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 12:33:12*

Project Information	on:			
Assessed By:	Ben Marsh (STR	O005374)	Building Type:	End-terrace House
Dwelling Details:				
NEW DWELLING	DESIGN STAGE		Total Floor Area: 1	05.64m²
Site Reference :	New Project		Plot Reference:	Plot 12
Address :	Plot 12			
Client Details:				
Name:				
Address :				
This report cover	s items included	within the SAP calculations.		
t is not a comple	te report of regula	tions compliance.		
1a TER and DER				
	ing system: Mains	jas		
Fuel factor: 1.00 (r	•		10.05 1 . ()	
-	xide Emission Rate		16.95 kg/m ²	OK
1b TFEE and DF	Dioxide Emission Ra	ale (DER)	15.51 kg/m²	OK
	rgy Efficiency (TFE	E)	50.8 kWh/m ²	
-	ergy Efficiency (DF		44.7 kWh/m²	
5	<u> </u>	,		ОК
2 Fabric U-value	S			
Element		Average	Highest	
External		0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Party wal		0.00 (max. 0.20)	-	OK
Floor		0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof Openings		0.11 (max. 0.20)	0.11 (max. 0.35)	OK OK
2a Thermal bridg		1.40 (max. 2.00)	1.40 (max. 3.30)	UK
		from linear thermal transmittan	ces for each junction	
3 Air permeabilit				
Air permeat	pility at 50 pascals		5.00 (design val	ue)
Maximum			10.0	ОК
4 Heating efficie	ncy			
Main Heatir	ng system:	Database: (rev 507, produc	t index 017953):	
		Boiler systems with radiator	s or underfloor heating - ma	ains gas
		Brand name: Vaillant		
		Model: ecoTEC exclusive 8		
		Model qualifier: VUW 356/5	-7 (H-GB)	
		(Combi) Efficiency 89.7 % SEDBUK	2009	
		Minimum 88.0 %	2000	ОК
				511
Secondary	heating system:	None		

Regulations Compliance Report

5 Cylinder insulation			
Hot water Storage:	No cylinder		
6 Controls			
Space heating controls	TTZC by plumbing and el	ectrical services	OK
Hot water controls:	No cylinder thermostat		
	No cylinder		
Boiler interlock:	Yes		OK
7 Low energy lights			
Percentage of fixed lights wit	h low-energy fittings	100.0%	
Minimum		75.0%	OK
8 Mechanical ventilation			
Not applicable			
9 Summertime temperature			
Overheating risk (South East	England):	Not assessed	?
10 Key features			
Roofs U-value		0.11 W/m²K	
Party Walls U-value		0 W/m²K	

Thermal Bridge Report

Property Details: Plot 12					
Address:	Plot 12				
Located in:	England				
Region:	South East Er	ngland			
Thermal bridges:					
Thermal bridges:		User-defined = UD Default = D Approved = A User-defined (individ	ual PSI-values) `	Y-Value = 0.0883	
External Junctions Details:					
Junction Type		PSI-Value	Length	Reference	Туре
Other lintels (including other steel lintels)		0.3	11.36	E2	[A]
Sill		0.04	8.42	E3	[A]
Jamb		0.05	24.68	E4	[A]
Intermediate floor within a dwelling		0.07	21.4	E6	[A]
Eaves (insulation at ceiling level)		0.06	10.28	E10	[A]
Corner (normal)		0.09	20.12	E16	[A]
Gable (insulation at ceiling level)		0.24	11.12	E12	[A]
Ground floor (normal)		0.16	21.4	E5	[A]
Party Junctions Dotails:					
Party Junctions Details:					
Party Junctions Details: Ground floor		0.16	8.72	P1	[D]
		0.16 0	8.72 8.72	P1 P2	[D] [D] [D]



Plot 12

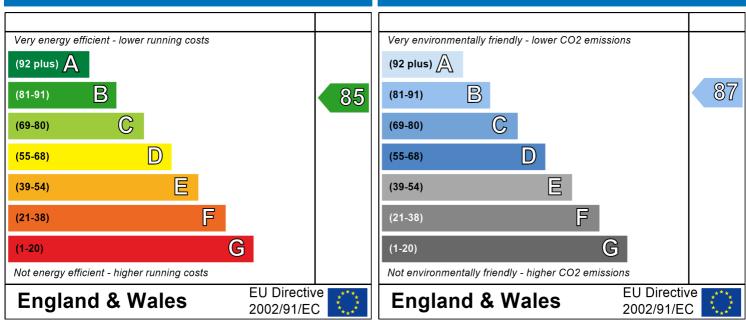
Dwelling type: Date of assessment: Produced by: Total floor area: End-terrace House 19 October 2022 Ben Marsh 105.64 m²

Environmental Impact (CO₂) 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 12						
Address: Located in: Region: UPRN: Date of assessm Date of certifica Assessment type Transaction type Tenure type: Related party di Thermal Mass Pa Water use <= 12 PCDF Version:	te: e: e: sclosure: arameter:	19 Octo 21 Octo New dw New dw Owner- No relat Indicati	ast England ber 2022 ber 2022 velling design stag	ge			
Property description	n:						
Dwelling type: Detachment: Year Completed: Floor Location: Floor 0 Floor 1		House End-ter 2022 Floor a 52.82 m 52.82 m	area: 1 ² 1 ²		itorey height 2.4 m 2.63 m	:	
Living area: Front of dwelling f	aces:	North	² (fraction 0.232))			
Opening types:							
Name: Front Front Rear	Source: Manufacturer SAP 2012 SAP 2012	So Wi	/pe: lid ndows ndows	Glazing: double-glaze double-glaze		Argon: Yes Yes	Frame: PVC-U PVC-U PVC-U
Name: Front Front Rear Name:	Gap: mm 16mm o 16mm o Type-Nam	r more	Frame Facto 0.7 0.7 0.7 0.7	or: g-value: 0 0.76 0.76 Orient:	U-value: 1.4 1.4 1.4	Area: 2.14 5.48 8.42 Width:	No. of Openin 1 1 1 Height:
Front Front Rear	51	Ex Ex	t Walls t Walls t Walls	Unspecified Unspecified		0 0 0	0 0 0
Overshading:		Average	e or unknown				
Opaque Elements:							
Type: <u>External Elements</u> Ext Walls Cold Roof Ground Floor <u>Internal Elements</u> <u>Party Elements</u> Party Wall	Gross area: 103.71 52.82 52.82 45.9	Openings: 16.04 0	Net area: 87.67 52.82	U-value: 0.17 0.11 0.14	Ru value: 0 0	Curtain False	wall: Kappa N/A N/A N/A N/A
Thermal bridges:							

SAP Input

Thermal bridges:		d (individual l Psi-valu	•	Y-Value = 0.0883
[Approved]	Length		-	Other lintels (including other steel lintels)
[Approved]	11.36	0.3	E2	
[Approved]	8.42	0.04	E3	Sill
[Approved]	24.68	0.05	E4	Jamb
[Approved]	21.4	0.07	E6	Intermediate floor within a dwelling
[Approved]	10.28	0.06	E10	Eaves (insulation at ceiling level)
[Approved]	20.12	0.09	E16	Corner (normal)
[Approved]	11.12	0.24	E12	Gable (insulation at ceiling level)
[Approved]	21.4	0.16	E5	Ground floor (normal)
	8.72	0.16	P1	Ground floor
	8.72	0	P2	Intermediate floor within a dwelling
	8.72	0.24	P4	Roof (insulation at ceiling level)
Ventilation:				
Pressure test:	Yes (As des	ianod)		
		•	at fana)	
Ventilation:		tilation (extra	ict faits)	
Number of chimneys:	0			
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:				
Main heating system:	Boiler syste	ms with radia	itors or und	lerfloor heating
5 5	-	and oil boilers		ů –
	Fuel: mains			
		: Boiler Datab	nase	
				17052) Efficiency: Winter 85.0 % Summer: 00.6
				017953) Efficiency: Winter 85.0 % Summer: 90.6
	Has integra			
	Brand name			
	Model: eco	TEC exclusive	835	
	Model quali	fier: VUW 356	6/5-7 (H-GE	3)
	(Combi boil	er)		
	Systems wi	th radiators		
	•	ting pump: 2	013 or late	r
		temperature		
	Boiler interl	•	. 0110100011	
Main heating Control:	Doner interi			
Main heating Control:	Time and te	emperature zo	one control	by suitable arrangement of plumbing and electrical
	services			
	Control cod	e· 2110		
Secondary heating system:	Control cou	0.2110		
Secondary heating system:	None			
Water heating:				
Water heating:	From main	heating syste	m	
-	Water code	: 901		
	Fuel :mains	gas		
	No hot wate	•		
		eat Recovery S	System	
		(rev 507, prod	-	
	Solar panel			
Others:				
	Chan david T	orlff		
Electricity tariff:	Standard Ta No	ai II I		
In Smoke Control Area:	NU			

SAP Input

Conservatory: Low energy lights: Terrain type: EPC language: Wind turbine: Photovoltaics: Assess Zero Carbon Home: No conservatory 100% Low rise urban / suburban English No None No

