	-	1	(00)
(83)m=	0	0	0	0	0	0	0	0	0	0	0	0		(83)

	650.54	645.08	619.06	578.9	537.76	501.22	480.15	490.03	513.41	553.81	598.53	632.39		(84)
7. Me	an inter	nal temp	erature	(heating	season	)								
				periods ir			from Tab	ole 9, Th	1 (°C)			ĺ	21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.96	0.96	0.96	0.95	0.92	0.86	0.76	0.77	0.87	0.93	0.96	0.97		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fr	ullow ste	ns 3 to 7	r in Tabl	a 9c)					
(87)m=	18.59	18.71	19	19.43	19.92	20.42	20.72	20.7	20.34	19.73	19.1	18.56		(87)
											_			
	19.95			periods ir	i	aweiling 19.97	19.97	19.97	n2 (°C) 19.97	10.00	10.00	10.05		(88)
(88)m=		19.95	19.95	19.96	19.96				19.97	19.96	19.96	19.95		(00)
	-	_		rest of d	-	1		9a)						
(89)m=	0.96	0.96	0.95	0.93	0.9	0.81	0.66	0.68	0.83	0.92	0.95	0.96		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fo	ollow ste	eps 3 to 7	7 in Tabl	e 9c)	-			
(90)m=	16.73	16.9	17.32	17.96	18.67	19.37	19.75	19.72	19.26	18.4	17.48	16.69		(90)
									f	iLA = Livin	g area ÷ (4	4) =	0.15	(91)
Mear	interna	l temper	ature (fo	or the wh	ole dwe	llina) = fl	_A × T1	+ (1 – fL	A) × T2					_
(92)m=	17	17.17	17.57	18.18	18.85	19.52	19.89	19.87	, 19.42	18.59	17.72	16.97		(92)
Apply	v adjustn	nent to th	ne mear	n internal	l tempera	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	17	17.17	17.57	18.18	18.85	19.52	19.89	19.87	19.42	18.59	17.72	16.97		(93)
8 Sn	aca haa	ting rog	•											
0.00	acenea	ung requ	uirement	i i										
					re obtain	ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
Set T	i to the r	nean int factor fo	ernal tei or gains			ied at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(	76)m an		ulate	
Set T the ut	i to the r tilisation Jan	mean int factor fo Feb	ernal ter or gains Mar	mperatui using Ta Apr		ed at ste Jun	ep 11 of Jul	Table 9l Aug	o, so tha Sep	t Ti,m=( Oct	76)m an Nov	d re-calc	ulate	
Set T the ut Utilisa	i to the r tilisation Jan ation fac	nean int factor fo Feb tor for ga	ernal ter or gains Mar ains, hm	mperatur using Ta Apr	able 9a May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ulate	(0.1)
Set T the ut Utilisa (94)m=	i to the r tilisation Jan ation fac	mean int factor fo Feb tor for ga 0.93	ernal ter or gains Mar ains, hm 0.93	mperatur using Ta Apr n: 0.91	ble 9a May 0.87			· · · · ·		r ·	, I		ulate	(94)
Set T the ut Utilisa (94)m= Usefu	i to the r tilisation Jan ation fac 0.94 Jl gains,	nean int factor fo Feb tor for ga 0.93 hmGm ,	ernal ter or gains Mar ains, hm 0.93 W = (94	mperatur using Ta Apr n: 0.91 4)m x (84	able 9a May 0.87 4)m	Jun 0.78	Jul 0.65	Aug 0.66	Sep 0.8	Oct 0.89	Nov 0.92	Dec 0.94	ulate	<b>、</b> ,
Set T the ut Utilisa (94)m= Usefu (95)m=	i to the r tilisation Jan ation fac 0.94 J gains, 609.83	mean int factor for Feb tor for ga 0.93 hmGm , 602.44	ernal ter or gains Mar ains, hm 0.93 W = (94 572.7	mperatur using Ta Apr 1: 0.91 4)m x (84 524.91	able 9a May 0.87 4)m 466.96	Jun 0.78 392.26	Jul	Aug	Sep	Oct	Nov	Dec	ulate	(94) (95)
Set T the ut Utilisa (94)m= Usefu (95)m= Monti	i to the r tilisation Jan ation fac 0.94 I gains, 609.83 hly avera	mean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte	ernal ter or gains Mar ains, hm 0.93 W = (94 572.7 rnal ter	mperatur using Ta Apr 1: 0.91 4)m x (84 524.91 perature	able 9a May 0.87 4)m 466.96 e from Ta	Jun 0.78 392.26 able 8	Jul 0.65 313.36	Aug 0.66 325.66	Sep 0.8 410.76	Oct 0.89 490.86	Nov 0.92 552.79	Dec 0.94 595.27	ulate	(95)
Set T the ut Utilisa (94)m= Usefu (95)m= Montil (96)m=	i to the r tilisation Jan ation fac 0.94 Jl gains, 609.83 hly avera 4.3	mean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte 4.9	ernal ter or gains Mar ains, hm 0.93 W = (94 572.7 rnal tem 6.5	mperatur using Ta Apr 1: 0.91 4)m x (84 524.91 perature 8.9	able 9a May 0.87 4)m 466.96 e from Ta 11.7	Jun 0.78 392.26 able 8 14.6	Jul 0.65 313.36 16.6	Aug 0.66 325.66 16.4	Sep 0.8 410.76 14.1	Oct 0.89 490.86 10.6	0.92	Dec 0.94	ulate	<b>、</b> ,
Set T the ut Utilisa (94)m= Usefu (95)m= Montl (96)m= Heat	i to the r tilisation Jan ation fac 0.94 J gains, 609.83 hly avera 4.3 loss rate	mean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte 4.9 e for mea	ernal ter or gains Mar ains, hm 0.93 W = (94 572.7 rnal tem 6.5 an intern	mperatur using Ta Apr 1: 0.91 4)m x (84 524.91 524.91 perature 8.9 nal tempe	able 9a May 0.87 4)m 466.96 e from Ta 11.7 erature, 1	Jun 0.78 392.26 able 8 14.6 Lm , W =	Jul 0.65 313.36 16.6 =[(39)m 2	Aug 0.66 325.66 16.4 x [(93)m	Sep 0.8 410.76 14.1 – (96)m	Oct 0.89 490.86 10.6 ]	Nov 0.92 552.79 7.1	Dec 0.94 595.27 4.2	ulate	(95) (96)
Set T the ut (94)m= Usefu (95)m= Montil (96)m= Heat (97)m=	i to the r tilisation Jan 0.94 J gains, 609.83 hly avera 4.3 loss rate 1571.27	nean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte 4.9 e for mea 1514.31	ernal ter or gains Mar ains, hm 0.93 W = (94 572.7 rnal tem 6.5 an intern 1363.52	mperatur using Ta Apr 1: 0.91 4)m x (84 524.91 perature 8.9 nal temper 1132.17	able 9a May 0.87 4)m 466.96 e from Ta 11.7 erature, 1 871.24	Jun 0.78 392.26 able 8 14.6 Lm , W = 594.35	Jul 0.65 313.36 16.6 =[(39)m 2 397.33	Aug 0.66 325.66 16.4 x [(93)m 417.99	Sep 0.8 410.76 14.1 - (96)m 644.38	Oct 0.89 490.86 10.6 ] 973.54	Nov 0.92 552.79 7.1 1298.06	Dec 0.94 595.27 4.2	ulate	(95)
Set T the ut (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Spac	i to the r tilisation Jan ation fac 0.94 J gains, 609.83 hly avera 4.3 loss rate 1571.27 e heatin	nean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte 4.9 e for mea 1514.31 g require	ernal ten or gains Mar ains, hm 0.93 W = (94 572.7 rnal tem 6.5 an intern 1363.52 ement fo	mperatur using Ta Apr 1: 0.91 4)m x (84 524.91 524.91 perature 8.9 nal temper 1132.17 or each n	able 9a May 0.87 4)m 466.96 e from Ta 11.7 erature, 871.24 nonth, k\	Jun 0.78 392.26 able 8 14.6 Lm , W = 594.35 Wh/mont	Jul 0.65 313.36 16.6 =[(39)m 2 397.33	Aug 0.66 325.66 16.4 x [(93)m 417.99	Sep 0.8 410.76 14.1 - (96)m 644.38	Oct 0.89 490.86 10.6 ] 973.54 )m] x (4	Nov 0.92 552.79 7.1 1298.06 1)m	Dec 0.94 595.27 4.2 1566.61	ulate	(95) (96)
Set T the ut (94)m= Usefu (95)m= Montil (96)m= Heat (97)m=	i to the r tilisation Jan 0.94 J gains, 609.83 hly avera 4.3 loss rate 1571.27	nean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte 4.9 e for mea 1514.31	ernal ter or gains Mar ains, hm 0.93 W = (94 572.7 rnal tem 6.5 an intern 1363.52	mperatur using Ta Apr 1: 0.91 4)m x (84 524.91 perature 8.9 nal temper 1132.17	able 9a May 0.87 4)m 466.96 e from Ta 11.7 erature, 1 871.24	Jun 0.78 392.26 able 8 14.6 Lm , W = 594.35	Jul 0.65 313.36 16.6 =[(39)m 2 397.33 :h = 0.02	Aug 0.66 325.66 16.4 x [(93)m 417.99 24 x [(97) 0	Sep 0.8 410.76 14.1 - (96)m 644.38 )m - (95 0	Oct 0.89 490.86 10.6 ] 973.54 )m] x (4 359.12	Nov 0.92 552.79 7.1 1298.06 1)m 536.6	Dec 0.94 595.27 4.2 1566.61 722.67		(95) (96) (97)
Set T the ut Utilisa (94)m= Usefu (95)m= Montil (96)m= Heat (97)m= Spac (98)m=	i to the r tilisation Jan ation fac 0.94 J gains, 609.83 hly avera 4.3 loss rate 1571.27 e heatin 715.31	nean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte 4.9 e for mea 1514.31 g require 612.78	ernal ter or gains Mar ains, hm 0.93 W = (94 572.7 rnal tem 6.5 an interr 1363.52 ement fo 588.37	mperatur using Ta Apr 1: 0.91 4)m x (84 524.91 perature 8.9 nal temper 1132.17 or each n 437.23	able 9a May 0.87 4)m 466.96 e from Ta 11.7 erature, 1 871.24 nonth, kV 300.78	Jun 0.78 392.26 able 8 14.6 Lm , W = 594.35 Wh/mont	Jul 0.65 313.36 16.6 =[(39)m 2 397.33 :h = 0.02	Aug 0.66 325.66 16.4 x [(93)m 417.99 24 x [(97) 0	Sep 0.8 410.76 14.1 - (96)m 644.38 )m - (95 0	Oct 0.89 490.86 10.6 ] 973.54 )m] x (4 359.12	Nov 0.92 552.79 7.1 1298.06 1)m	Dec 0.94 595.27 4.2 1566.61 722.67	4272.86	(95) (96) (97) (98)
Set T the ut Utilisa (94)m= Usefu (95)m= Montil (96)m= Heat (97)m= Spac (98)m=	i to the r tilisation Jan 0.94 J gains, 609.83 hly avera 4.3 loss rate 1571.27 e heatin 715.31	nean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte 4.9 e for mea 1514.31 g require 612.78 g require	ernal ter or gains Mar ains, hm 0.93 W = (94 572.7 rnal tem 6.5 an intern 1363.52 ement fo 588.37	mperatur using Ta Apr 0.91 4)m x (84 524.91 perature 8.9 nal tempe 1132.17 or each n 437.23	able 9a May 0.87 4)m 466.96 e from Ta 11.7 erature, 871.24 nonth, kV 300.78	Jun 0.78 392.26 able 8 14.6 Lm , W = 594.35 Wh/mont 0	Jul 0.65 313.36 16.6 =[(39)m 2 397.33 th = 0.02 0	Aug 0.66 325.66 16.4 x [(93)m 417.99 24 x [(97) 0 Tota	Sep 0.8 410.76 14.1 - (96)m 644.38 )m - (95 0 1 per year	Oct 0.89 490.86 10.6 ] 973.54 )m] x (4 359.12	Nov 0.92 552.79 7.1 1298.06 1)m 536.6	Dec 0.94 595.27 4.2 1566.61 722.67		(95) (96) (97)
Set T the ut (94)m= Usefu (95)m= Montl (96)m= Heat (97)m= Spac (98)m= Spac (98)m=	i to the r tilisation Jan ation fac 0.94 J gains, 609.83 hly avera 4.3 loss rate 1571.27 e heating 715.31	mean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte 4.9 e for mea 1514.31 g require 612.78 g require	ernal ter or gains Mar ains, hm 0.93 W = (94 572.7 rnal tem 6.5 an intern 1363.52 ement fo 588.37	mperatur using Ta Apr 1: 0.91 4)m x (84 524.91 perature 8.9 nal temper 1132.17 or each n 437.23	able 9a May 0.87 4)m 466.96 e from Ta 11.7 erature, 871.24 nonth, kV 300.78	Jun 0.78 392.26 able 8 14.6 Lm , W = 594.35 Wh/mont 0	Jul 0.65 313.36 16.6 =[(39)m 2 397.33 th = 0.02 0	Aug 0.66 325.66 16.4 x [(93)m 417.99 24 x [(97) 0 Tota	Sep 0.8 410.76 14.1 - (96)m 644.38 )m - (95 0 1 per year	Oct 0.89 490.86 10.6 ] 973.54 )m] x (4 359.12	Nov 0.92 552.79 7.1 1298.06 1)m 536.6	Dec 0.94 595.27 4.2 1566.61 722.67	4272.86	(95) (96) (97) (98)
Set T the ut Utilisa (94)m= Usefu (95)m= Montil (96)m= Heat (97)m= Spac (98)m= Spac 9a. En Spac	i to the r tilisation Jan ation fac 0.94 J gains, 609.83 hly avera 4.3 loss rate 1571.27 e heatin 715.31 e heatin ergy rec e heatin	mean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte 4.9 e for mea 1514.31 g require 612.78 g require 612.78	ernal ter or gains Mar ains, hm 0.93 W = (94 572.7 rnal tem 6.5 an interr 1363.52 ement fo 588.37 ement in ats - Ind	mperatur using Ta Apr 0.91 4)m x (84 524.91 perature 8.9 nal tempe 1132.17 or each n 437.23	able 9a May 0.87 4)m 466.96 e from Ta 11.7 erature, 871.24 nonth, kV 300.78 2/year eating sy	Jun 0.78 392.26 able 8 14.6 Lm , W = 594.35 Wh/mont 0	Jul 0.65 313.36 16.6 =[(39)m : 397.33 th = 0.02 0	Aug 0.66 325.66 16.4 x [(93)m 417.99 24 x [(97) 0 Tota micro-C	Sep 0.8 410.76 14.1 - (96)m 644.38 )m - (95 0 1 per year	Oct 0.89 490.86 10.6 ] 973.54 )m] x (4 359.12	Nov 0.92 552.79 7.1 1298.06 1)m 536.6	Dec 0.94 595.27 4.2 1566.61 722.67	4272.86	(95) (96) (97) (98) (99)
Set T the ut (94)m= Usefu (95)m= Montl (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (98)m= Spac (98)m=	i to the r tilisation Jan ation fac 0.94 J gains, 609.83 hly avera 4.3 loss rate 1571.27 e heatin 715.31 e heatin ergy rec e heatin	mean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte 4.9 e for mea 1514.31 g require 612.78 g require uiremer ng: pace hea	ernal ten or gains Mar ains, hm 0.93 W = (94 572.7 rnal tem 6.5 an interr 1363.52 ement fo 588.37 ement in ats - Ind at from s	mperatur using Ta Apr 1: 0.91 4)m x (84 524.91 perature 8.9 nal tempe 1132.17 or each m 437.23 kWh/m <sup>2</sup> ividual h	able 9a May 0.87 4)m 466.96 e from Ta 11.7 erature, 871.24 nonth, k\ 300.78 2/year eating sy y/supple	Jun 0.78 392.26 able 8 14.6 Lm , W = 594.35 Wh/mont 0	Jul 0.65 313.36 16.6 =[(39)m 2 397.33 :h = 0.02 0 ncluding system	Aug 0.66 325.66 16.4 x [(93)m 417.99 24 x [(97) 0 Tota micro-C	Sep 0.8 410.76 14.1 - (96)m 644.38 )m - (95 0 I per year CHP)	Oct 0.89 490.86 10.6 ] 973.54 )m] x (4 359.12	Nov 0.92 552.79 7.1 1298.06 1)m 536.6	Dec 0.94 595.27 4.2 1566.61 722.67	4272.86 40.33 0	(95) (96) (97) (98) (99)
Set T the ut (94)m= Usefu (95)m= Montl (96)m= Heat (97)m= Spac (98)m= Spac (98)m= Spac (98)m= Spac Fract	i to the r tilisation Jan ation fac 0.94 I gains, 609.83 hly avera 4.3 loss rate 1571.27 e heatin 715.31 e heatin ergy rec e heatin ion of sp	mean int factor for Feb tor for ga 0.93 hmGm , 602.44 age exte 4.9 e for mea 1514.31 g require 612.78 g require uiremen bace hea bace hea	ernal ter or gains Mar ains, hm 0.93 W = (94 572.7 rnal tem 6.5 an intern 1363.52 ement fo 588.37 ement in its - Ind at from s at from n	mperatur using Ta Apr 0.91 4)m x (84 524.91 perature 8.9 nal tempe 1132.17 or each n 437.23	able 9a May 0.87 4)m 466.96 e from Ta 11.7 erature, 1 871.24 nonth, k\ 300.78 2/year eating sy y/supple em(s)	Jun 0.78 392.26 able 8 14.6 Lm , W = 594.35 Wh/mont 0	Jul 0.65 313.36 16.6 =[(39)m : 397.33 :h = 0.02 0 ncluding system	Aug 0.66 325.66 16.4 x [(93)m 417.99 24 x [(97) 0 Tota micro-C	Sep 0.8 410.76 14.1 - (96)m 644.38 )m - (95 0 I per year CHP) - (201) =	Oct 0.89 490.86 10.6 ] 973.54 )m] x (4 359.12 (kWh/year	Nov 0.92 552.79 7.1 1298.06 1)m 536.6	Dec 0.94 595.27 4.2 1566.61 722.67	4272.86	(95) (96) (97) (98) (99)