					User [Details:						
Assessor Name: Software Name:		n Marsh oma FS				Softwa	a Num are Vei	rsion:			005374 n: 1.0.5.58	
A dalama a a	Die	. 40		PI	operty	Address	: Plot 12					
Address : 1. Overall dwelling dim	Plot											
T. Overall dwelling diff	IENSION	5.			Aro	a(m²)		Av. Hei	ight(m)		Volume(m ³)	
Ground floor							(1a) x		.4	(2a) =	126.77	(3a)
First floor						52.82	(10) x		.63	(2b) =	138.92](3b)
Total floor area TFA = (1a)+(1t	o)+(1c)+	(1d)+(1e	e)+(1n		05.64	(4)				100.02	
Dwelling volume	, (, , ,		, ,	,)+(3c)+(3d)+(3e)+	.(3n) =	265.68	(5)
2. Ventilation rate:												4
		main neating		econdar neating	у	other		total			m ³ per hour	
Number of chimneys	Ĺ	0] + [0] + [0] = [0	x 4	40 =	0	(6a)
Number of open flues		0	+	0] + [0	=	0	x 2	20 =	0	(6b)
Number of intermittent f	ans							3	x 1	0 =	30	(7a)
Number of passive vent	S						Γ	0	x 1	0 =	0	(7b)
Number of flueless gas	fires							0	x 4	40 =	0	(7c)
										Air ch	anges per hou	ır
Infiltration due to chimn	eys, flu	es and fa	ans = (6	a)+(6b)+(7	a)+(7b)+	(7c) =	Г	30	<u> </u>	÷ (5) =	0.11	(8)
If a pressurisation test has							continue fr				0.11	
Number of storeys in	the dw	elling (ne	s)								0	(9)
Additional infiltration									[(9)-	1]x0.1 =	0	(10)
Structural infiltration:	0.25 fo	r steel oi	timber t	frame or	0.35 fo	r masoni	ry constr	uction			0	(11)
if both types of wall are deducting areas of oper				ponding to	the grea	ter wall are	a (after					-
If suspended wooden	floor, e	enter 0.2	(unseal	ed) or 0.	1 (seal	ed), else	enter 0				0	(12)
lf no draught lobby, e	nter 0.0)5, else e	enter 0								0	(13)
Percentage of window	vs 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		•			•	•	•	etre of e	nvelope	area	5	(17)
If based on air permeab	-										0.36	(18)
Air permeability value appl		ressurisatio	on test has	s been don	e or a de	gree air pe	rmeability	is being us	sed	1		-
Number of sides shelter Shelter factor	ed					(20) - 1 - 1	[0.075 x (1	9)1 -			2	(19)
	oting ob	altar for	tor					[0]] =			0.85	(20)
Infiltration rate incorpora	-			J		(21) = (18) x (20) =				0.31	(21)
Infiltration rate modified		· ·			11	۸	0.07	Oct	Maria	Det		
Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind s						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		
Adjust	ed infiltra	ation rat	e (allowi	ng for sl	nelter an	id wind s	peed) =	= (21a) x	(22a)m	_			_	
0-11	0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36		
	ate ettec echanica		-	rate for t	ne appli	cable ca	se						0	(23a)
				endix N, (2	3b) = (23a	a) × Fmv (e	equation (N5)) , othe	rwise (23b	o) = (23a)			0	(23b)
If bala	anced with	heat reco	overy: effic	iency in %	allowing	for in-use f	actor (from	m Table 4h) =				0	(23c)
a) If	balance	d mecha	anical ve	entilation	with he	at recove	∋ry (MV	HR) (24a	a)m = (2	2b)m + (2	23b) × [1	I – (23c)) ÷ 100]	
(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat rec	overy (MV) (24b)m = (2	2b)m + (2	23b)		_	
(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(24b)
,						•		on from c lc) = (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=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57]	(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24	o) or (24	c) or (24	4d) in boy	k (25)				_	
(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57		(25)
3. He	at losse	s and he	at loss i	paramet	er:									
ELEN	IENT	Gros area		Openin rr		Net Ar A ,r		U-valı W/m2		A X U (W/I	≺)	k-value kJ/m²-		A X k kJ/K
Doors						2.14	x	1.4	=	2.996				(26)
Windo	ws Type	e 1				5.48	x 1	1/[1/(1.4)+	0.04] =	7.27				(27)
Windo	ws Type	2				8.42	x 1	1/[1/(1.4)+	0.04] =	11.16				(27)
Floor						52.82	2 x	0.14	=	7.3948				(28)
Walls		103.	71	16.0	4	87.67	′ X	0.17	=	14.9				(29)
Roof		52.8	2	0		52.82	<u>x</u>	0.11	=	5.81				(30)
Total a	area of e	lements	, m²			209.3	5							(31)
Party v	wall					45.9	x	0	=	0				(32)
				effective wi nternal wal			ated using	g formula 1	/[(1/U-vali	ue)+0.04] a	ns given in	paragraph	h 3.2	
Fabric	heat los	s, W/K =	= S (A x	U)				(26)(30)	+ (32) =				49.5	3 (33)
Heat c	apacity	Cm = S(Axk)						((28).	(30) + (32	2) + (32a).	(32e) =	15336	.61 (34)
Therm	al mass	parame	ter (TMF	P = Cm -	- TFA) ir	n kJ/m²K			Indica	ative Value:	: Low		100) (35)
	ign assess			tails of the	construct	ion are not	t known p	recisely the	e indicative	e values of	TMP in Ta	able 1f		
can be t	used instea	ad of a dei	tailed calc	ulation.										
Therm	al bridge	es : S (L	x Y) cal	culated	• •	opendix ł	<						18.4	9 (36)
Therm if details	al bridge of therma	es : S (L al bridging	x Y) cal		• •		<		(22)	(36) -				
Therm <i>if details</i> Total fa	al bridge of therma abric he	es : S (L al bridging at loss	x Y) cal are not kn	culated	= 0.05 x (3		K			+ (36) = n = 0.33 × (25)m x (5)		18.4 68.0	

(38)m=	50.62	50.36	50.1	48.89	48.66	47.6	47.6	47.41	48.01	48.66	49.12	49.6		(38)
Heat tr	ansfer o	coefficier	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	118.64	118.37	118.12	116.9	116.68	115.62	115.62	115.43	116.03	116.68	117.14	117.62		_
Heat lo	ss para	meter (H	HLP), W/	/m²K						Average = = (39)m ÷	Sum(39) ₁ · (4)	12 /12=	116.9	(39)
(40)m=	1.12	1.12	1.12	1.11	1.1	1.09	1.09	1.09	1.1	1.1	1.11	1.11		
Numbe	or of day	us in mou	nth (Tab	le 12)	1	1	1	1	,	Average =	Sum(40)1	12 /12=	1.11	(40)
Turnoc	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. if TF.	A > 13.9 A £ 13.9	9, N = 1	+ 1.76 x	[1 - exp	·	,	·	, , -	· · ·	TFA -13.		79		(42)
Reduce	the annua	al average	hot water	ge in litre usage by r day (all w	5% if the a	lwelling is	designed t			se target o		5.65		(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate				ach month	,			Ŭ Ŭ	000	000	1101	000		
(44)m=	116.21	111.99	107.76	103.54	99.31	95.08	95.08	99.31	103.54	107.76	111.99	116.21		
I											m(44) ₁₁₂ =		1267.79	(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	ables 1b, 1	c, 1d)		
(45)m=	172.34	150.73	155.54	135.6	130.12	112.28	104.04	119.39	120.82	140.8	153.7	166.9		-
lf instant	aneous w	vater heatii	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	=	1662.27	(45)
(46)m=	25.85	22.61	23.33	20.34	19.52	16.84	15.61	17.91	18.12	21.12	23.05	25.04		(46)
	storage		includir		olor or M		otorogo	within or						(47)
-				ng any so Ink in dw			-		ame ves	501		0		(47)
Otherw	•	o stored		er (this in	•			· /	ers) ente	er '0' in (47)			
	-		eclared I	oss facto	or is kno	wn (kWł	n/day):				,	0		(48)
Tempe	rature f	actor fro	m Table	2b			• /					0		(49)
Energy	lost fro	m water	storage	, kWh/ye	ear			(48) x (49)) =			0		(50)
,				cylinder l om Tabl										(51)
		-	ee secti			n/ntre/ua	iy)					0		(51)
	•	from Ta										0		(52)
Tempe	rature f	actor fro	m Table	2b								0		(53)
•••			-	e, kWh/ye	ear			(47) x (51)	x (52) x (53) =		0		(54)
	. ,	(54) in (5		_								0		(55)
	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)
	er contains	s dedicate	d solar sto	rage, (57)ı I	m = (56)m	x [(50) – (H11)] ÷ (5	0), else (5 1	/)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)

Primar	v circuit	loss (ar	nual) fro	om Table	2							0]	(58)
	•	loss (al	,			(59)m = ((58) ÷ 36	65 x (41)	m			-	1	
		factor fi					· ·	• • •		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) – 36	65 x (41						1	
(61)m=	0	0	0	0	0	0	0	0	0	0	0	0]	(61)
	L	L uired for	water h	L eating ca	I	l I for eac	l h month	l (62)m –	0.85 x 1	(45)m +	l (46)m +	L (57)m +	J (59)m + (61)m	
(62)m=	172.34	150.73	155.54	135.6	130.12	112.28	104.04	119.39	120.82	140.8	153.7	166.9]	(62)
		calculated											1	
		l lines if										, inclaiming)		
、 (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	1	(63) (G2)
Output	from w	ater hea	ter											
(64)m=	172.34	150.73	155.54	135.6	130.12	112.28	104.04	119.39	120.82	140.8	153.7	166.9]	
		ļ		Į		ļ	Į		L but from wa	L ater heate	l r (annual)₁	12	1662.27	(64)
Heat o	ains fro	m water	heating	kWh/m	onth 0.2	5 ´ [0 85	x (45)m						1	1
(65)m=	57.3	50.12	51.72	45.09	43.26	37.33	34.59	39.7	40.17	46.82	51.1	55.5		(65)
		n in calo	L Sulation (l of (65)m		l vlinder i		l	or hot w	l ater is fr			J	
	. ,			. ,	-	,yiiriaci i		awennig	or not w			interney i	leating	
		ains (see).									
Metab	olic gair Jan	is (Table Feb	5), Wat Mar		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	
(66)m=	167.16	167.16	167.16	Apr 167.16	167.16	167.16	167.16	167.16	167.16	167.16	167.16	167.16		(66)
										107.10	107.10	107.10	J	(00)
-	64.27	(calcula 57.08	46.42	35.14	26.27	22.18	23.96	31.15	41.81	53.09	61.96	66.05	1	(67)
(67)m=											01.90	00.05	J	(07)
•••	<u> </u>	ins (calc		· · ·	· · · · ·	i	· · · · · · · · · · · · · · · · · · ·	<u> </u>			050.40	070.07	1	(69)
(68)m=	395.73	399.83	389.48	367.45	339.65	313.51	296.05	291.94	302.29	324.32	352.13	378.27	J	(68)
	r	(calcula	i	1	i	1	1	1	i	1		i	1	(00)
(69)m=	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	54.5	J	(69)
-		ns gains I	r`	<u> </u>		1		-				1	1	(70)
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	J	(70)
	<u> </u>	aporatio	<u> </u>	· · · · · · · · · · · · · · · · · · ·	<u> </u>	· · · · · · · · · · · · · · · · · · ·	r	r	r	r	r		1	
(71)m=	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44		(71)
Water	heating	gains (T	able 5)										1	
(72)m=	77.02	74.58	69.51	62.62	58.15	51.85	46.5	53.36	55.79	62.93	70.98	74.59]	(72)
Total i	nternal	gains =		-		(66)	m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72))m		
(73)m=	650.23	644.71	618.64	578.44	537.29	500.76	479.73	489.67	513.12	553.55	598.29	632.13		(73)
	lar gain													
-		calculated	-					itions to co		e applicat		tion.	0.1	
Orienta		Access F Fable 6d		Area m²		Flu Tal	x ble 6a	т	g_ able 6b	Т	FF able 6c		Gains (W)	
						1.01		I					(**)	
Color			ملمانيما	1 f or	h. 100 c -= 41-			(00) - 0		(00)				
Solar ((83)m=	pains in 0	watts, ca		for eac	h month	0	0	(83)m = S 0	um(74)m . 0	(82)m 0	0	0	1	(83)
(00)11-	ľ	IŬ	IŬ	IŬ	I	IŬ	I	I	IŬ	I	I	I	1	(00)

	650.23	644.71	618.64	578.44	537.29	500.76	479.73	489.67	513.12	553.55	598.29	632.13		(84)
7. Me	an inter	nal temp	erature	(heating	season)								
Temp	erature	during h	eating p	eriods ir	n the livir	ng area t	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)					I		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	0.96	0.96	0.96	0.94	0.92	0.85	0.75	0.76	0.87	0.93	0.96	0.97		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ullow ste	ns 3 to 7	r in Tabl	e 9c)					
(87)m=	18.69	18.8	19.08	19.51	19.98	20.46	20.74	20.72	20.39	19.8	19.19	18.66		(87)
		alu urius au la					(
(88)m=	19.98	19.98	19.99	eriods ir 20	20	20.01	20.01	20.01	20	20	19.99	19.99		(88)
									20	20	19.99	19.99		(00)
				rest of d	<u> </u>	i È	i	<u> </u>			1			(00)
(89)m=	0.96	0.96	0.95	0.93	0.9	0.8	0.65	0.67	0.82	0.91	0.95	0.96		(89)
Mean	interna	l temper	ature in	the rest	of dwelli	ng T2 (f	ollow ste	eps 3 to	7 in Tabl	e 9c)				
(90)m=	16.89	17.06	17.47	18.09	18.77	19.44	19.8	19.78	19.34	18.51	17.62	16.86		(90)
									f	iLA = Livin	g area ÷ (4	4) =	0.23	(91)
Mean	interna	l temper	ature (fo	or the wh	ole dwe	lling) = fl	LA x T1	+ (1 – fL	A) × T2					
(92)m=	17.31	17.46	17.84	18.42	19.05	19.68	20.02	20	, 19.58	18.81	17.99	17.27		(92)
Apply	, adjustn	nent to t	he mear	n internal	l temper	ature fro	m Table	4e, whe	ere appro	opriate				
(93)m=	17.31	17.46	17.84	18.42	19.05	19.68	20.02	20	19.58	18.81	17.99	17.27		(93)
8. Sp	ace hea	ting requ	uirement			-	2	•	•	•	•			
			ernal te	mperatur		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
	ilisation	factor fo	ernal te or gains	mperatur using Ta	able 9a		r	· · · · · ·		r ·	, I		ulate	
the ut	ilisation Jan	factor fo Feb	ernal ter or gains Mar	mperatur 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 Dec	ulate	
the ut Utilisa	ilisation Jan ation fac	factor fo Feb tor for g	ernal ter or gains Mar ains, hm	mperatur using Ta Apr	able 9a May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ulate	(04)
the ut Utilisa (94)m=	ilisation Jan ation fac	factor fo Feb tor for ga 0.94	ernal ter or gains Mar ains, hm 0.93	mperatur using Ta Apr : 0.91	ble 9a May 0.87		r			r ·	, I		ulate	(94)
the ut Utilisa (94)m= Usefu	ilisation Jan ation fac 0.94 Il gains,	factor fo Feb tor for ga 0.94 hmGm	ernal ter or gains Mar ains, hm 0.93 W = (94	mperatur using Ta Apr : 0.91 4)m x (84	able 9a May 0.87 4)m	Jun 0.78	Jul 0.66	Aug 0.67	Sep 0.8	Oct 0.89	0.92	Dec 0.94	ulate	. ,
the ut Utilisa (94)m= Usefu (95)m=	ilisation Jan ation fac 0.94 Il gains, 610.4	factor for Feb tor for ga 0.94 hmGm 602.96	ernal ter or gains Mar ains, hm 0.93 W = (9- 573.18	mperatur using Ta Apr :: 0.91 4)m x (84 525.34	able 9a May 0.87 4)m 467.4	Jun 0.78 392.77	Jul	Aug	Sep	Oct	Nov	Dec	ulate	(94) (95)
the ut Utilisa (94)m= Usefu (95)m= Month	ilisation Jan ation fac 0.94 Il gains, 610.4 nly avera	factor for Feb tor for ga 0.94 hmGm 602.96 age exte	ernal ter or gains Mar ains, hm 0.93 , W = (9 573.18	mperatur using Ta Apr : 0.91 4)m x (84 525.34 perature	able 9a May 0.87 4)m 467.4 e from Ta	Jun 0.78 392.77 able 8	Jul 0.66 314.52	Aug 0.67 326.65	Sep 0.8 411.31	Oct 0.89 491.43	Nov 0.92 553.39	Dec 0.94 595.85	ulate	(95)
the ut Utilisa (94)m= Usefu (95)m= Montł (96)m=	ilisation Jan ation fac 0.94 Il gains, 610.4 nly avera 4.3	factor for Feb tor for g 0.94 hmGm 602.96 age exte 4.9	ernal ten or gains Mar ains, hm 0.93 W = (94) 573.18 ornal tem 6.5	mperatur using Ta Apr : 0.91 4)m x (84 525.34 perature 8.9	able 9a May 0.87 4)m 467.4 e from Ta 11.7	Jun 0.78 392.77 able 8 14.6	Jul 0.66 314.52 16.6	Aug 0.67 326.65 16.4	Sep 0.8 411.31 14.1	Oct 0.89 491.43 10.6	0.92	Dec 0.94	ulate	. ,
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat	ilisation Jan ation fac 0.94 Il gains, 610.4 nly avera 4.3 loss rate	factor for Feb tor for g 0.94 hmGm 602.96 age exte 4.9	ernal ter or gains Mar ains, hm 0.93 , W = (9- 573.18 rnal tem 6.5 an interr	mperatur using Ta Apr : 0.91 4)m x (84 525.34 perature	able 9a May 0.87 4)m 467.4 e from Ta 11.7	Jun 0.78 392.77 able 8 14.6	Jul 0.66 314.52 16.6	Aug 0.67 326.65 16.4	Sep 0.8 411.31 14.1	Oct 0.89 491.43 10.6	Nov 0.92 553.39	Dec 0.94 595.85	ulate	(95)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m=	ilisation Jan ation fac 0.94 Il gains, 610.4 nly avera 4.3 loss rate 1543.05	factor for Feb tor for g 0.94 hmGm 602.96 age exte 4.9 e for mea 1487.13	ernal ten or gains Mar ains, hm 0.93 W = (94) 573.18 ornal tem 6.5 an interr 1339.59	mperatur using Ta Apr 1: 0.91 4)m x (84 525.34 perature 8.9 nal temper 1112.81	able 9a May 0.87 4)m 467.4 e from Ta 11.7 erature, 1 857.92	Jun 0.78 392.77 able 8 14.6 Lm , W = 587.29	Jul 0.66 314.52 16.6 =[(39)m 2 395.56	Aug 0.67 326.65 16.4 x [(93)m 415.52	Sep 0.8 411.31 14.1 - (96)m 636.21	Oct 0.89 491.43 10.6] 957.84	Nov 0.92 553.39 7.1 1275.07	Dec 0.94 595.85 4.2	ulate	(95) (96)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m=	ilisation Jan ation fac 0.94 Il gains, 610.4 nly avera 4.3 loss rate 1543.05	factor for Feb tor for g 0.94 hmGm 602.96 age exte 4.9 e for mea 1487.13	ernal ten or gains Mar ains, hm 0.93 W = (94) 573.18 ornal tem 6.5 an interr 1339.59	mperatur using Ta Apr 1: 0.91 4)m x (84 525.34 sperature 8.9 nal tempe	able 9a May 0.87 4)m 467.4 e from Ta 11.7 erature, 1 857.92	Jun 0.78 392.77 able 8 14.6 Lm , W = 587.29	Jul 0.66 314.52 16.6 =[(39)m 2 395.56	Aug 0.67 326.65 16.4 x [(93)m 415.52	Sep 0.8 411.31 14.1 - (96)m 636.21	Oct 0.89 491.43 10.6] 957.84	Nov 0.92 553.39 7.1 1275.07	Dec 0.94 595.85 4.2	ulate	(95) (96)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space	ilisation Jan ation fac 0.94 Il gains, 610.4 nly avera 4.3 loss rate 1543.05 e heatin	factor for Feb tor for ga 0.94 hmGm 602.96 age exte 4.9 e for mea 1487.13 g require	ernal ten or gains Mar ains, hm 0.93 , W = (9- 573.18 rnal tem 6.5 an interr 1339.59 ement fo	mperatur using Ta Apr 1: 0.91 4)m x (84 525.34 525.34 perature 8.9 nal tempe 1112.81 r each m	able 9a May 0.87 4)m 467.4 e from Ta 11.7 erature, 1 857.92 nonth, k\	Jun 0.78 392.77 able 8 14.6 Lm , W = 587.29 Wh/mont	Jul 0.66 314.52 16.6 =[(39)m 395.56 th = 0.02	Aug 0.67 326.65 16.4 x [(93)m 415.52 24 x [(97 0	Sep 0.8 411.31 14.1 - (96)m 636.21)m - (95 0	Oct 0.89 491.43 10.6] 957.84)m] x (4 347	Nov 0.92 553.39 7.1 1275.07 1)m	Dec 0.94 595.85 4.2 1537.82 700.82	ulate 4139.23	(95) (96)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m=	ilisation Jan ation fac 0.94 Il gains, 610.4 nly avera 4.3 loss rate 1543.05 e heatin 693.89	factor for Feb tor for g 0.94 hmGm 602.96 age exte 4.9 e for mea 1487.13 g require 594.16	ernal ter or gains Mar ains, hm 0.93 W = (90) 573.18 ornal tem 6.5 an interr 1339.59 ement fc 570.21	mperatur using Ta Apr 1: 0.91 4)m x (84 525.34 perature 8.9 nal tempe 1112.81 or each m 422.98	able 9a May 0.87 4)m 467.4 e from Ta 11.7 erature, 1 857.92 nonth, k\ 290.54	Jun 0.78 392.77 able 8 14.6 Lm , W = 587.29 Wh/mont	Jul 0.66 314.52 16.6 =[(39)m 395.56 th = 0.02	Aug 0.67 326.65 16.4 x [(93)m 415.52 24 x [(97 0	Sep 0.8 411.31 14.1 - (96)m 636.21)m - (95 0	Oct 0.89 491.43 10.6] 957.84)m] x (4 347	Nov 0.92 553.39 7.1 1275.07 1)m 519.62	Dec 0.94 595.85 4.2 1537.82 700.82	4139.23	(95) (96) (97) (98)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m=	ilisation Jan ation fac 0.94 I gains, 610.4 nly avera 4.3 loss rate 1543.05 e heatin 693.89	factor for Feb tor for gi 0.94 hmGm 602.96 age exte 4.9 e for mea 1487.13 g require 594.16	ernal ten or gains Mar ains, hm 0.93 W = (90) 573.18 ornal tem 6.5 an interr 1339.59 ement fc 570.21	hperatur using Ta Apr 1: 0.91 4)m x (84 525.34 perature 8.9 hal tempe 1112.81 or each m 422.98 kWh/m ²	able 9a May 0.87 4)m 467.4 e from Ta 11.7 erature, 1 857.92 nonth, kV 290.54	Jun 0.78 392.77 able 8 14.6 Lm , W = 587.29 Wh/mont 0	Jul 0.66 314.52 16.6 =[(39)m : 395.56 th = 0.02 0	Aug 0.67 326.65 16.4 x [(93)m 415.52 24 x [(97 0 Tota	Sep 0.8 411.31 14.1 - (96)m 636.21)m - (95 0 l per year	Oct 0.89 491.43 10.6] 957.84)m] x (4 347	Nov 0.92 553.39 7.1 1275.07 1)m 519.62	Dec 0.94 595.85 4.2 1537.82 700.82		(95) (96) (97)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space 9a. En	ilisation Jan ation fac 0.94 Il gains, 610.4 nly avera 4.3 loss rate 1543.05 e heatin 693.89 e heatin ergy rec	factor for Feb tor for gi 0.94 hmGm 602.96 age exte 4.9 e for mea 1487.13 g require 594.16 g require	ernal ten or gains Mar ains, hm 0.93 W = (90) 573.18 ornal tem 6.5 an interr 1339.59 ement fc 570.21	mperatur using Ta Apr 1: 0.91 4)m x (84 525.34 perature 8.9 nal tempe 1112.81 or each m 422.98	able 9a May 0.87 4)m 467.4 e from Ta 11.7 erature, 1 857.92 nonth, kV 290.54	Jun 0.78 392.77 able 8 14.6 Lm , W = 587.29 Wh/mont 0	Jul 0.66 314.52 16.6 =[(39)m : 395.56 th = 0.02 0	Aug 0.67 326.65 16.4 x [(93)m 415.52 24 x [(97 0 Tota	Sep 0.8 411.31 14.1 - (96)m 636.21)m - (95 0 l per year	Oct 0.89 491.43 10.6] 957.84)m] x (4 347	Nov 0.92 553.39 7.1 1275.07 1)m 519.62	Dec 0.94 595.85 4.2 1537.82 700.82	4139.23	(95) (96) (97) (98)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space 9a. En Space	ilisation Jan ation fac 0.94 I gains, 610.4 nly avera 4.3 loss rate 1543.05 e heatin 693.89 e heatin ergy rec e heatir	factor for Feb tor for gi 0.94 hmGm 602.96 age exte 4.9 e for mea 1487.13 g require 594.16 g require g require ng:	ernal ter or gains Mar ains, hm 0.93 W = (94) 573.18 ornal tem 6.5 an interr 1339.59 ement for 570.21 ement in 570.21	mperatur using Ta Apr 0.91 4)m x (84 525.34 perature 8.9 nal tempe 1112.81 or each m 422.98 kWh/m ² ividual h	able 9a May 0.87 4)m 467.4 e from Ta 11.7 erature, 857.92 nonth, k\ 290.54 2/year eating sy	Jun 0.78 392.77 able 8 14.6 Lm , W = 587.29 Wh/mont 0	Jul 0.66 314.52 16.6 =[(39)m 1 395.56 th = 0.02 0	Aug 0.67 326.65 16.4 x [(93)m 415.52 24 x [(97) 0 Tota micro-C	Sep 0.8 411.31 14.1 - (96)m 636.21)m - (95 0 l per year	Oct 0.89 491.43 10.6] 957.84)m] x (4 347	Nov 0.92 553.39 7.1 1275.07 1)m 519.62	Dec 0.94 595.85 4.2 1537.82 700.82	4139.23 39.18	(95) (96) (97) (98) (99)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space 9a. En Space Fracti	ilisation Jan ation fac 0.94 I gains, 610.4 nly avera 4.3 loss rate 1543.05 e heatin 693.89 e heatin ergy rec e heatir	factor for Feb tor for gi 0.94 hmGm 602.96 age exte 4.9 e for mea 1487.13 g require 594.16 g require uiremen ng: bace hea	ernal ten or gains Mar ains, hm 0.93 , W = (9- 573.18 rnal tem 6.5 an interr 1339.59 ement for 570.21 ement in at from s	mperatur using Ta Apr 1: 0.91 4)m x (84 525.34 perature 8.9 nal tempe 1112.81 r each m 422.98 kWh/m ² ividual he	able 9a May 0.87 4)m 467.4 e from Ta 11.7 erature, 857.92 nonth, k\ 290.54 290.54 2/year eating sy	Jun 0.78 392.77 able 8 14.6 Lm , W = 587.29 Wh/mont 0	Jul 0.66 314.52 16.6 =[(39)m 2 395.56 th = 0.02 0 ncluding	Aug 0.67 326.65 16.4 x [(93)m 415.52 24 x [(97 0 Tota micro-C	Sep 0.8 411.31 14.1 - (96)m 636.21)m - (95 0 I per year CHP)	Oct 0.89 491.43 10.6] 957.84)m] x (4 347	Nov 0.92 553.39 7.1 1275.07 1)m 519.62	Dec 0.94 595.85 4.2 1537.82 700.82	4139.23 39.18 0	(95) (96) (97) (98) (99) (201)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space (98)m= Space Fracti	ilisation Jan ation fac 0.94 Il gains, 610.4 hly avera 4.3 loss rate 1543.05 e heatin 693.89 e heatin ergy rec e heatir ion of sp	factor for Feb tor for g: 0.94 hmGm 602.96 age exte 4.9 e for mea 1487.13 g require 594.16 g require uiremen ng: pace hea pace hea	ernal ten or gains Mar ains, hm 0.93 W = (90) 573.18 rnal tem 6.5 an interr 1339.59 ement for 570.21 ement in hts - Ind at from s at from n	mperatur using Ta Apr 0.91 4)m x (84 525.34 perature 8.9 nal tempe 1112.81 or each m 422.98 kWh/m ² ividual h	Able 9a May 0.87 4)m 467.4 e from Ta 11.7 erature, 1 857.92 nonth, k\ 290.54 290.54 2year eating sy y/supple em(s)	Jun 0.78 392.77 able 8 14.6 Lm , W = 587.29 Wh/mont 0	Jul 0.66 314.52 16.6 =[(39)m : 395.56 th = 0.02 0 ncluding	Aug 0.67 326.65 16.4 x [(93)m 415.52 24 x [(97) 0 Tota micro-C	Sep 0.8 411.31 14.1 - (96)m 636.21)m - (95 0 I per year CHP) - (201) =	Oct 0.89 491.43 10.6] 957.84)m] x (4 347 (kWh/year	Nov 0.92 553.39 7.1 1275.07 1)m 519.62	Dec 0.94 595.85 4.2 1537.82 700.82	4139.23 39.18	(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 s	seconda	ry/suppl	ementar	y heating	g systen	า, %						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))					-			
	693.89	594.16	570.21	422.98	290.54	0	0	0	0	347	519.62	700.82		
(211)m	= {[(98)m x (20	4)] } x 1	00 ÷ (20)6)		-							(211)
	765.89	655.81	629.38	466.87	320.69	0	0	0	0	383.01	573.53	773.54		-
								Tota	ll (kWh/yea	ar) =Sum(2	211) _{15,1012}	Ē	4568.69	(211)
•		•		y), kWh/	month									
i i i	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	01)] } x 1	00 ÷ (20	08)	0	0	0	0	0	0	0	0	1	
(215)m=	0	0	0	0	0	0	0	-	l (kWh/yea	-	-		0	(215)
Wator	heating								(- • • /15,1012		0	
			ter (calc	ulated al	bove)									
	172.34	150.73	155.54	135.6	130.12	112.28	104.04	119.39	120.82	140.8	153.7	166.9		
Efficier	icy of w	ater hea	iter										85	(216)
(217)m=	89.43	89.41	89.34	89.17	88.79	85	85	85	85	88.91	89.26	89.47		(217)
		heating,											-	
(219)m (219)m=		m x 100 168.59) ÷ (217) 174.1	m 152.07	146.54	132.09	122.4	140.46	142.14	158.37	172.19	186.56	1	
(219)11=	192.72	100.59	174.1	152.07	140.04	132.09	122.4		142.14 II = Sum(2'		172.19	100.00	1888.23	(219)
∆nnua	l totals										Wh/year		kWh/year	(219)
			ed, main	system	1					ĸ	wii/ycai		4568.69	1
Water I	neating	fuel use	d										1888.23	1
Electric	ity for p	oumps, fa	ans and	electric	keep-ho	t								1
		ig pump			•							30]	(230c)
		an-assis										45]	(230e)
				kWh/yea	r			sum	of (230a).	(230a) =		10	75	(231)
	city for li	·	ubove, 1	(WIII/yea					. (,	(0)			453.98	(232)
			for all u	ses (211) (224)	. (221)	. (ววว)	(007h)	_				6985.9	(338)
		0,		•	, , ,	+ (231)	+ (232).	(2370)	-				0905.9	
10a. r	uer cos	sis - inaiv	ndual ne	eating sy	stems.									
						Fu kW	el /h/year			Fuel P (Table			Fuel Cost £/year	
Space	heating	- main s	system 1	l		(21	1) x			3.4	8	x 0.01 =	158.99	(240)
Space	heating	- main s	system 2	2		(21:	3) x			0		x 0.01 =	0	(241)
Space	heating	- secon	dary			(21	5) x			13.	19	x 0.01 =	0	(242)
Water I	neating	cost (otl	her fuel)			(219	9)			3.4	8	x 0.01 =	65.71	(247)
Pumps	, fans a	nd elect	ric keep	-hot		(23	1)			13.	19	x 0.01 =	9.89	(249)
•	eak tari for ligh		ich of (2	30a) to (230g) se	eparately (232		licable a	nd apply	fuel pri		ding to T x 0.01 =	Table 12a 59.88	(250)