Total gains – internal and solar (84)m = (73)m + (83)m, watts

Efficie	ency of i	main spa	ace heat	ing syste	em 1								90.6	(206)
Efficie	ency of	seconda	ry/suppl	ementar	y heating	g systen	n, %						0	(208)
[	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space	e heatin	g require	ement (c	alculate	d above)	)	1	r	r	1	1	1	•	
	715.31	612.78	588.37	437.23	300.78	0	0	0	0	359.12	536.6	722.67	J	
(211)m	= {[(98	)m x (20	4)] } x 1	100 ÷ (20	)6)		·							(211)
	789.53	676.35	649.42	482.59	331.99	0	0	0	0	396.38	592.27	797.65		_
								Tota	l (kWh/yea	ar) =Sum(2	2 <b>11)</b> <sub>15,1012</sub>	-	4716.18	(211)
•		•		y), kWh/	month									
i i i	-	)1)]}x1	· · · ·	1									1	
(215)m=	0	0	0	0	0	0	0	0 Toto	0 I (kWh/yea	0	0	0		
								TULA	ii (KVVII/yea	ar) =3um(2	213) <sub>15,1012</sub>	-	0	(215)
	heating		tor (colo	ulated a	hava)									
Output	172.43	150.81	155.62	135.67	130.18	112.34	104.1	119.45	120.88	140.87	153.77	166.99	]	
Efficier	icy of w	ater hea	iter										85	(216)
(217)m=	89.46	89.44	89.37	89.21	88.83	85	85	85	85	88.95	89.29	89.49		」 (217)
ı Fuel fo	r water	heating,	kWh/m	onth			1	1					1	
(219)m	= (64)	<u>m x 100</u>	) ÷ (217)	) <u>m</u>									1	
(219)m=	192.76	168.62	174.13	152.09	146.55	132.16	122.47	140.53	142.21	158.38	172.22	186.59		-
_								lota	I = Sum(2'		,		1888.71	(219)
	I totals		nd main	system	1					k	Wh/year	•	<b>kWh/year</b> 4716.18	1
•	•			System	1									]
	-	fuel use											1888.71	
Electric	city for p	oumps, fa	ans and	electric	keep-ho	t							_	
centra	l heatir	ng pump	:									30		(230c)
boiler	with a f	an-assis	sted flue									45	]	(230e)
Total e	lectricity	y for the	above, l	kWh/yea	r			sum	of (230a).	(230g) =			75	(231)
Electric	ity for l	ighting											450.67	(232)
Total d	elivered	l energy	for all u	ses (211	)(221)	+ (231)	+ (232).	(237b)	=				7130.57	(338)
10a. F	uel cos	sts - indiv	/idual he	eating sy	stems:									
						Fu				Fuel P	rico		Fuel Cost	
							/h/year			(Table			£/year	
Space	heating	- main s	system 1	1		(21	1) x			3.4	8	x 0.01 =	164.12	(240)
Space	heating	- main s	system 2	2		(21	3) x			0		x 0.01 =	0	(241)
•	•	- secon	•			(21	5) x			13.		x 0.01 =	0	(242)
•	•	cost (otl	•			(21	9)			3.4		x 0.01 =	65.73	(247)
	-	nd elect				(23	1)			13.		x 0.01 =	9.89	(249)
					230a) se			licable a	nd apply				Table 12a	ц, <sub>т</sub> ,
•	for ligh					(23				13.		x 0.01 =	59.44	(250)