Additional standing charges (Table 12)			120 (251)
Appendix Q items: repeat lines (253) and (2 Total energy cost (244)	54) as needed 5)(247) + (250)(254) =		414.47 (255)
11a. SAP rating - individual heating system	IS		
Energy cost deflator (Table 12)			0.42 (256)
Energy cost factor (ECF) [(25	5) x (256)] ÷ [(4) + 45.0] =		1.16 (257)
SAP rating (Section 12)			83.88 (258)
12a. CO2 emissions – Individual heating s	ystems including micro-CHP		
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	986.84 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	407.86 (264)
Space and water heating	(261) + (262) + (263) + (2	264) =	1394.7 (265)
Electricity for pumps, fans and electric keep	-hot (231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	235.61 (268)
Total CO2, kg/year		sum of (265)(271) =	1669.23 (272)
CO2 emissions per m ²		(272) ÷ (4) =	15.8 (273)
EI rating (section 14)			85 (274)
13a. Primary Energy			
	Energy kWh/year	Primary factor	P. Energy kWh/year
Space heating (main system 1)	(211) x	1.22 =	5573.8 (261)
Space heating (secondary)	(215) x	3.07 =	0 (263)
Energy for water heating	(219) x	1.22 =	2303.64 (264)
Space and water heating	(261) + (262) + (263) + (2	264) =	7877.45 (265)
Electricity for pumps, fans and electric keep	-hot (231) x	3.07 =	230.25 (267)
Electricity for lighting	(232) x	0 =	1393.71 (268)
'Total Primary Energy		sum of (265)(271) =	9501.41 (272)
Primary energy kWh/m²/year		(272) ÷ (4) =	89.94 (273)

				User D	Details:						
Assessor Name: Software Name:	Ben Marsh Stroma FS				Softwa	a Num are Ver	rsion:			005374 n: 1.0.5.58	
			Pi	operty	Address	: Plot 12					
Address :	Plot 12										
1. Overall dwelling dime	ensions:			•	- (2)		A) (- l	
Ground floor					a(m²)	(10) ×	Av. Hei			Volume(m ³)	
					52.82	(1a) x	2	2.4	(2a) =	126.77	(3a)
First floor				ŧ	52.82	(1b) x	2.	.63	(2b) =	138.92	(3b)
Total floor area TFA = (1	a)+(1b)+(1c)+	(1d)+(1e	e)+(1n) 1	05.64	(4)					
Dwelling volume				L		(3a)+(3b))+(3c)+(3d)+(3e)+	.(3n) =	265.68	(5)
2. Ventilation rate:											
	main heating		econdar leating	У	other		total			m ³ per hour	
Number of chimneys	0] + [0	+ [0] = [0	x 4	40 =	0	(6a)
Number of open flues	0		0	- - - - - -	0	- = [0	x 2	20 =	0	_ (6b)
Number of intermittent fa	ns						3	x 1	10 =	30](7a)
Number of passive vents							0	x 1	10 =	0](7b)
Number of flueless gas fi							0	x4	40 =	0](7c)
							0			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) =	0.11	(8)
If a pressurisation test has b						continue fr					
Number of storeys in the	ne dwelling (na	S)								0	(9)
Additional infiltration								[(9)-	-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or	r timber i	frame or	0.35 fo	r masoni	ry constr	ruction			0	(11)
if both types of wall are pl deducting areas of openir			ponding to	the grea	ter wall are	a (after					
If suspended wooden f	0 // 1		ed) or 0.	1 (seale	ed), else	enter 0				0	(12)
If no draught lobby, en			,	,	,,					0	(13)
Percentage of windows	s and doors dr	aught st	ripped							0	(14)
Window infiltration		-			0.25 - [0.2	x (14) ÷ 1	= [00			0	(15)
Infiltration rate					(8) + (10)	+ (11) + (1	2) + (13) +	+ (15) =		0	(16)
Air permeability value,	q50, expresse	ed in cub	oic 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), otherw	ise (18) = ((16)				0.36	(18)
Air permeability value applie	es if a pressurisati	on test has	s been don	e or a de	gree air pe	rmeability	is being us	sed			_
Number of sides sheltere	ed				(20) 4	0.075(4				2	(19)
Shelter factor					(20) = 1 -		[9)] =			0.85	(20)
Infiltration rate incorporat	•				(21) = (18) x (20) =				0.31	(21)
Infiltration rate modified f			i i								
Jan Feb	Mar Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly average wind sp			,							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	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		
Adjust	ed infiltra	ation rate	e (allowi	ing for sł	nelter an	d wind s	peed) =	(21a) x	(22a)m					
	0.39	0.39	0.38	0.34	0.33	0.29	0.29	0.29	0.31	0.33	0.35	0.36		
		c <i>tive air (</i> al ventila	-	rate for t	he appli	cable ca	se							(23a)
				endix N, (2	3b) = (23a	a) x Fmv (e	equation (N	(5)) other	wise (23h) = (23a)			0	
				iency in %) = (200)			0	(23b)
			-	entilation	-					2b)m + (23h) x [1	– (23c)	0 ∸ 100]	(23c)
(24a)m=		0	0	0	0	0		0	0	0	0	0		(24a)
b) If	balance	d mecha	anical ve	entilation	without	heat rec	covery (N	и V) (24b)m = (22	1 2b)m + (2	 23b)		1	
, (24b)m=		0	0	0	0	0	0	0	0	0	0	0		(24b)
,				ntilation of the first the first the first the first the first term of term	•					5 × (23b)		1	
(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0		(24c)
,				iole hous m = (221						0.5]				
(24d)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57		(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24	o) or (240	c) or (24	d) in box	(25)					
(25)m=	0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57		(25)
3. He	at losse	s and he	at loss i	paramet	er:									
ELEN		Gros area	S	Openin rr	gs	Net Ar A ,r		U-valı W/m2		A X U (W/I	K)	k-value kJ/m²·l		A X k kJ/K
Doors						2.14	x	1.4		2.996				(26)
Windo	ws Type	e 1							I					
Windo						5.48	x1.	/[1/(1.4)+	!	7.27				(27)
	ws type	e 2				5.48 8.42	╡,		0.04] =	7.27				(27) (27)
Floor	ws Type	92					x1	/[1/(1.4)+	0.04] =					
Floor Walls	ws type	2	71	16.0	4	8.42	x1,	/[1/(1.4)+ /[1/(1.4)+	0.04] = 0.04] =	11.16				(27)
Walls	ws type			16.0	4	8.42	x1, 2 x 7 x	/[1/(1.4)+ /[1/(1.4)+ 0.14	0.04] = [0.04] = [= [11.16 7.3948				(27)
Walls Roof		103.	2		4	8.42 52.82 87.67	x1 2 x 7 x 2 x	/[1/(1.4)+ /[1/(1.4)+ 0.14 0.17	0.04] = [0.04] = [= [= [11.16 7.3948 14.9				(27) (28) (29)
Walls Roof	area of e	103. ⁻ 52.8	2		4	8.42 52.82 87.67 52.82	x1. 2 x 7 x 2 x 5	/[1/(1.4)+ /[1/(1.4)+ 0.14 0.17	0.04] = [0.04] = [= [= [11.16 7.3948 14.9				(27) (28) (29) (30)
Walls Roof Total a Party v * for win	area of e wall dows and	103. 52.8 elements	, m²		ndow U-va	8.42 52.82 87.67 52.82 209.33 45.9 alue calcula	x1. 2 x 7 x 2 x 5 x	/[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0	0.04] = [0.04] = [= [= [= [= [= [11.16 7.3948 14.9 5.81 0		paragraph		(27) (28) (29) (30) (31)
Walls Roof Total a Party v * for win ** incluo	area of e wall dows and le the area	103. 52.8 elements	, m² , m² ows, use e sides of ir	0 effective wi	ndow U-va	8.42 52.82 87.67 52.82 209.33 45.9 alue calcula	x1, 2 x 7 x 2 x 5 x 5 x 2 x 5 x 2 x 5 x	/[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0	0.04] = [0.04] = [] = [] = [] = [] = [//(1/U-valu	11.16 7.3948 14.9 5.81 0		paragraph	 	(27) (28) (29) (30) (31)
Walls Roof Total a Party v * for win ** incluo Fabric	area of e wall Indows and le the area heat los	103. 52.8 Ilements	, m ² , m ² ows, use e sides of ir = S (A x	0 effective wi	ndow U-va	8.42 52.82 87.67 52.82 209.33 45.9 alue calcula	x1, 2 x 7 x 2 x 5 x 5 x 2 x 5 x 2 x 5 x	/[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 1 formula 1,	$\begin{array}{c} 0.04] = \\ 0.04] = \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	11.16 7.3948 14.9 5.81 0 re)+0.04] a				(27) (28) (29) (30) (31) (32) (33)
Walls Roof Total a Party v * for win ** incluo Fabric Heat c	area of e wall dows and le the area heat los apacity	103. 52.8 elements $roof winder as on both as, W/K = Cm = S($, m ² , m ² sides of ir = S (A x A x k)	0 effective wi	ndow U-va	8.42 52.82 87.67 52.82 209.33 45.9 alue calcula titions	x1 2 x 7 x 2 x 5 x 2 x 5 x 2 x 5 x 2 x	/[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 1 formula 1,	$\begin{array}{c} 0.04] = \\ 0.04] = \\ \\ \end{array}$ $\begin{array}{c} \\ \\ \\ \\ \end{array}$ $\begin{array}{c} \\ \\ \end{array}$ $\begin{array}{c} \\ \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ \end{array} \begin{array} $\begin{array}{c} \\ \end{array}$ \end{array} \begin{array} $\begin{array}{c} \\ \end{array}$ \end{array} \end{array} \begin{array} \end{array} \begin{array} \end{array} \begin{array} \end{array} \end{array} \begin{array} \end{array}	11.16 7.3948 14.9 5.81 0 re)+0.04] a	2) + (32a)		49.53	(27) (28) (29) (30) (31) (32) (33)
Walls Roof Total a Party v * for win ** incluo Fabric Heat c Therm For desi can be c	area of e wall dows and le the area heat los apacity al mass ign assess used inste	103. 52.8 $roof winden as on both$ $ss, W/K = Cm = S(m)$ $parameters what of a determined of a determined$, m ² , m ² sides of ir = S (A x A x k) ter (TMF ere the de tailed calc	0 effective wi nternal wal U) P = Cm - etails of the ulation.	ndow U-va ls and par - TFA) ir construct	8.42 52.82 87.67 52.82 209.33 45.9 alue calcula titions	x1 x x x x x x x x x x x z x z x z x z x t known pr	(1/(1.4)+)/(1/(1.4)+) 0.14 0.17 0.11 0 formula 1, (26)(30)	$\begin{array}{c} 0.04] = \\ 0.04] = \\ \\ \end{array}$ $\begin{array}{c} \\ \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ $\begin{array}{c} \\ \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ \end{array} $\begin{array}{c} \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ \end{array} $\begin{array}{c} \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ \end{array} $\begin{array}{c} \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ \end{array} $\begin{array}{c} \\ \end{array}$ \end{array} \begin{array} \end{array} $\begin{array}{c} \\ \end{array}$ \end{array} \end{array} \begin{array} \end{array}	11.16 7.3948 14.9 5.81 0 we)+0.04] a .(30) + (32 tive Value:	2) + (32a). : Low	(32e) =	49.53 15336.61	(27) (28) (29) (30) (31) (32) (33) (33) (34)
Walls Roof Total a Party w * for win ** incluo Fabric Heat c Therm For desi can be u Therm	area of e wall dows and le the area heat los apacity al mass ign assess used instea al bridge	$\begin{bmatrix} 103. \\ 52.8 \end{bmatrix}$, m ² , m ² = S (A x A x k) ter (TMF ere the de tailed calco x Y) cal	0 effective winternal wal U) P = Cm - etails of the ulation. culated of	ndow U-va Is and par - TFA) ir construct using Ap	8.42 52.82 87.67 52.82 209.33 45.9 alue calcula titions	x1 x x x x x x x x x x x z x z x z x z x t known pr	(1/(1.4)+)/(1/(1.4)+) 0.14 0.17 0.11 0 formula 1, (26)(30)	$\begin{array}{c} 0.04] = \\ 0.04] = \\ \\ \end{array}$ $\begin{array}{c} \\ \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ $\begin{array}{c} \\ \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ \end{array} $\begin{array}{c} \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ \end{array} $\begin{array}{c} \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ \end{array} $\begin{array}{c} \\ \end{array}$ $\begin{array}{c} \\ \end{array}$ \end{array} $\begin{array}{c} \\ \end{array}$ \end{array} \begin{array} \end{array} $\begin{array}{c} \\ \end{array}$ \end{array} \end{array} \begin{array} \end{array}	11.16 7.3948 14.9 5.81 0 we)+0.04] a .(30) + (32 tive Value:	2) + (32a). : Low	(32e) =	49.53 15336.61	(27) (28) (29) (30) (31) (32) (33) (33) (34)
Walls Roof Total a Party w * for win ** incluo Fabric Heat c Therm For desi can be u Therm if details	area of e wall dows and le the area heat los apacity al mass ign assess used inste- al bridge s of therma	$\begin{bmatrix} 103. \\ 52.8 \end{bmatrix}$ I roof winde as on both as on both ss, W/K = Cm = S(parame sments wh ad of a dea es : S (L al bridging	, m ² , m ² = S (A x A x k) ter (TMF ere the de tailed calco x Y) cal	0 effective wi nternal wal U) P = Cm - etails of the ulation.	ndow U-va Is and par - TFA) ir construct using Ap	8.42 52.82 87.67 52.82 209.33 45.9 alue calcula titions	x1 x x x x x x x x x x x z x z x z x z x t known pr	(1/(1.4)+)/(1/(1.4)+) 0.14 0.17 0.11 0 formula 1, (26)(30)	$\begin{array}{c} 0.04] = \\ 0.04] = \\ \\ \end{array}$ $\begin{array}{c} 0.04] = \\ \\ \end{array}$ $\begin{array}{c} 0.04] = \\ \\ \end{array}$ $\begin{array}{c} 0.04] = \\ \end{array}$	11.16 7.3948 14.9 5.81 0 ue)+0.04] a .(30) + (32 tive Values of	2) + (32a). : Low	(32e) =	49.53 15336.61 100 18.49	(27) (28) (29) (30) (31) (31) (32) (33) (33) (34) (35) (36)
Walls Roof Total a Party v * for win ** incluo Fabric Heat c Therm <i>For desi</i> <i>can be u</i> Therm <i>if detai</i> ls Total f	area of e wall dows and le the area heat los apacity al mass agn assess used inste- al bridge s of therma abric he	103. 52.8 Idements Froof winde as on both ss, W/K = Cm = S(parame sments wh ad of a dea es : S (L al bridging at loss	, m ² , m ² = S (A x A x k) ter (TMF ere the de tailed calco x Y) cal are not kn	0 effective winternal wal U) P = Cm - etails of the ulation. culated of	ndow U-va ls and par - TFA) ir construct using Ap = 0.05 x (3	8.42 52.82 87.67 52.82 209.33 45.9 alue calcula titions	x1 x x x x x x x x x x x z x z x z x z x t known pr	(1/(1.4)+)/(1/(1.4)+) 0.14 0.17 0.11 0 formula 1, (26)(30)	(33) +	$\frac{11.16}{7.3948}$ $\frac{14.9}{5.81}$ 0 $(30) + (32)$ $(30$	2) + (32a). : Low	(32e) =	49.53 15336.61 100	(27) (28) (29) (30) (31) (32) (33) (33) (34) (35)