Additional standing charges (Table 12)			120	(251)
Appendix Q items: repeat lines (253) and (2	254) as needed			
Total energy cost(24)	45)(247) + (250)(254) =		419.19	(255)
11a. SAP rating - individual heating system	ms			
Energy cost deflator (Table 12)			0.42	(256)
Energy cost factor (ECF) [(2	55) x (256)] ÷ [(4) + 45.0] =		1.17	(257)
SAP rating (Section 12)			83.73	(258)
12a. CO2 emissions – Individual heating s	systems including micro-CHP			
	<b>Energy</b> kWh/year	Emission factor kg CO2/kWh	<b>Emissions</b> kg CO2/yea	ar
Space heating (main system 1)	(211) x	0.216 =	1018.7	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	407.96	(264)
Space and water heating	(261) + (262) + (263) + (26	54) =	1426.66	(265)
Electricity for pumps, fans and electric keep	o-hot (231) x	0.519 =	38.93	(267)
Electricity for lighting	(232) x	0.519 =	233.9	(268)
Total CO2, kg/year		sum of (265)(271) =	1699.48	(272)
CO2 emissions per m <sup>2</sup>		(272) ÷ (4) =	16.04	(273)
EI rating (section 14)			85	(274)
13a. Primary Energy				
	<b>Energy</b> kWh/year	<b>Primary</b> factor	<b>P. Energy</b> kWh/year	
Space heating (main system 1)	(211) x	1.22 =	5753.74	(261)
Space heating (secondary)	(215) x	3.07 =	0	(263)
Energy for water heating	(219) x	1.22 =	2304.23	(264)
Space and water heating	(261) + (262) + (263) + (26	64) =	8057.97	(265)
Electricity for pumps, fans and electric keep	o-hot (231) x	3.07 =	230.25	(267)
Electricity for lighting	(232) x	0 =	1383.56	(268)
'Total Primary Energy		sum of (265)(271) =	9671.78	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =	91.29	(273)

				User D	Details:						
Assessor Name: Software Name:	Ben Marsh Stroma FS				Softwa	a Num are Vei				005374 n: 1.0.5.58	
			Pi	roperty	Address	: Plot 8					
Address :	Plot 8										
1. Overall dwelling dime	ensions:			•	- ( 2)		A			) ( - I	
Ground floor					a(m²)	(10) ×	Av. Hei			Volume(m <sup>3</sup> )	
					53.97	(1a) x	2	2.4	(2a) =	129.53	(3a)
First floor				ę	51.97	(1b) x	2	2.4	(2b) =	124.73	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e	)+(1n	) 1	05.94	(4)					
Dwelling volume						(3a)+(3b)	)+(3c)+(3d	)+(3e)+	.(3n) =	254.26	(5)
2. Ventilation rate:											
	main heating		econdar eating	у	other		total			m <sup>3</sup> per hour	
Number of chimneys	0	<u>ר ד</u> + ר	0	] + [	0	] = [	0	x 4	40 =	0	(6a)
Number of open flues	0		0	i + F	0	-   -	0	x 2	20 =	0	_ (6b)
Number of intermittent fa	ns						3	x 1	0 =	30	] (7a)
Number of passive vents							0	x 1	0 =	0	](7b)
Number of flueless gas fi							0	x 4	40 =	0	](7c)
						L	0		<u>.</u>	0	
									Air ch	anges per hou	ır
Infiltration due to chimne	ys, flues and f	ans = (6	a)+(6b)+(7	a)+(7b)+	(7c) =	Г	30	<u> </u>	÷ (5) =	0.12	(8)
If a pressurisation test has b	een carried out o	r is intende	ed, proceed	d to (17),	otherwise o	continue fr	om (9) to (				
Number of storeys in the	ne dwelling (na	6)								0	(9)
Additional infiltration								[(9)-	1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or	timber f	frame or	0.35 fo	r masoni	ry constr	ruction			0	(11)
if both types of wall are p deducting areas of openii			ponding to	the grea	ter wall are	a (after					
If suspended wooden f	<b>0</b> // 1		ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en	ter 0.05, else o	enter 0	ŗ							0	(13)
Percentage of windows	s and doors dr	aught st	ripped							0	(14)
Window infiltration					0.25 - [0.2	2 x (14) ÷ 1	= [00		·	0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =	·	0	(16)
Air permeability value,	q50, expresse	ed in cub	ic metre	s per ho	our per s	quare m	etre of e	nvelope	area	5	(17)
If based on air permeabil	ity value, then	(18) = [(1	7) ÷ 20]+(8	8), otherw	vise (18) = (	(16)				0.37	(18)
Air permeability value applie		on test has	s been don	e or a de	gree air pe	rmeability	is being us	sed			_
Number of sides sheltere	ed				(20) - 1	[0 075 v (1	0)1			2	(19)
Shelter factor	la a al alta a ta	1			(20) = 1 -		[9]] =			0.85	(20)
Infiltration rate incorporat	•				(21) = (18	) x (20) =				0.31	(21)
Infiltration rate modified f		· ·	i	1. 1	Δ	0.0		N Le			
Jan Feb	Mar Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp					1				· _ 1	l	
(22)m= 5.1 5	4.9 4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind F	actor (2	2a)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	]	
Adjuste	ed infiltra	ation rate	e (allowi	ng for sh	elter an	d wind s	peed) =	(21a) x	(22a)m					
[	0.4	0.39	0.38	0.34	0.34	0.3	0.3	0.29	0.31	0.34	0.35	0.37		
		<i>tive air i</i> al ventila	-	rate for t	he appli	cable ca	se							(23a)
				endix N, (2	3b) = (23a	i) x Fmv (e	equation (N	N5)) . othe	rwise (23b	) = (23a)			0	(23a)
			• • •	iency in %	, ,					, ()			0	(230) (23c)
			-	entilation	-					2b)m + (;	23b) x [1	– (23c)	-	(200)
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
b) If I	balance	d mecha	anical ve	entilation	without	heat rec	overy (N	и V) (24b	)m = (22	2b)m + (2	23b)		1	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24b)
,				ntilation c hen (24c	•	•				5 × (23b	)		-	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,				ole hous m = (22t	•	•				0.5]			-	
(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	]	(24d)
Effec	ctive air	change	rate - er	nter (24a	) or (24b	o) or (24	c) or (24	d) in boy	k (25)				_	
(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57		(25)
3. Hea	at losse	s and he	at loss	paramete	er:									
ELEM	IENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²·		A X k ⟨J/K
Doors						2.14	x	1.4	=	2.996				(26)
Windov	ws Type	1				5.38	x1/	/[1/( 1.4 )+	0.04] =	7.13				(27)
Windov	ws Type	2				8.432	x1/	/[1/( 1.4 )+	0.04] =	11.18				(27)
Windov	ws Type	3				0.71	x1/	/[1/( 1.4 )+	0.04] =	0.94				(27)
Floor						53.97	' X	0.14	= [	7.5558				(28)
Walls		143.	52	16.66	6	126.8	6 <mark>x</mark>	0.17	= [	21.57				(29)
Roof		51.9	7	0		51.97	' x	0.11	=	5.72				(30)
Total a	rea of e	lements	, m²			249.4	6							(31)
				effective wil nternal wall			ated using	formula 1	/[(1/U-valu	e)+0.04] a	s given in	paragrapł	h 3.2	
Fabric I	heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				57.09	(33)
Heat ca	apacity	Cm = S(	Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	7546.15	(34)
		parame	ter (TMF		TFA) ir	n kJ/m²K			Indica	tive Value:	Low		100	(35)
	al mass		`		,									
Therma For desig	gn assess	ments wh ad of a det	ere the de	tails of the	,	ion are not	t known pr	ecisely the	e indicative	values of	TMP in Ta	able 1f		
Therma For desig can be us Therma	gn assess sed instea al bridge	ad of a dei es : S (L	ere the de ailed calc x Y) cal	tails of the ulation. culated u	construct	pendix ł		ecisely the	e indicative	values of	TMP in Ta	able 1f	18.01	(36)
Therma For desig can be us Therma if details	gn assess sed instea al bridge of therma	ad of a dei es : S (L Il bridging	ere the de ailed calc x Y) cal	tails of the ulation.	construct	pendix ł		ecisely the			TMP in Ta	able 1f	· · · · · · · · · · · · · · · · · · ·	
Therma For desig can be us Therma if details Total fa	gn assess sed instea al bridge of therma abric hea	ad of a det es : S (L Il bridging at loss	ere the de ailed calc x Y) cal are not kn	tails of the ulation. culated u	constructi using Ap 0.05 x (3	pendix ł		ecisely the	(33) +				18.01 75.09	(36)

(38)m=	48.62	48.37	48.11	46.92	46.7	45.66	45.66	45.46	46.06	46.7	47.15	47.62		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	123.72	123.46	123.2	122.01	121.79	120.75	120.75	120.56	121.15	121.79	122.24	122.71		
Hootle		motor (L	יאי (סור)	/m2k						Average = = (39)m ÷	Sum(39)1.	12 /12=	122.01	(39)
(40)m=	1.17	1.17	HLP), W/	1.15	1.15	1.14	1.14	1.14	1.14	= ( <del>39)</del> 1.15	1.15	1.16		
()											Sum(40)1		1.15	(40)
Numbe	er of day	/s in mo	nth (Tab	le 1a)								- 		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31		(41)
4. Wa	iter heat	ting ene	rgy requi	irement:								kWh/ye	ar:	
if TF				[1 - exp	(-0.0003	849 x (TF	-A -13.9	)2)] + 0.(	0013 x ( <sup>-</sup>	TFA -13.		79		(42)
			ater usag	ge in litre	es per da	ay Vd,av	erage =	(25 x N)	+ 36		10	5.7		(43)
		-		usage by r day (all w		-	-	to achieve	a water us	se target o	f			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage il	n litres per	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)						
(44)m=	116.27	112.05	107.82	103.59	99.36	95.13	95.13	99.36	103.59	107.82	112.05	116.27		<b>-</b>
Energy o	content of	hot water	used - cal	culated m	onthly $= 4$ .	190 x Vd,r	n x nm x D	0Tm / 3600			m(44) <sub>112</sub> = ables 1b, 1		1268.44	(44)
(45)m=	172.43	150.81	155.62	135.67	130.18	112.34	104.1	119.45	120.88	140.87	153.77	166.99		
lf instant	taneous w	vater heati	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46		Total = Su	m(45) <sub>112</sub> =	=	1663.12	(45)
(46)m=	25.86 storage	22.62	23.34	20.35	19.53	16.85	15.61	17.92	18.13	21.13	23.07	25.05		(46)
	-		includir	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr	nunity h	eating a	ind no ta	nk in dw	velling, e	nter 110	litres in	(47)						
			hot wate	er (this ir	icludes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (	47)			
	storage		eclared I	oss facto	or is kno	wn (kWł	n/dav).					0		(48)
			m Table				"aay).					0		(49)
•				, kWh/ye	ear			(48) x (49)	) =			0		(50)
b) If m	anufact	urer's de	eclared o	cylinder l	oss fact									
		-		om Tabl	e 2 (kW	h/litre/da	ıy)					0		(51)
		from Ta	ee secti ble 2a	011 4.3								0		(52)
			m Table	2b								0		(53)
Energy	/ lost fro	m water	· storage	, kWh/ye	ear			(47) x (51)	x (52) x (	53) =		0		(54)
Enter	(50) or (	(54) in (5	55)									0		(55)
Water	storage	loss cal	culated f	for each	month			((56)m = (	55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)ı	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	хH	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