(38)m=	50.62	50.36	50.1	48.89	48.66	47.6	47.6	47.41	48.01	48.66	49.12	49.6		(38)
Heat tr	ansfer o	coefficie	nt, W/K						(39)m	= (37) + (3	38)m			
(39)m=	118.64	118.37	118.12	116.9	116.68	115.62	115.62	115.43	116.03	116.68	117.14	117.62		_
Heat lo	iss para	ameter (H	HLP), W/	′m²K						Average = = (39)m ÷		12 /12=	116.9	(39)
(40)m=	1.12	1.12	1.12	1.11	1.1	1.09	1.09	1.09	1.1	1.1	1.11	1.11		
										Average =	Sum(40)1.	12 /12=	1.11	(40)
Numbe			nth (Tab	, <u> </u>	Max	lun	11	A	Car	Ort	Nov			
(41)m=	Jan 31	Feb 28	Mar 31	Apr 30	May 31	Jun 30	Jul 31	Aug 31	Sep 30	Oct 31	Nov 30	Dec 31		(41)
(41)11-	51	20	51		01		51	51		51				()
4. Wa	ter hea	tina ene	rgy requi	irement:								kWh/ye	ar:	
if TF	A > 13.		N + 1.76 x	[1 - exp	(-0.0003	849 x (TF	FA -13.9)2)] + 0.0	0013 x (⁻	TFA -13.		79		(42)
		9, N = 1 ie hot wa	ater usag	ne in litre	es per da	av Vd.av	erage =	(25 x N)	+ 36		104	5.65		(43)
Reduce	the annua	, al average	hot water person per	usage by	5% if the a	lwelling is	designed t			se target o		5.00		()
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate	er usage i	n litres pei	r day for ea	ach month	Vd,m = fa	ctor from	Table 1c x	(43)						
(44)m=	116.21	111.99	107.76	103.54	99.31	95.08	95.08	99.31	103.54	107.76	111.99	116.21		
Energy	content of	bot water	used - cal	culated m	onthly - 1	100 v Vd r	п х пт х Г)Tm / 360(Total = Su			1267.79	(44)
	172.34	150.73	155.54	135.6	130.12	112.28	104.04	119.39	120.82	140.8	153.7	166.9		
(45)m=	172.34	150.75	155.54	155.0	130.12	112.20	104.04	119.39		Total = Su			1662.27	(45)
lf instant	aneous w	vater heati	ng at point	of use (no	o hot water	r storage),	enter 0 in	boxes (46				L	1002.27	
(46)m=	25.85	22.61	23.33	20.34	19.52	16.84	15.61	17.91	18.12	21.12	23.05	25.04		(46)
	storage) includir	na anv si	alar ar M		storada	within s	ama vas	مما				(47)
0		· · ·	and no ta	0 ,			U		ame ves	501		0		(47)
Otherw	ise if no	o stored	hot wate		-			• •	ers) ente	er '0' in (47)			
	storage		eclared I	occ fact	or ie kno	wp (k\//k	v/dov/):							(40)
			m Table				i/uay).					0		(48) (49)
			r storage		ear			(48) x (49)) =			0		(43)
			eclared of	•		or is not		()(, ,			0		(00)
		-	factor fr		le 2 (kW	h/litre/da	ay)					0		(51)
		from Ta	see secti ble 2a	on 4.3								0		(52)
			m Table	2b								0		(53)
Energy	lost fro	om watei	r storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter	(50) or	(54) in (8	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 contain:	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 Appendix	кН	
(57)m=	0	0	0	0	0	0	0	0	0	0	0	0		(57)

	•	t loss (ar	,									0]	(58)
	•	t loss cal					· ·	```		r tharma	atat)			
•		/ factor fi	i i i i i i i i i i i i i i i i i i i	i	i		er neatil	ng and a			<u> </u>	0	1	(59)
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(39)
Combi	loss ca	lculated	for each	month ((61)m =	(60) ÷ 30	65 × (41)m	i	i	i	i		
(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 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	172.34	150.73	155.54	135.6	130.12	112.28	104.04	119.39	120.82	140.8	153.7	166.9		(62)
Solar DI	HW input	calculated	using App	endix G or	Appendix	d 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	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=	172.34	150.73	155.54	135.6	130.12	112.28	104.04	119.39	120.82	140.8	153.7	166.9		_
				-			-	Out	out from w	ater heate	r (annual) ₁	12	1662.27	(64)
Heat g	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=	57.3	50.12	51.72	45.09	43.26	37.33	34.59	39.7	40.17	46.82	51.1	55.5		(65)
inclu	de (57)	m in calo	ulation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	vater 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=	139.3	139.3	139.3	139.3	139.3	139.3	139.3	139.3	139.3	139.3	139.3	139.3		(66)
Lightin	a gains	ı (calcula	L ted in Ar	n Dendix	L equat	ion I 9 o	rl9a)a	lso see '	I Table 5				1	
(67)m=	25.71	22.83	18.57	14.06	10.51	8.87	9.59	12.46	16.72	21.23	24.78	26.42		(67)
		ins (calc											I	
(68)m=	265.14	267.89	260.95	246.19	227.56	210.05	198.35	195.6	202.54	217.3	235.93	253.44]	(68)
											200.00	200.11	l	()
(69)m=	36.93	calcula 36.93	36.93	36.93	L, equa	36.93	36.93	36.93	36.93	36.93	36.93	36.93	1	(69)
		I			30.93	50.95	50.95	30.93	30.95	50.95	50.95	30.93	l	(00)
	r	ns gains	r`	, 									1	(70)
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3		(70)
		aporatio	<u> </u>		, `	<u>,</u>							1	
		-111.44		-111.44	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44		(71)
	<u> </u>	gains (T	· · · ·		i		i	i	1		1		1	()
(72)m=	77.02	74.58	69.51	62.62	58.15	51.85	46.5	53.36	55.79	62.93	70.98	74.59		(72)
Total i	nternal	gains =				(66)	m + (67)m	n + (68)m ·	+ (69)m +	(70)m + (7	1)m + (72)	m		
(73)m=	435.65	433.09	416.83	390.66	364.01	338.56	322.23	329.21	342.84	369.24	399.48	422.24		(73)
	lar gain													
-		calculated	-					tions to co		ne applicat		ion.	. .	
Orienta		Access F Table 6d	actor	Area m²		Flu Tal	x ble 6a	т	g_ able 6b	т	FF able 6c		Gains (W)	
				1112		ia		I					(**)	
		watts, ca		1					um(74)m	1			1	(02)
(83)m=	0	0	0	0	0	0	0	0	0	0	0	0		(83)

	435.65	433.09	416.83	390.66	364.01	338.56	322.23	329.21	342.84	369.24	399.48	422.24		(84)
7. Me	an inter	nal temp	erature	(heating	season)								
				eriods ir			from Tab	ole 9, Th	1 (°C)				21	(85)
		-	• •	living are		-						I		
•	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	0.87	0.94	0.97	0.98	0.99		(86)
		· · ·		living are	,		i	I	,	40.50	40.00	40.00		(87)
(87)m=	18.35	18.47	18.77	19.23	19.74	20.27	20.61	20.58	20.18	19.53	18.88	18.33		(07)
Temp	erature	during h	eating p	eriods ir	n rest of	dwelling	from Ta	ble 9, T	h2 (°C)	r				
(88)m=	19.98	19.98	19.99	20	20	20.01	20.01	20.01	20	20	19.99	19.99		(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	na T2 (fe	ollow ste	eps 3 to 7	7 in Tabl	e 9c)				
(90)m=	16.4	16.58	17.02	17.69	18.43	19.2	19.66	19.63	19.07	18.13	17.18	16.37		(90)
				I					f	LA = Livin	g area ÷ (4	4) =	0.23	(91)
	• • • • • • • •						· ^ T 4	. (4 (1	A) TO			l		
		· · ·	· · ·	or the wh				<u>`</u>	<i>,</i>	40.40	47.57	40.00		(02)
(92)m=	16.85	17.02	17.42	18.04	18.74	19.45	19.88	19.85	19.32	18.46	17.57	16.83		(92)
Appiy (93)m=	16.85	17.02	ne mear 17.42	18.04	18.74	ature fro 19.45	m Table 19.88	4e, whe 19.85	19.32	18.46	17.57	16.83		(93)
· ·				<u> </u>	10.74	19.45	19.00	19.65	19.52	10.40	17.57	10.83		(00)
		ting requ			ro obtoin		on 11 of						. .	
		nean in						I anie ui	n so tha	t Ti m–((6)m an	d re-calc		
uie ui	ilisation			using Ta		ied at ste	эрттог	Table 9	o, so tha	t Tî,m=(76)m an	d re-calc	ulate	
ine ui	ilisation Jan					Jun	Jul	Aug	o, so tha Sep	t Tî,m=(Oct	76)m an	d re-calc	ulate	
	Jan	factor fo	or gains Mar	using Ta Apr	ble 9a		r			r ·	, I		ulate	
	Jan	factor fo Feb	or gains Mar	using Ta Apr	ble 9a		r			r ·	, I		ulate	(94)
Utilisa (94)m=	Jan ation fac 0.97	factor fo Feb tor for ga	or gains Mar ains, hm 0.97	using Ta Apr	ble 9a May 0.93	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ulate	(94)
Utilisa (94)m=	Jan ation fac 0.97	factor fo Feb tor for ga	or gains Mar ains, hm 0.97	using Ta Apr : 0.96	ble 9a May 0.93	Jun	Jul	Aug	Sep	Oct	Nov	Dec	ulate	(94) (95)
Utilisa (94)m= Usefu (95)m=	Jan ation fac 0.97 Il gains, 423.64	factor for Feb tor for ga 0.97 hmGm , 420.32	or gains Mar ains, hm 0.97 W = (94 402.57	using Ta Apr 1: 0.96 4)m x (84	ble 9a May 0.93 4)m 339.82	Jun 0.88 297.67	Jul 0.79	Aug 0.79	Sep 0.89	Oct 0.95	0.97	Dec 0.97	ulate	
Utilisa (94)m= Usefu (95)m=	Jan ation fac 0.97 Il gains, 423.64	factor for Feb tor for ga 0.97 hmGm , 420.32	or gains Mar ains, hm 0.97 W = (94 402.57	using Ta Apr 1: 0.96 4)m x (84 373.43	ble 9a May 0.93 4)m 339.82	Jun 0.88 297.67	Jul 0.79	Aug 0.79	Sep 0.89	Oct 0.95	0.97	Dec 0.97	ulate	
Utilisa (94)m= Usefu (95)m= Month (96)m=	Jan ation fac 0.97 Il gains, 423.64 hly avera 4.3 loss rate	factor for Feb tor for ga 0.97 hmGm , 420.32 age exte 4.9 e for mea	or gains Mar ains, hm 0.97 W = (94 402.57 rnal tem 6.5 an interr	using Ta Apr 0.96 4)m x (84 373.43 perature 8.9 nal tempe	ble 9a May 0.93 4)m 339.82 e from Ta 11.7 erature,	Jun 0.88 297.67 able 8 14.6 Lm , W =	Jul 0.79 253.08 16.6 =[(39)m	Aug 0.79 261.51 16.4 x [(93)m	Sep 0.89 306.12 14.1	Oct 0.95 349.2 10.6]	Nov 0.97 385.79 7.1	Dec 0.97 411.53 4.2	ulate	(95) (96)
Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m=	Jan ation fac 0.97 Il gains, 423.64 hly avera 4.3 loss rate 1489.33	factor for Feb tor for ga 0.97 hmGm , 420.32 age exte 4.9 e for mea 1434.58	or gains Mar ains, hm 0.97 W = (94 402.57 rnal tem 6.5 an intern 1290.4	using Ta Apr 0.96 4)m x (84 373.43 perature 8.9 nal tempe 1069.04	ble 9a May 0.93 4)m 339.82 e from Ta 11.7 erature, 821	Jun 0.88 297.67 able 8 14.6 Lm , W = 560.29	Jul 0.79 253.08 16.6 =[(39)m 2 379.14	Aug 0.79 261.51 16.4 x [(93)m 398.01	Sep 0.89 306.12 14.1 - (96)m 606.11	Oct 0.95 349.2 10.6] 916.75	Nov 0.97 385.79 7.1 1226.99	Dec 0.97 411.53	ulate	(95)
Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m=	Jan ation fac 0.97 Il gains, 423.64 hly avera 4.3 loss rate 1489.33 e heatin	factor for Feb tor for ga 0.97 hmGm , 420.32 age exte 4.9 e for mea 1434.58 g require	or gains Mar ains, hm 0.97 W = (94 402.57 rnal tem 6.5 an intern 1290.4 ement fo	using Ta Apr 0.96 4)m x (84 373.43 perature 8.9 nal tempe 1069.04 or each m	ble 9a May 0.93 4)m 339.82 e from Ta 11.7 erature, 821 nonth, k\	Jun 0.88 297.67 able 8 14.6 Lm , W = 560.29 Wh/mont	Jul 0.79 253.08 16.6 =[(39)m 2 379.14	Aug 0.79 261.51 16.4 x [(93)m 398.01	Sep 0.89 306.12 14.1 - (96)m 606.11	Oct 0.95 349.2 10.6] 916.75)m] x (4	Nov 0.97 385.79 7.1 1226.99 1)m	Dec 0.97 411.53 4.2 1485.19	ulate	(95) (96)
Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m=	Jan ation fac 0.97 Il gains, 423.64 hly avera 4.3 loss rate 1489.33	factor for Feb tor for ga 0.97 hmGm , 420.32 age exte 4.9 e for mea 1434.58	or gains Mar ains, hm 0.97 W = (94 402.57 rnal tem 6.5 an intern 1290.4	using Ta Apr 0.96 4)m x (84 373.43 perature 8.9 nal tempe 1069.04	ble 9a May 0.93 4)m 339.82 e from Ta 11.7 erature, 821	Jun 0.88 297.67 able 8 14.6 Lm , W = 560.29	Jul 0.79 253.08 16.6 =[(39)m 2 379.14	Aug 0.79 261.51 16.4 x [(93)m 398.01	Sep 0.89 306.12 14.1 - (96)m 606.11	Oct 0.95 349.2 10.6] 916.75	Nov 0.97 385.79 7.1 1226.99	Dec 0.97 411.53 4.2	ulate	(95) (96) (97)
Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space	Jan ation fac 0.97 Il gains, 423.64 hly avera 4.3 loss rate 1489.33 e heatin	factor for Feb tor for ga 0.97 hmGm , 420.32 age exte 4.9 e for mea 1434.58 g require	or gains Mar ains, hm 0.97 W = (94 402.57 rnal tem 6.5 an intern 1290.4 ement fo	using Ta Apr 0.96 4)m x (84 373.43 perature 8.9 nal tempe 1069.04 or each m	ble 9a May 0.93 4)m 339.82 e from Ta 11.7 erature, 821 nonth, k\	Jun 0.88 297.67 able 8 14.6 Lm , W = 560.29 Wh/mont	Jul 0.79 253.08 16.6 =[(39)m 1 379.14 th = 0.02	Aug 0.79 261.51 16.4 x [(93)m 398.01 24 x [(97) 0	Sep 0.89 306.12 14.1 - (96)m 606.11)m - (95 0	Oct 0.95 349.2 10.6] 916.75)m] x (4 422.26	Nov 0.97 385.79 7.1 1226.99 1)m	Dec 0.97 411.53 4.2 1485.19 798.81	ulate 4820.56	(95) (96)
Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m=	Jan ation fac 0.97 Il gains, 423.64 nly avera 4.3 loss rate 1489.33 e heating 792.88	factor for Feb tor for ga 0.97 hmGm , 420.32 age exte 4.9 e for mea 1434.58 g require 681.58	or gains Mar ains, hm 0.97 W = (94) 402.57 rnal tem 6.5 an intern 1290.4 ement fo 660.54	using Ta Apr 0.96 4)m x (84 373.43 perature 8.9 nal tempe 1069.04 or each m	ble 9a May 0.93 4)m 339.82 e from Ta 11.7 erature, 821 nonth, k\ 357.99	Jun 0.88 297.67 able 8 14.6 Lm , W = 560.29 Wh/mont	Jul 0.79 253.08 16.6 =[(39)m 1 379.14 th = 0.02	Aug 0.79 261.51 16.4 x [(93)m 398.01 24 x [(97) 0	Sep 0.89 306.12 14.1 - (96)m 606.11)m - (95 0	Oct 0.95 349.2 10.6] 916.75)m] x (4 422.26	Nov 0.97 385.79 7.1 1226.99 1)m 605.66	Dec 0.97 411.53 4.2 1485.19 798.81		(95) (96) (97)
Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m=	Jan ation fac 0.97 Il gains, 423.64 hly avera 4.3 loss rate 1489.33 e heatin 792.88	factor for Feb tor for ga 0.97 hmGm , 420.32 age exte 4.9 e for mea 1434.58 g require 681.58 g require	or gains Mar ains, hm 0.97 W = (94) 402.57 rnal tem 6.5 an intern 1290.4 ement fo 660.54	using Ta Apr 0.96 4)m x (84 373.43 perature 8.9 nal tempe 1069.04 r each m 500.84	ble 9a May 0.93 4)m 339.82 e from Ta 11.7 erature, 821 nonth, k\ 357.99	Jun 0.88 297.67 able 8 14.6 Lm , W = 560.29 Wh/mont 0	Jul 0.79 253.08 16.6 =[(39)m 1 379.14 th = 0.02 0	Aug 0.79 261.51 16.4 x [(93)m 398.01 24 x [(97) 0 Tota	Sep 0.89 306.12 14.1 - (96)m 606.11)m - (95 0 1 per year	Oct 0.95 349.2 10.6] 916.75)m] x (4 422.26	Nov 0.97 385.79 7.1 1226.99 1)m 605.66	Dec 0.97 411.53 4.2 1485.19 798.81	4820.56	(95) (96) (97)](98)
Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space (98)m=	Jan ation fac 0.97 Il gains, 423.64 hly avera 4.3 loss rate 1489.33 e heatin 792.88 e heatin e heatin	factor for Feb tor for ga 0.97 hmGm , 420.32 age exte 4.9 e for mea 1434.58 g require 681.58 g require	or gains Mar ains, hm 0.97 W = (94) 402.57 rnal tem 6.5 an intern 1290.4 ement fo 660.54	using Ta Apr 0.96 4)m x (84 373.43 perature 8.9 nal tempe 1069.04 r each m 500.84	ble 9a May 0.93 4)m 339.82 e from Ta 11.7 erature, 821 nonth, k\ 357.99	Jun 0.88 297.67 able 8 14.6 Lm , W = 560.29 Wh/mont 0	Jul 0.79 253.08 16.6 =[(39)m 1 379.14 th = 0.02 0	Aug 0.79 261.51 16.4 x [(93)m 398.01 24 x [(97) 0 Tota	Sep 0.89 306.12 14.1 - (96)m 606.11)m - (95 0 1 per year	Oct 0.95 349.2 10.6] 916.75)m] x (4 422.26	Nov 0.97 385.79 7.1 1226.99 1)m 605.66	Dec 0.97 411.53 4.2 1485.19 798.81	4820.56	(95) (96) (97)](98)
Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space 9a. En Space	Jan ation fac 0.97 Il gains, 423.64 hly avera 4.3 loss rate 1489.33 e heatin 792.88 e heatin ergy rec e heatin	factor for Feb tor for ga 0.97 hmGm , 420.32 age exte 4.9 e for mea 1434.58 g require 681.58 g require g require puiremen ng:	or gains Mar ains, hm 0.97 W = (94 402.57 rnal tem 6.5 an intern 1290.4 ement fo 660.54 ement in ats - Ind	using Ta Apr 0.96 4)m x (84 373.43 perature 8.9 nal tempe 1069.04 r each m 500.84	ble 9a May 0.93 4)m 339.82 e from Ta 11.7 erature, 821 nonth, k\ 357.99 2/year eating s	Jun 0.88 297.67 able 8 14.6 Lm , W = 560.29 Wh/mont 0	Jul 0.79 253.08 16.6 =[(39)m 1 379.14 th = 0.02 0	Aug 0.79 261.51 16.4 x [(93)m 398.01 24 x [(97) 0 Tota micro-C	Sep 0.89 306.12 14.1 - (96)m 606.11)m - (95 0 1 per year	Oct 0.95 349.2 10.6] 916.75)m] x (4 422.26	Nov 0.97 385.79 7.1 1226.99 1)m 605.66	Dec 0.97 411.53 4.2 1485.19 798.81	4820.56	(95) (96) (97)](98)
Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space 9a. En Space	Jan ation fac 0.97 Il gains, 423.64 Aly avera 4.3 Ioss rate 1489.33 e heatin 792.88 e heatin ergy rec e heatin	factor for Feb tor for ga 0.97 hmGm , 420.32 age exte 4.9 e for mea 1434.58 g require 681.58 g require 1434.58	or gains Mar ains, hm 0.97 W = (94 402.57 rnal tem 6.5 an intern 1290.4 ement fo 660.54 ement in ats - Ind at from s	using Ta Apr 1: 0.96 4)m x (84 373.43 perature 8.9 nal tempe 1069.04 r each m 500.84 kWh/m ²	ble 9a May 0.93 4)m 339.82 e from Ta 11.7 erature, 821 nonth, k\ 357.99 k/year eating sy y/supple	Jun 0.88 297.67 able 8 14.6 Lm , W = 560.29 Wh/mont 0	Jul 0.79 253.08 16.6 =[(39)m 2 379.14 th = 0.02 0 ncluding	Aug 0.79 261.51 16.4 x [(93)m 398.01 24 x [(97) 0 Tota micro-C	Sep 0.89 306.12 14.1 - (96)m 606.11)m - (95 0 I per year CHP)	Oct 0.95 349.2 10.6] 916.75)m] x (4 422.26	Nov 0.97 385.79 7.1 1226.99 1)m 605.66	Dec 0.97 411.53 4.2 1485.19 798.81	4820.56 45.63	(95) (96) (97) (98) (99)
Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space 9a. En Space Fracti	Jan ation fac 0.97 Il gains, 423.64 hly avera 4.3 loss rate 1489.33 e heatin 792.88 e heatin ergy rec e heatin fon of sp	factor for Feb tor for g: 0.97 hmGm , 420.32 age exte 4.9 e for mea 1434.58 g require 681.58 g require for mea 681.58	or gains Mar ains, hm 0.97 W = (94) 402.57 rnal tem 6.5 an intern 1290.4 ement for 660.54 ement int 1290.4 ement for 660.54 ement int at from s at from n	using Ta Apr 1: 0.96 4)m x (84 373.43 perature 8.9 nal tempe 1069.04 or each m 500.84 kWh/m ² ividual h	ble 9a May 0.93 4)m 339.82 e from Ta 11.7 erature, 821 nonth, kV 357.99 ?/year eating s y/supple em(s)	Jun 0.88 297.67 able 8 14.6 Lm , W = 560.29 Wh/mont 0	Jul 0.79 253.08 16.6 =[(39)m : 379.14 th = 0.02 0 ncluding	Aug 0.79 261.51 16.4 x [(93)m 398.01 24 x [(97) 0 Tota micro-C (202) = 1 -	Sep 0.89 306.12 14.1 - (96)m 606.11)m - (95 0 I per year CHP)	Oct 0.95 349.2 10.6] 916.75)m] x (4 422.26 (kWh/year	Nov 0.97 385.79 7.1 1226.99 1)m 605.66	Dec 0.97 411.53 4.2 1485.19 798.81	4820.56 45.63 0	(95) (96) (97) (98) (99) (201)