		loss (an	,									0		(58)
		loss cal			```	,	· ·	``'		* 46 0 **** 0	atat)			
, L		factor fi		1		r	r	r <u> </u>	<u> </u>	r	<u> </u>	0	I	(50)
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	lculated	for each	month (	(61)m =	(60) ÷ 36	65 × (41)	)m						
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0		(61)
Total h	eat req	uired for	water he	eating ca	alculated	for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	172.43	150.81	155.62	135.67	130.18	112.34	104.1	119.45	120.88	140.87	153.77	166.99		(62)
Solar DH	IW input	calculated	using App	endix G or	Appendix	: H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add ac	ditiona	l lines if	FGHRS	and/or V	VWHRS	applies	, see Ap	pendix (	G)	1	i	i		
(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 w	ater hea	ter	-		-	-	-	-	-	-	-		
(64)m=	172.43	150.81	155.62	135.67	130.18	112.34	104.1	119.45	120.88	140.87	153.77	166.99		_
								Outp	out from w	ater heate	r (annual)₁	12	1663.12	(64)
Heat ga	ains fro	m water	heating,	kWh/mo	onth 0.2	5´[0.85	× (45)m	+ (61)m	n] + 0.8 x	k [(46)m	+ (57)m	+ (59)m	]	
(65)m=	57.33	50.14	51.74	45.11	43.29	37.35	34.61	39.72	40.19	46.84	51.13	55.52		(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Inte	ernal ga	ains (see	Table 5	5 and 5a	):									
Metabo	olic gain	is (Table	5). Wat	ts										
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	139.41	139.41	139.41	139.41	139.41	139.41	139.41	139.41	139.41	139.41	139.41	139.41		(66)
Lighting	g gains	(calcula	ted in Ar	pendix	L, equat	ion L9 o	r L9a), a	lso see <sup>·</sup>	Table 5	ļ	I	Į		
(67)m=	25.52	22.67	18.43	13.95	10.43	8.81	9.52	12.37	16.6	21.08	24.6	26.23		(67)
Applian	nces da	ins (calc	ulated in	Append	l dix L. ea	uation L	13 or L1	i 3a), also	see Ta	ble 5				
(68)m=	265.59	268.34	261.4	246.61	227.95	210.41	198.69	195.94	202.88	217.67	236.33	253.87		(68)
Ľ	a aains	(calcula	ted in A	nnendix	l equat	tion I 15	or I 15a'	l also se	i e Table	5				
(69)m=	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94	36.94		(69)
ι ή L		ns gains												
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	l	(70)
		aporatio	_				Ů	Ů	Ů	Ů	Ű	Ů		
-	-	-111.53	· •		, , ,	· · · · · · · · · · · · · · · · · · ·	-111.53	-111.53	-111.53	-111.53	-111.53	-111.53		(71)
Ľ				-111.00	-111.00	-111.00	-111.00	-111.00	-111.00	-111.00	-111.00	-111.00		()
г		gains (T 74.62	able 5) 69.55	62.66	58.18	F1 00	46.52	52.20	55.82	62.06	71.01	74.63	I	(72)
(72)m=	77.06			62.66	00.10	51.88		53.38		62.96	71.01			(12)
г		gains =		004.05	004.00	r	1	1	1	(70)m + (7	1	i	I	(72)
(73)m=	435.99	433.45	417.2	391.05	364.38	338.92	322.55	329.51	343.13	369.53	399.77	422.55		(73)
	ar gains	S: calculated		r flux from	Table 6a	and accord	iated oqua	tions to co	nvort to th	annliach		ion		
-		Access F	-	Area	able od	Flu			g_	ie applicat	FF		Gains	
Chonica		Table 6d	40101	m <sup>2</sup>			ble 6a	Т	able 6b	Та	able 6c		(W)	
Solar o	ains in	watts, ca	alculated	l for eac	h month			(83)m – S	um(74)m .	(82)m				
(83)m=	0	0	0		0	0	0	0	0	0	0	0		(83)

(84)m=	435.99	433.45	417.2	391.05	364.38	338.92	322.55	329.51	343.13	369.53	399.77	422.55		(84)
7. Me	an inter	nal temp	erature	(heating	season	)								
				periods ir		, 	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for a	ains for	living are	a. h1.m	see Ta	ble 9a)					1		_
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.99	0.98	0.98	0.98	0.96	0.93	0.87	0.88	0.94	0.97	0.98	0.99		(86)
Moon		l tompor	atura in	living are			nc 2 to 7	L 7 in Tabl						
(87)m=	18.26	18.38	18.69	19.16	19.68	20.23	20.58	20.55	20.13	19.47	18.8	18.23		(87)
										10.47	10.0	10.20		()
		<u> </u>		periods ir			i	i						(00)
(88)m=	19.95	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.97	19.96	19.96	19.95		(88)
Utilisa	ation fac	tor for g	ains for	rest of d	welling,	h2,m (se	e Table	9a)						
(89)m=	0.98	0.98	0.98	0.97	0.95	0.9	0.8	0.81	0.92	0.96	0.98	0.98		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	16.25	16.43	16.88	17.57	18.33	19.12	19.6	19.57	18.99	18.02	17.05	16.22		(90)
									f	LA = Livin	g area ÷ (4	4) =	0.15	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwel	llina) = fl	A x T1	+ (1 – fl	A) x T2					_
(92)m=	16.54	16.72	17.15	17.8	18.53	19.28	19.74	19.71	19.15	18.24	17.3	16.51		(92)
				internal						opriate				
(93)m=	16.54	16.72	17.15	17.8	18.53	19.28	19.74	19.71	19.15	18.24	17.3	16.51		(93)
8. Sp	ace hea	ting requ	uirement	t										
Set T	i to the r	mean int	ernal te	mperatui	e obtain	ed at ste	əp 11 of	Table 9	o, so tha	t Ti,m=(	76)m an	d re-calc	ulate	
the ut	tilisation	factor fo	or gains	using Ta	ble 9a									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
		tor for g												()
(94)m=	0.97	0.97	0.96	0.95	0.93	0.88	0.78	0.79	0.89	0.94	0.96	0.97		(94)
		1	,	4)m x (84	<i>,</i>					o / o = o				(05)
(95)m=	423.44	420.12	402.35	373.16	339.4	296.93	251.69	260.21	305.4	348.78	385.51	411.34		(95)
10000000000000000000000000000000000000	4.3	age exte	rnal terr 6.5	perature 8.9	11.7	able 8 14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
				al tempe							7.1	4.2		(30)
(97)m=		1458.85		· · ·	832.08	565.54	379.75	399.22	612.31	J 930.05	1247.27	1511.08		(97)
				or each n								1011.00		()
(98)m=	811.83	698.03	676.46	513.15	366.56	0	0.02	0		432.46	620.47	818.21		
()						-	-		l per year				4937.16	(98)
0								1014	i por your	(RVIII/you	) = 0um(0	<b>C</b> )15,912 -		
•	e neatin	<b>.</b>	ement in	kWh/m <sup>2</sup>	/year								46.6	(99)
			its – Ind	ividual h	eating sy	ystems i	ncluding	micro-C	CHP)					
Spac	e heatir	ng:						micro-C	CHP)					
<b>Spac</b> Fracti	<b>e heatir</b> ion of sp	<b>1g:</b> bace hea	t from s	econdar	y/supple		system						0	(201)
<b>Spac</b> Fracti Fracti	<b>e heatir</b> ion of sp ion of sp	<b>1g:</b> bace hea bace hea	t from s t from n	econdar <u>:</u> nain syst	y/supple em(s)		system	(202) = 1 -	- (201) =				0	(201) (202)
<b>Spac</b> Fracti Fracti	<b>e heatir</b> ion of sp ion of sp	<b>1g:</b> bace hea bace hea	t from s t from n	econdar	y/supple em(s)		system	(202) = 1 -		(203)] =				4

Total gains – internal and solar (84)m = (73)m + (83)m, watts

ency of I	main spa	ace heat	ting syste	em 1								90.6	(206)
ency of a	seconda	ry/suppl	ementar	y heating	g systen	n, %						0	(208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
e heatin	g require	ement (o	calculate	d above)	)								
811.83	698.03	676.46	513.15	366.56	0	0	0	0	432.46	620.47	818.21		
= {[(98	í È	04)] } x 1	100 ÷ (20	)6)		,			r		r	1	(211)
896.06	770.45	746.64	566.39	404.59	0	0	0	0	477.33	684.84	903.1		_
							lota	l (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	Ē	5449.41	(211)
	•		• •	month									
	T	<u> </u>	<u> </u>	0	0	0	0	0	0	0	0	]	
Ŭ				Ů	Ĵ				-			0	(215)
heating	3												
	-	ter (calc	ulated a	bove)									
172.43	150.81	155.62	135.67	130.18	112.34	104.1	119.45	120.88	140.87	153.77	166.99		_
ncy of w	ater hea	ter	·									85	(216)
89.57	89.55	89.5	89.37	89.06	85	85	85	85	89.16	89.43	89.6		(217)
192.52	168.4	173.88	151.81	146.17	132.16	122.47	140.53	142.21	158.01	171.95	186.37		
						1	Tota	I = Sum(2	19a) <sub>112</sub> =			1886.49	(219)
I totals									k	Wh/year		kWh/yea	
heating	fuel use	ed, main	system	1								5449.41	
heating	fuel use	d										1886.49	
city for p	oumps, f	ans and	electric	keep-ho	t								
al heatir	ng pump	:									30		(230c)
with a f	an-assis	sted flue									45		(230e)
lectricit	v for the	above.	kWh/vea	ır			sum	of (230a).	(230g) =			75	(231)
			,									450.67	(232)
		for all u	ses (211	)(221)	+ (231)	+ (232)	)(237b)	=					(338)
			•	, , ,	. ,	•	,						
502 CIII	10010110	marria	idal ficat	ing by bic		ading n							
											tor		
heating	(main s	ystem 1	)		(21	1) x			0.2	16	=	1177.07	(261)
heating	(second	dary)			(21	5) x			0.5	19	=	0	(263)
heating					(21	9) x			0.2	16	=	407.48	(264)
and wa	ter heati	ng			(26	1) + (262)	) + (263) + (	264) =				1584.56	(265)
city for p	oumps, f	ans and	electric	keep-ho	t (23	1) x			0.5	19	=	38.93	(267)
city for l	ighting				(23	2) x					=	233.9	(268)
:O2, kg/	/year							sum o	f (265)(2	271) =		1857.38	 (272)
	ency of s Jan a heatin 811.83 $= \{[(98) 896.06$ a heatin $m \times (20)$ 0 heating from w 172.43 ncy of w 89.57 r water = (64) 192.52 I totals heating heating heating heating city for p al heating	ency of seconda Jan Feb heating require 811.83 698.03 $= \{[(98)m x (20)] \} x (20)$ 896.06 770.45 $= ([(98)m x (20)] \} x (20)$ $= ([(98)m x (20)] \} x (20)$ $= ([(98)m x (20)] \} x (20)$ $= ((20)m x (20)] \} x (20)$ = ((20)m x (20) $= ((20)m x (20)] \} x (20)$ $= ((20)m x (20)] \} x (20)$ = ((20)m x (20) $= ((20)m x (20)] \} x (20)$ = ((20)m x (20) = ((20)m x	ency of secondary/suppl Jan Feb Mar a heating requirement (a 811.83 698.03 676.46 a = {[(98)m x (204)] } x $^{-2}$ 896.06 770.45 746.64 a heating fuel (secondar m x (201)] } x 100 $\div$ (20 0 0 0 heating from water heater (calc 172.43 150.81 155.62 ncy of water heater 89.57 89.55 89.5 r water heating, kWh/m a = (64)m x 100 $\div$ (217 192.52 168.4 173.88 I totals heating fuel used, main heating fuel used sity for pumps, fans and al heating pump: with a fan-assisted flue lectricity for the above, sity for lighting elivered energy for all u CO2 emissions – Individ heating (main system 1 heating (secondary) heating and water heating sity for pumps, fans and and water heating sity for pumps, fans and heating (main system 1 heating (secondary) heating and water heating sity for pumps, fans and sity for pumps, fans and heating (secondary) heating sity for lighting and water heating sity for lighting and water heating sity for pumps, fans and sity for lighting	ency of secondary/supplementar Jan Feb Mar Apr a heating requirement (calculate 811.83 698.03 676.46 513.15 $= \{[(98)m \times (204)] \} \times 100 \div (208)$ $= \{(98)m \times (204)\} \} \times 100 \div (208)$ $= \{(98)m \times (204)\} \} \times 100 \div (208)$ $= (208)m \times (204)\} $ $= (208)m \times (204)$ $= (208)m \times (208)m \times (208)m $ $= (208)m \times (204)$ $= (208)m \times (208)m $ $= (208)m \times (204)m $ $= (208)m \times (208)m $ $= (208)m \times (208)$	Jan Feb Mar Apr May heating requirement (calculated above) 811.83 698.03 676.46 513.15 366.56 $i = \{[(98)m \times (204)] \} \times 100 \div (206)$ 896.06 770.45 746.64 566.39 404.59 $i = \{[(98)m \times (204)] \} \times 100 \div (208)$ 0 0 0 0 0 0 heating from water heater (calculated above) 172.43 150.81 155.62 135.67 130.18 heating water heater 89.57 89.55 89.5 89.37 89.06 r water heating, kWh/month $= (64)m \times 100 \div (217)m$ 192.52 168.4 173.88 151.81 146.17 I totals heating fuel used, main system 1 heating fuel used city for pumps, fans and electric keep-ho al heating pump: with a fan-assisted flue lectricity for the above, kWh/year city for lighting elivered energy for all uses (211)(221) CO2 emissions – Individual heating system heating (main system 1) heating (secondary) heating and water heating city for pumps, fans and electric keep-ho city for lighting elivered energy for all uses (211)(221) CO2 emissions – Individual heating system heating fuel used city for lighting elivered energy for all uses (211)(221) CO2 emissions – Individual heating system heating (main system 1) heating (secondary) heating city for pumps, fans and electric keep-ho city for lighting and water heating city for pumps, fans and electric keep-ho city for lighting and water heating city for pumps, fans and electric keep-ho city for lighting elivered energy for all uses (211)(221) CO2 emissions – Individual heating system heating (main system 1) heating city for pumps, fans and electric keep-ho city for lighting elivered energy for all uses (calcular) heating and water heating city for pumps, fans and electric keep-ho city for lighting	ancy of secondary/supplementary heating systemJanFebMarAprMayJuna heating requirement (calculated above)811.83698.03676.46513.15366.560a f([98)m x (204)] $x 100 \div (206)$ 896.06770.45746.64566.39404.590a heating fuel (secondary), kWh/monthm x (201)] $x 100 \div (208)$ 00000a heating fuel (secondary), kWh/monthm x (201)] $x 100 \div (208)$ 000072.43150.81155.62135.67130.18112.34ncy of water heater89.5789.5589.589.3789.5789.5589.589.3789.5789.5589.589.37192.52168.4173.88151.81146.17132.16I totalsheating fuel used, main system 1heating fuel usedsity for pumps, fans and electric keep-hotal heating pump:with a fan-assisted fluelectricity for the above, kWh/yearsity for lightingelivered energy for all uses (211)(221) + (231)CO2 emissions – Individual heating systems inclkheating (main system 1)heating (secondary)(21heating (secondary)(22in dwater heating(23city for pumps, fans and electric keep-hot(23city for lighting(24 </td <td>ancy of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul a heating requirement (calculated above) 811.83 698.03 676.46 513.15 366.56 0 0 = {[(98)m x (204)] } x 100 ÷ (206) 896.06 770.45 746.64 566.39 404.59 0 0 a heating fuel (secondary), kWh/month m x (201)] <math>x</math> 100 ÷ (208) 0 0 0 0 0 0 0 0 0 heating from water heater (calculated above) 172.43 150.81 155.62 135.67 130.18 112.34 104.1 rey of water heater 89.57 89.55 89.5 89.7 89.06 85 85 r water heating, kWh/month = (64)m x 100 ÷ (217)m 192.52 168.4 173.88 151.81 146.17 132.16 122.47 I totals heating fuel used, main system 1 heating fuel used bity for pumps, fans and electric keep-hot al heating pump: with a fan-assisted flue electricity for the above, kWh/year bity for lighting elivered energy for all uses (211)(221) + (231) + (232) CO2 emissions – Individual heating systems including m kWh/year sity for pumps, fans and electric keep-hot al heating (main system 1) heating (main system 1) heating (main system 1) heating (and system 1) heating (and system 1) heating (219) x and water heating bity for pumps, fans and electric keep-hot al heating (219) x and water heating bity for pumps, fans and electric keep-hot and water heating (231) x bity for pumps, fans and electric keep-hot bity for pumps, fans and electric keep-hot and water heating (231) x bity for pumps, fans and electric keep-hot bity for pumps, fans and electric keep-hot</td> <td><math display="block">\begin{array}{c c c c c c c c c c c c c c c c c c c </math></td> <td><math display="block">\begin{array}{c c c c c c c c c c c c c c c c c c c </math></td> <td></td> <td><math display="block">\begin{array}{c c c c c c c c c c c c c c c c c c c </math></td> <td></td> <td>Inclusion       Secondary/supplementary heating system, %       0         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec       KWh/yee         811.83       698.03       676.46       513.15       366.56       0       0       0       422.46       620.47       818.21         If (R8)m x (204)       1 × 100 + (206)       1</td>	ancy of secondary/supplementary heating system, % Jan Feb Mar Apr May Jun Jul a heating requirement (calculated above) 811.83 698.03 676.46 513.15 366.56 0 0 = {[(98)m x (204)] } x 100 ÷ (206) 896.06 770.45 746.64 566.39 404.59 0 0 a heating fuel (secondary), kWh/month m x (201)] $x$ 100 ÷ (208) 0 0 0 0 0 0 0 0 0 heating from water heater (calculated above) 172.43 150.81 155.62 135.67 130.18 112.34 104.1 rey of water heater 89.57 89.55 89.5 89.7 89.06 85 85 r water heating, kWh/month = (64)m x 100 ÷ (217)m 192.52 168.4 173.88 151.81 146.17 132.16 122.47 I totals heating fuel used, main system 1 heating fuel used bity for pumps, fans and electric keep-hot al heating pump: with a fan-assisted flue electricity for the above, kWh/year bity for lighting elivered energy for all uses (211)(221) + (231) + (232) CO2 emissions – Individual heating systems including m kWh/year sity for pumps, fans and electric keep-hot al heating (main system 1) heating (main system 1) heating (main system 1) heating (and system 1) heating (and system 1) heating (219) x and water heating bity for pumps, fans and electric keep-hot al heating (219) x and water heating bity for pumps, fans and electric keep-hot and water heating (231) x bity for pumps, fans and electric keep-hot bity for pumps, fans and electric keep-hot and water heating (231) x bity for pumps, fans and electric keep-hot bity for pumps, fans and electric keep-hot	$\begin{array}{c c c c c c c c c c c c c c c c c c c $	$\begin{array}{c c c c c c c c c c c c c c c c c c c $		$\begin{array}{c c c c c c c c c c c c c c c c c c c $		Inclusion       Secondary/supplementary heating system, %       0         Jan       Feb       Mar       Apr       May       Jun       Jul       Aug       Sep       Oct       Nov       Dec       KWh/yee         811.83       698.03       676.46       513.15       366.56       0       0       0       422.46       620.47       818.21         If (R8)m x (204)       1 × 100 + (206)       1

#### **Dwelling CO2 Emission Rate**

EI rating (section 14)

(272) ÷ (4) =

17.53	(273)
84	(274)

							User [	Details:						
	ssor N vare Na			n Marsh oma FS	י AP 201			Softwa	a Num are Vei				0005374 on: 1.0.5.58	
A			Dia	4.0		P	roperty	Address	: Plot 8					
Addre		olling di	Plo mension											
1. Uve	erali dwo	ening an	nension	5.			Aro	$\alpha(m^2)$			iaht(m)		Volumo(m <sup>3</sup> )	
Ground	1 floor						-	53.97	(1a) x	<b></b>	ight(m)	(2a) =	Volume(m <sup>3</sup> )	(3a)
									1		2.4	]		
First flo								51.97	(1b) x	2	2.4	(2b) =	124.73	(3b)
Total flo	oor area	a TFA =	(1a)+(1	o)+(1c)+	(1d)+(1e	e)+(1n	) 1	05.94	(4)					
Dwellin	ig volum	ne							(3a)+(3b	)+(3c)+(3d	l)+(3e)+	.(3n) =	254.26	(5)
2. Ver	ntilation	rate:												
				main heating		econdar neating	У	other		total			m <sup>3</sup> per hour	
Numbe	er of chir	nneys	Г	0	+	0	] + [	0	] = [	0	x 4	40 =	0	(6a)
Numbe	er of ope	en flues	Ē	0	- + -	0	<u> </u> + [	0	_ _ = _	0	x 2	20 =	0	(6b)
Numbe	er of inte	rmittent	fans						- L	4	x ^	10 =	40	(7a)
Numbe	er of pas	sive ver	nts							0	x	10 =	0	(7b)
Numbe	er of flue	less ga	s fires						Г	0	x 4	40 =	0	(7c)
									L					_
												Air ch	anges per ho	ur
Infiltrati	ion due	to chim	neys, flu	es and f	ans = (6	a)+(6b)+(7	a)+(7b)+	(7c) =	Γ	40	· ·	÷ (5) =	0.16	(8)
						ed, proceed	d to (17),	otherwise	continue fr	om (9) to (	(16)			_
		•		elling (n	s)								0	(9)
		filtration		_						_	[(9)-	-1]x0.1 =	0	(10)
								or mason		uction			0	(11)
				use the va equal user		ponaing to	the grea	ter wall are	a (atter					
If sus	spended	, d woode	n floor,	enter 0.2	2 (unseal	led) or 0.	1 (seal	ed), else	enter 0				0	(12)
lf no	draught	t lobby,	enter 0.0	05, else	enter 0								0	(13)
Perc	entage	of windo	ws and	doors di	raught st	ripped							0	(14)
Wind	low infil	tration						0.25 - [0.2	2 x (14) ÷ 1	= [00			0	(15)
Infiltr	ation ra	te						(8) + (10)	+ (11) + (1	12) + (13) -	+ (15) =		0	(16)
•		•		•			•	our per s	•	etre of e	nvelope	area	5	(17)
If base	d on air	permea	bility va	lue, then	(18) = [(1	7) ÷ 20]+(8	8), otherw	/ise (18) =	(16)				0.41	(18)
	-			ressurisati	on test has	s been don	e or a de	egree air pe	rmeability	is being u	sed		<b>-</b>	-
		es shelte	ered					(20) – 1 -	[0.075 x (1	10)1 -			2	(19)
Shelter			ration al	altar fa						[3]] –			0.85	(20)
			-	nelter fac		J		(21) = (18	, ∧ (∠∪) =				0.35	(21)
iniiitrati			r	<u> </u>	nd speed		11	۸	San	Oct	Nov	Dee	1	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	l	
ŕ			·	rom Tab	<b></b>		0.0	07		4.0	4.5	47	1	
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

(22a)m=	actor (2	.2a)m =	(22)m ÷	4										
(22a)111-	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18	]	
Adjuste	ed infiltra	ation rate	e (allowi	ng for sh	nelter an	d wind s	peed) =	(21a) x	(22a)m					
[	0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41		
		<i>ctive air i</i> al ventila	-	rate for t	he appli	cable ca	se						0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)), other	wise (23b)	) = (23a)			0	(23b)
lf bala	anced with	heat reco	very: effici	ency in %	allowing f	or in-use fa	actor (from	n Table 4h)	) =				0	(23c)
a) If I	balance	d mecha	anical ve	ntilation	with he	at recove	ery (MVI	HR) (24a	ı)m = (22	2b)m + (2	23b) × [1	– (23c)	) ÷ 100]	
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24a)
b) If I	balance	d mecha	anical ve	ntilation	without	heat rec	overy (N	MV) (24b	)m = (22	2b)m + (2	23b)		_	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24b)
,					•	•		on from c c) = (22b		5 × (23b	)			
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	]	(24c)
,								on from l 0.5 + [(2		0.5]				
(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(24d)
Effec	ctive air	change	rate - er	iter (24a	) or (24b	o) or (24	c) or (24	d) in box	(25)					
(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58		(25)
3. Hea	at losse	s and he	at loss p	paramete	ər:									
ELEM	IENT	Gros area		Openin m		Net Ar A ,r		U-valı W/m2		A X U (W/ł	<)	k-value kJ/m²₊l		A X k kJ/K
Doors						2.14	x	1	=	2.14				(26)
Window	ws Type	1							_					
Minday						5.38	x1.	/[1/( 1.4 )+	0.04] =	7.13				(27)
vvindov	ws Type					5.38 8.432	╡.	/[1/( 1.4 )+ /[1/( 1.4 )+	Ļ	7.13 11.18				(27) (27)
	ws Type ws Type	2					<u>x</u> 1		0.04] =					
Window		2				8.432	x1.	/[1/( 1.4 )+	0.04] =	11.18				(27)
Windov Floor		2	52	16.60	6	8.432 0.71	x1, x1, x1,	/[1/( 1.4 )+ /[1/( 1.4 )+	0.04] = [ 0.04] = [	11.18 0.94				(27)
Windov Floor Walls		2 3		16.60	ô	8.432 0.71 53.97	x1, x1, x1, x 6 x	/[1/( 1.4 )+ /[1/( 1.4 )+ 0.13	0.04] = [ 0.04] = [ = [	11.18 0.94 7.0161				(27) (27) (28)
Windov Floor Walls Roof Total a	ws Type rea of e	2 3 143. 51.9 Iements	7 , m²	0		8.432 0.71 53.97 126.8 51.97 249.4	2 x1. x1. x x 6 x x 6	/[1/( 1.4 )+ /[1/( 1.4 )+ 0.13 0.18 0.13	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	11.18 0.94 7.0161 22.83 6.76				(27) (27) (28) (29)
Windov Floor Walls Roof Total a	ws Type rea of e dows and	2 3 143.5 51.9 Iements roof windo	7 , m² ows, use e	0	ndow U-va	8.432 0.71 53.97 126.80 51.97 249.40 alue calcula	2 x1. x1. x x 6 x x 6	/[1/( 1.4 )+ /[1/( 1.4 )+ 0.13 0.18	$0.04] = \begin{bmatrix} 0.04 \end{bmatrix} = \begin{bmatrix}$	11.18 0.94 7.0161 22.83 6.76	s given in	paragraph		(27) (27) (28) (29) (30)
Windov Floor Walls Roof Total a * for wind ** include	rea of e dows and e the area	2 3 143. 51.9 Iements	7 , m² ows, use e sides of in	0 ffective wi ternal wal	ndow U-va	8.432 0.71 53.97 126.80 51.97 249.40 alue calcula	2 x1. x1. x x 6 x x 6 x x 6 ated using	/[1/( 1.4 )+ /[1/( 1.4 )+ 0.13 0.18 0.13	$0.04] = \begin{bmatrix} \\ 0.04 \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \\ \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \\ \\ \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	11.18 0.94 7.0161 22.83 6.76	s given in	paragraph	n 3.2	(27) (27) (28) (29) (30)
Windov Floor Walls Roof Total a * for wind ** include Fabric	rea of e dows and e the area heat los	2 3 143.5 51.9 Iements roof windo	7 , m² ows, use e sides of in = S (A x	0 ffective wi ternal wal	ndow U-va	8.432 0.71 53.97 126.80 51.97 249.40 alue calcula	2 x1. x1. x x 6 x x 6 x x 6 ated using	/[1/( 1.4 )+ /[1/( 1.4 )+ 0.13 0.18 0.13	$0.04] = \begin{bmatrix} \\ 0.04 \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	11.18 0.94 7.0161 22.83 6.76 e)+0.04] a	[ ] ]			(27) (27) (28) (29) (30) (31) (33)
Windov Floor Walls Roof Total a * for wind ** include Fabric I Heat ca	rea of e dows and e the area heat los apacity	= 2 $= 3$ $= 143.5$ $= 51.9$ Independents Independent of the set of the se	7 , m <sup>2</sup> ows, use e sides of in = S (A x A x k )	ffective wi ternal wal U)	ndow U-va	8.432 0.71 53.97 126.80 51.97 249.40 alue calcula	2 x1 x1 x 6 x x 6 x x 6 ated using	/[1/( 1.4 )+ /[1/( 1.4 )+ 0.13 0.18 0.13	$\begin{array}{l} 0.04] = \begin{bmatrix} \\ 0.04] \\ = \end{bmatrix} \\ = \begin{bmatrix} \\ \\ \end{bmatrix} \\ = \begin{bmatrix} \\ \\ \end{bmatrix} \\ = \begin{bmatrix} \\ \\ \\ \\ \end{bmatrix} \\ + (32) = \\ ((28) \end{array}$	11.18 0.94 7.0161 22.83 6.76 e)+0.04] a	2) + (32a)		58	(27) (27) (28) (29) (30) (31)
Windov Floor Walls Roof Total a * for wind * for wind Fabric Heat ca Therma For desig	rea of e dows and e the area heat los apacity al mass gn assess	2 $3$ $143.5$ $51.9$ $1000  winder$	7 , m <sup>2</sup> sides of in = S (A x A x k ) ter (TMF ere the de	ffective wi ternal wal U) P = Cm ÷	ndow U-va Is and pan - TFA) ir	8.432 0.71 53.97 126.80 51.97 249.40 alue calcula titions	2 x1. x1. x x 6 x x 6 x x 6 ated using	/[1/( 1.4 )+ /[1/( 1.4 )+ 0.13 0.18 0.13	$0.04] = \begin{bmatrix} \\ 0.04 \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	11.18 0.94 7.0161 22.83 6.76 e)+0.04] a .(30) + (32 tive Value:	2) + (32a) Medium	(32e) =	58 7546.15	(27) (27) (28) (29) (30) (31) (31) (33) (33) (34)
Windov Floor Walls Roof Total a * for wind * include Fabric Heat ca Therma For desig can be u	rea of e dows and e the area heat los apacity al mass gn assess used inste	= 2 = 3 143.5 51.9 Iements roof windo as on both as, W/K = Cm = S( parame sements who ad of a det	7 , m <sup>2</sup> ows, use e sides of in = S (A x A x k ) ter (TMF ere the de ailed calcu	ffective wi ternal walk U) P = Cm ÷ tails of the ulation.	ndow U-va Is and part - TFA) ir construct	8.432 0.71 53.97 126.80 51.97 249.40 alue calcula titions	x1 x1 x 6 x 6 x x 6 ated using	/[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13 1 formula 1, (26)(30)	$0.04] = \begin{bmatrix} \\ 0.04 \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	11.18 0.94 7.0161 22.83 6.76 e)+0.04] a .(30) + (32 tive Value:	2) + (32a) Medium	(32e) =	58 7546.15	(27) (27) (28) (29) (30) (31) (31) (33) (33) (34)
Windov Floor Walls Roof Total a * for wind * for vind Fabric Fabric Heat ca Therma <i>For desig</i> <i>can be u</i> Therma <i>if details</i>	rea of e dows and e the area heat los apacity al mass gn assess used instea al bridge of therma	= 2 = 3 143.5 51.9 Iements roof windo as on both as on both as, W/K = Cm = S( parame ad of a det es : S (L al bridging	7 , m <sup>2</sup> sides of in = S (A x A x k ) ter (TMF ere the de ailed calcu x Y) calc	ffective wi ternal wal U) P = Cm ÷ tails of the lation. culated of	ndow U-va ls and part - TFA) ir construct using Ap	8.432 0.71 53.97 126.8 51.97 249.4 alue calcula titions	x1 x1 x 6 x 6 x x 6 ated using	/[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13 1 formula 1, (26)(30)	0.04] = [ 0.04] = [ = [ = = [ = = [ /[(1/U-value + (32) = ((28) Indicative	11.18 0.94 7.0161 22.83 6.76 e)+0.04] a .(30) + (32 tive Values values of	2) + (32a) Medium	(32e) =	58 7546.15 250	(27) (27) (28) (29) (30) (31) (31) (33) (33) (34) (35) (36)
Windov Floor Walls Roof Total a * for wind * for wind Fabric Heat ca For desig can be u Therma if details Total fa	rea of e dows and e the area heat los apacity al mass gn assess used instea al bridge of therma abric he	= 2 = 3 143.5 51.9 Iements roof windo as on both as on both as, W/K = Cm = S( parame ad of a det es : S (L al bridging	7 , m <sup>2</sup> sides of in = S (A x A x k ) ter (TMF ere the de ailed calcu x Y) calcu are not kn	ffective wi ternal wal U) P = Cm ÷ tails of the ilation. culated to own (36) =	ndow U-va ls and part - TFA) ir construct using Ap = 0.05 x (3	8.432 0.71 53.97 126.8 51.97 249.4 alue calcula titions	x1 x1 x 6 x 6 x x 6 ated using	/[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13 1 formula 1, (26)(30)	$0.04] = \begin{bmatrix} \\ 0.04 \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \\ \end{bmatrix} = \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	11.18 0.94 7.0161 22.83 6.76 e)+0.04] a .(30) + (32 tive Value: values of (36) =	2) + (32a) Medium	(32e) =	58 7546.15 250	(27) (27) (28) (29) (30) (31) (31) (33) (33) (34) (35)

(38)m=	50.13	49.81	49.5	48.04	47.76	46.49	46.49	46.26	46.98	47.76	48.32	48.9		(38)
Heat tr	ansfer c	coefficie	nt, W/K	I	I	I	I		(39)m	= (37) + (3	38)m			
(39)m=	118.98	118.67	118.36	116.89	116.62	115.35	115.35	115.11	115.84	116.62	117.17	117.75		
				(						Average =		12 /12=	116.89	(39)
Heat IC (40)m=	ss para 1.12	1.12	HLP), W/ 1.12	1	1.1	1.09	1.09	1.09	(40)m 1.09	= (39)m ÷ 1.1		1.11		
(40)11=	1.12	1.12	1.12	1.1	1.1	1.09	1.09	1.09		Average =	1.11 Sum(40) <sub>1</sub>		1.1	(40)
Numbe	er of day	s in mo	nth (Tab	le 1a)						lionago		L		
	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	ter heat	ting ene	rgy requi	irement:								kWh/ye	ar:	
		ipancy, I		14	( 0 0000	40 (T	- 40.0		0040 (			79		(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	549 X (11	-A -13.9	)2)] + 0.0	JU13 X (	IFA -13.	9)			
Annua	averag	e hot wa	ater usag									).42		(43)
			hot water person per					to achieve	a water us	se target o	f			
	Jan	Feb	Mar		May	Jun	Jul	Δυσ	Sep	Oct	Nov	Dec		
Hot wate			day for ea	Apr ach month	,			Aug (43)	Sep		INOV	Dec		
(44)m=	110.46	106.44	102.43	98.41	94.39	90.38	90.38	94.39	98.41	102.43	106.44	110.46		
										Total = Su		-	1205.02	(44)
Energy o	content of	hot water	used - cal	culated mo	onthly $= 4$ .	190 x Vd,r	n x nm x C	0Tm / 3600	) kWh/mor	nth (see Ta	bles 1b, 1	c, 1d)		
(45)m=	163.81	143.27	147.84	128.89	123.67	106.72	98.89	113.48	114.84	133.83	146.09	158.64		_
lf instant	aneous w	ater heati	ng at point	of use (no	hot water	r storage)	enter () in	boxes (46		Total = Su	m(45) <sub>112</sub> =	-	1579.97	(45)
	24.57	21.49	22.18	19.33	18.55	16.01	14.83	17.02	17.23	20.07	21.91	23.8		(46)
(46)m= Water	storage		22.10	19.55	10.00	10.01	14.05	17.02	17.25	20.07	21.91	23.0		(40)
Storag	e volum	e (litres)	includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If comr	nunity h	eating a	ind no ta	ınk in dw	velling, e	nter 110	litres in	(47)						
			hot wate	er (this ir	icludes i	nstantar	neous co	ombi boil	ers) ente	er '0' in (	47)			
	storage anufact		eclared l	oss facto	or is kno	wn (kWł	n/dav).					0		(48)
			m Table				"aay).					0		(49)
			storage		ear			(48) x (49)	) =			0		(50)
•••			eclared o			or is not						•		()
		-	factor fr		e 2 (kW	h/litre/da	ıy)					0		(51)
		from Ta	ee section ble 2a	on 4.3								0		(52)
			m Table	2b								0		(52)
Energy	lost fro	m water	· storage	, kWh/ye	ear			(47) x (51)	) x (52) x (	53) =		0		(54)
		(54) in (5	-	,								0		(55)
Water	storage	loss cal	culated f	for each	month			((56)m = (	55) × (41)	m				
(56)m=	0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinde	er contains	s dedicate	d solar sto	rage, (57)	m = (56)m	x [(50) – (	H11)] ÷ (5	0), else (5	7)m = (56)	m where (	H11) is fro	m Appendi	хH	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

	•	t loss (ar										0		(58)
Primary circuit loss calculated for each month $(59)m = (58) \div 365 \times (41)m$ (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)														
(110) (59)m=												0		(59)
(59)11=	0	0	0	0	0	0	0	0	0	0	0	0		(00)
Combi		lculated	i	month (	(61)m =	(60) ÷ 30	65 × (41)	)m					l .	
(61)m=	50.96	46.03	50.96	48.53	48.1	44.57	46.05	48.1	48.53	50.96	49.32	50.96		(61)
Total h	neat req	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=	214.77	189.3	198.8	177.42	171.78	151.29	144.95	161.58	163.37	184.79	195.4	209.6		(62)
Solar DI	HW input	calculated	using App	endix G or	Appendix	k H (negati	ve quantity	/) (enter '0	' if no sola	r contribut	ion to wate	er heating)		
(add a	dditiona	I lines if	FGHRS	and/or V	WHRS	applies	, see Ap	pendix (	G)				L	
(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	t from w	ater hea	ter	-	-	-	-	-	-		-	-		
(64)m=	214.77	189.3	198.8	177.42	171.78	151.29	144.95	161.58	163.37	184.79	195.4	209.6		_
								Outp	out from wa	ater heate	r (annual)₁	12	2163.04	(64)
Heat g	ains fro	m water	heating,	kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	+ (61)m	n] + 0.8 x	(46)m	+ (57)m	+ (59)m	]	
(65)m=	67.21	59.14	61.9	54.99	53.15	46.63	44.4	49.76	50.32	57.24	60.9	65.49		(65)
inclu	de (57)	m in calo	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	ater is fr	om com	munity h	eating	
5. Int	ternal g	ains (see	e Table 5	5 and 5a	):									
		ns (Table												
metab	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	139.41	139.41	139.41	139.41	139.41	139.41	139.41	139.41	139.41	139.41	139.41	139.41		(66)
Lightin	a dains	ı (calcula	I ted in Ar	n Dendix	L equat	ion I 9 o	rl9a)a	l Iso see '	I Table 5					
(67)m=	25.52	22.67	18.43	13.95	10.43	8.81	9.52	12.37	16.6	21.08	24.6	26.23		(67)
		ins (calc												
(68)m=	265.59	268.34	261.4	246.61	227.95	210.41	198.69	195.94	202.88	217.67	236.33	253.87	l	(68)
											200.00	200.07		(00)
(69)m=	36.94	calcula 36.94	36.94	36.94	L, equa	36.94	36.94	36.94	36.94	5 36.94	36.94	36.94	l	(69)
					30.94	30.94	30.94	30.94	30.94	30.94	30.94	30.94		(00)
	r	ns gains	<u>`</u>	, 									I	(70)
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
		aporatic	<u> </u>		<u> </u>	· · · · · · · · · · · · · · · · · · ·							I	
		-111.53		-111.53	-111.53	-111.53	-111.53	-111.53	-111.53	-111.53	-111.53	-111.53		(71)
Water		gains (T	, <u> </u>											
(72)m=	90.33	88.01	83.19	76.37	71.43	64.76	59.67	66.88	69.88	76.93	84.59	88.02		(72)
Total i	nterna	gains =				(66)	m + (67)m	n + (68)m -	+ (69)m + (	(70)m + (7	1)m + (72)	m		
(73)m=	449.26	446.84	430.85	404.76	377.64	351.8	335.7	343.01	357.19	383.5	413.34	435.94		(73)
	lar gain													
-		calculated	-					tions to co	onvert to th	e applicab		ion.		
Orienta		Access F Table 6d		Area m²		Flu	x ble 6a	т	g_ able 6b	т	FF able 6c		Gains (W)	
		1 2016 00		111~		Id	ue ua	I		10			(**)	
		watts, ca	1	1					um(74)m .				I	(00)
(83)m=	0	0	0	0	0	0	0	0	0	0	0	0		(83)

(84)m=	449.26	446.84	430.85	404.76	377.64	351.8	335.7	343.01	357.19	383.5	413.34	435.94		(84)
7. Me	an inter	nal temp	erature	(heating	season	)								
Temp	erature	during h	eating p	eriods ir	n the livir	ng area	from Tab	ole 9, Th	1 (°C)				21	(85)
Utilisa	ation fac	tor for g	ains for	living are	ea, h1,m	(see Ta	ble 9a)							_
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	1	1	1	0.99	0.96	0.96	0.99	1	1	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ns 3 to 7	r in Tabl	e 9c)					
(87)m=	19.63	19.7	19.85	20.1	20.37	20.65	20.83	20.82	20.6	20.26	19.91	19.62		(87)
Tomp		during h		eriods ir	roct of	dwolling	from To		h2 (°C)					
(88)m=	19.98	19.98	19.99	20	20	20.01	20.01	20.01	20.01	20	20	19.99		(88)
									20101			10100		
Utilisa (89)m=	ation fac	tor for g	ains for	rest of d	velling, l	n2,m (se 0.98		9a) 0.91	0.98	1	1	1		(89)
				1							1	1		(00)
		· · ·		the rest		· · ·	i	r i		,				(22)
(90)m=	18.13	18.23	18.46	18.83	19.22	19.64	19.89	19.88	19.57	19.06	18.56	18.13		(90) רפיי ד
									Т	LA = LIVIN	g area ÷ (4	+) =	0.15	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA × T1	+ (1 – fL	A) × T2					
(92)m=	18.35	18.45	18.67	19.01	19.39	19.79	20.03	20.01	19.72	19.24	18.76	18.35		(92)
	· ·	1		n internal	temper		1	1	ere appro	opriate				
(93)m=	18.35	18.45	18.67	19.01	19.39	19.79	20.03	20.01	19.72	19.24	18.76	18.35		(93)
		ting requ			• - •	• • •				//	>			
				mperatui using Ta		ed at ste	ep 11 of	l able 9	o, so tha	t II,m=(	76)m an	d re-calc	ulate	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g						- 5	1					
(94)m=	1	1	1	1	0.99	0.97	0.9	0.91	0.98	1	1	1		(94)
Usefu	Il gains,	hmGm	W = (94	4)m x (84	4)m									
(95)m=	448.87	446.39	430.24	403.75	375.21	342.58	302.22	311.91	350.06	381.94	412.76	435.62		(95)
	<u> </u>	<u> </u>		perature		able 8								
(96)m=	4.3	4.9	6.5	8.9										
Heat					11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
				al tempe	erature,	Lm , W =	L =[(39)m :	x [(93)m	– (96)m	]				. ,
(97)m=	1672.13	1607.46	1440.2	al tempe 1182.38	erature, 897.1	Lm , W = 598.72	=[(39)m 395.46	x [(93)m 416.06	– (96)m 651.17	] 1007.65	1366.01	4.2 1666.13		(96) (97)
(97)m= Space	1672.13 e heatin	1607.46 g require	1440.2 ement fo	al tempe 1182.38 or each n	erature, 897.1 nonth, k\	Lm , W = 598.72 Nh/mont	=[(39)m 395.46 th = 0.02	x [(93)m 416.06 24 x [(97)	– (96)m <sup>651.17</sup> )m – (95	] 1007.65 )m] x (4 <sup>-</sup>	1366.01 1)m	1666.13		. ,
(97)m=	1672.13	1607.46	1440.2	al tempe 1182.38	erature, 897.1	Lm , W = 598.72	=[(39)m 395.46	x [(93)m 416.06 24 x [(97) 0	– (96)m 651.17 )m – (95 0	] 1007.65 )m] x (4 <sup>-</sup> 465.52	1366.01 1)m 686.34	1666.13 915.49	5450.02	(97)
(97)m= Space (98)m=	1672.13 e heatin 910.11	1607.46 g require 780.24	1440.2 ement fo 751.41	al tempe 1182.38 r each n 560.62	erature, 897.1 nonth, k\ 388.29	Lm , W = 598.72 Nh/mont	=[(39)m 395.46 th = 0.02	x [(93)m 416.06 24 x [(97) 0	– (96)m <sup>651.17</sup> )m – (95	] 1007.65 )m] x (4 <sup>-</sup> 465.52	1366.01 1)m 686.34	1666.13 915.49	5458.02	(97)
(97)m= Space (98)m=	1672.13 e heatin 910.11	1607.46 g require 780.24	1440.2 ement fo 751.41	al tempe 1182.38 or each n	erature, 897.1 nonth, k\ 388.29	Lm , W = 598.72 Nh/mont	=[(39)m 395.46 th = 0.02	x [(93)m 416.06 24 x [(97) 0	– (96)m 651.17 )m – (95 0	] 1007.65 )m] x (4 <sup>-</sup> 465.52	1366.01 1)m 686.34	1666.13 915.49	5458.02	(97)
(97)m= Space (98)m= Space 9a. En	1672.13 e heatin 910.11 e heatin ergy rec	1607.46 g require 780.24 g require quiremer	1440.2 ement fo 751.41 ement in	al tempe 1182.38 r each n 560.62	erature, 897.1 nonth, k\ 388.29 /year	Lm , W = 598.72 Wh/mont 0	=[(39)m : 395.46 th = 0.02 0	x [(93)m 416.06 24 x [(97) 0 Tota	– (96)m 651.17 )m – (95 0 I per year	] 1007.65 )m] x (4 <sup>-</sup> 465.52	1366.01 1)m 686.34	1666.13 915.49		(97)
(97)m= Space (98)m= Space 9a. En <b>Spac</b>	1672.13 e heatin 910.11 e heatin ergy rec e heatin	1607.46 g require 780.24 g require quiremen ng:	1440.2 ement fo 751.41 ement in nts – Ind	al tempe 1182.38 or each n 560.62 kWh/m <sup>2</sup> ividual h	erature, 897.1 nonth, k\ 388.29 /year eating sy	Lm , W = 598.72 Wh/mont 0	=[(39)m : 395.46 th = 0.02 0	x [(93)m 416.06 24 x [(97) 0 Tota micro-C	– (96)m 651.17 )m – (95 0 I per year	] 1007.65 )m] x (4 <sup>-</sup> 465.52	1366.01 1)m 686.34	1666.13 915.49	51.52	(97) ](98) ](99)
(97)m= Space (98)m= Space 9a. En Spac Fracti	1672.13 e heatin 910.11 e heatin ergy rec e heatin fon of sp	1607.46 g require 780.24 g require quiremen ng: pace hea	1440.2 ement fo 751.41 ement in hts – Ind	al tempe 1182.38 r each n 560.62 kWh/m <sup>2</sup> ividual h	erature, 897.1 nonth, k\ 388.29 //year eating sy	Lm , W = 598.72 Wh/mont 0	=[(39)m : 395.46 th = 0.02 0 ncluding	x [(93)m 416.06 24 x [(97) 0 Tota micro-C	– (96)m 651.17 )m – (95 0 I per year	] 1007.65 )m] x (4 <sup>-</sup> 465.52	1366.01 1)m 686.34	1666.13 915.49		(97) (98) (99) (201)
(97)m= Space (98)m= Space 9a. En Spac Fracti	1672.13 e heatin 910.11 e heatin ergy rec e heatin ion of sp	1607.46 g require 780.24 g require quiremen ng: pace hea pace hea	1440.2 ement fo 751.41 ement in hts – Ind ht from s ht from m	al tempe 1182.38 or each n 560.62 kWh/m <sup>2</sup> ividual h	erature, 897.1 nonth, k\ 388.29 //year eating sy y/supple em(s)	Lm , W = 598.72 Wh/mont 0	=[(39)m : 395.46 th = 0.02 0	x [(93)m 416.06 24 x [(97) 0 Tota micro-C	- (96)m 651.17 )m - (95 0 I per year CHP)	] 1007.65 )m] x (4 <sup>,</sup> 465.52 (kWh/year	1366.01 1)m 686.34	1666.13 915.49	51.52	(97) ](98) ](99)

Total gains – internal and solar (84)m = (73)m + (83)m, watts

Efficie	anov of	main an	ace had	ting out	-m 1								02.4	(206)
	-	-		ting syste	y heating	n svetan	n %						93.4	(208)
	-	Feb	Mar	1		Jun	Jul	Aug	Sep	Oct	Nov	Dec	-	
Space	Jan a heatin			Apr calculate	May d above)		Jui	Aug	Sep	Oct	INOV	Dec	kWh/ye	ar
opuo	910.11	780.24	751.41	560.62	388.29	0	0	0	0	465.52	686.34	915.49		
(211)m	n = {[(98	)m x (20	)4)] } x ′	1 100 ÷ (20										(211)
( )	974.42	835.37	804.51	600.23	, 415.73	0	0	0	0	498.42	734.84	980.19		
				•				Tota	al (kWh/yea	ar) =Sum(2	211) <sub>15,1012</sub>	=	5843.71	(211)
•				′y), kWh/	month									
		<u> </u>	00 ÷ (20	T .		-							l	
(215)m=	0	0	0	0	0	0	0	0 Tota	0 al (kWh/yea	0	0	0		(215)
Wator	heating							1010			- 10) <sub>15,1012</sub>	2	0	(213)
			ter (calc	ulated a	bove)									
	214.77	189.3	198.8	177.42	171.78	151.29	144.95	161.58	163.37	184.79	195.4	209.6		
Efficier	ncy of w	ater hea	ater										80.3	(216
(217)m=	88.28	88.23	88.08	87.75	87.04	80.3	80.3	80.3	80.3	87.28	87.95	88.33		(217
		-	kWh/m											
(219)m (219)m=		<u>m x 100</u> 214.54	) ÷ (217 225.7	)m 202.2	197.35	188.41	180.51	201.22	203.45	211.72	222.18	237.29		
			1	I				Tota	1 = Sum(2)	19a) <sub>112</sub> =			2527.83	(219
Annua	I totals									k	Wh/year		kWh/year	 r
Space	heating	fuel use	ed, main	system	1								5843.71	
Water	heating	fuel use	ed										2527.83	٦
Electric	city for p	oumps, f	ans and	electric	keep-hot	t								_
centra	al heatir	ng pump	:									30		(230
boiler	with a f	an-assis	sted flue									45		(230
boiler with a fan-assisted flue							sum of (230a)(230g) =							(231
Total electricity for the above, kWh/year Electricity for lighting									. ,	( 0,			75	(232
		0 0	<i>,</i> , , ,	(0.1.4	(00 A)	(00.4)	(000)						450.67	4
				-	)(221)								8897.21	(338
12a. (	CO2 em	issions	– Indivic	lual heat	ing syste	ems incl	uding mi	cro-CHF	)					
						Er	ergy				ion fac	tor	Emissions	5
						kV	Vh/year			kg CO	2/kWh		kg CO2/ye	ar
Space	heating	(main s	system 1	)		(21	1) x			0.2	16	=	1262.24	(261
Space	heating	(secon	dary)			(21	5) x			0.5	19	=	0	(263
Water heating							9) x			0.2	16	=	546.01	(264
Space and water heating							1) + (262)	+ (263) + (	(264) =				1808.25	 ](265
Electricity for pumps, fans and electric keep-hot							1) x			0.5	10	=	38.93	(267
	city for I						2) x					=		(268
	•					(20	-, ^			0.5			233.9	_
i otal C	CO2, kg/	year							sum o	f (265)(2	271) =		2081.07	(272

TER =

19.64 (273)