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	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
Space	e heatin	g require	ement (c	alculate	d above)									
	792.88	681.58	660.54	500.84	357.99	0	0	0	0	422.26	605.66	798.81		
(211)m		í	, . ,	00 ÷ (20	r Ó		1					r	1	(211)
	875.14	752.3	729.08	552.8	395.14	0	0	0	0	466.07	668.5	881.69		-
-								lota	l (kWh/yea	ar) = Sum(2)	2 11) _{15,1012}	F	5320.71	(211)
•		• ·		y), kWh/	month									
= {[(90 (215)m=	0		00 ÷ (20	0	0	0	0	0	0	0	0	0]	
(,									l (kWh/yea	-			0	(215)
Water	heating	1												
	-	-	ter (calc	ulated a	bove)									
	172.34	150.73	155.54	135.6	130.12	112.28	104.04	119.39	120.82	140.8	153.7	166.9		_
	-	ater hea	i	1			1					r	85	(216)
(217)m=		89.53	89.48	89.35	89.04	85	85	85	85	89.13	89.41	89.58		(217)
		-	kWh/m) ÷ (217)											
. ,	192.46	168.36	173.83	151.78	146.14	132.09	122.4	140.46	142.14	157.97	171.9	186.32		
			1	1			1	Tota	I = Sum(2	19a) ₁₁₂ =			1885.86	(219)
Annua	I totals									k	Wh/year		kWh/year	
Space	heating	fuel use	ed, main	system	1								5320.71	
Water	heating	fuel use	d										1885.86	
Electric	city for p	oumps, f	ans and	electric	keep-ho	t								
centra	al heatir	ig pump	:									30		(230c)
boiler	with a f	an-assis	sted flue									45		(230e)
Total e	lectricit	y for the	above, l	kWh/yea	ır			sum	of (230a).	(230g) =			75	(231)
Electric	city for l	ighting											453.98	(232)
			for all u	ses (211)(221)	+ (231)	+ (232).	(237b)	=				7735.54	(338)
				•	, , ,	, ,	. ,	icro-CHP						
							e rgy /h/year			kg CO	ion fac 2/kWh	tor	Emissions kg CO2/ye	
Space	heating	(main s	ystem 1)			1) x			0.2		=	1149.27	(261)
		(second		,		(21	5) x			0.5		=	0	(263)
	heating	,	,			(21	9) x			0.2		=	407.35	(264)
	•	ter heati	ina			(26	1) + (262)	+ (263) + (264) =	0.2			1556.62	(265)
			-	electric	keep-ho		1) x			0.5	19	=	38.93	(267)
	city for l	•					2) x			0.5		=	235.61	(268)
	CO2, kg/								sum o	f (265)(2			1831.16	(272)
	,	,								· · · ·			1031.10	(- 1 -)

Dwelling CO2 Emission Rate

EI rating (section 14)

(272) ÷ (4) =

17.33	(273)
84	(274)

							User I	Details:						
	ssor N are Na			n Marsh oma FS	n SAP 201			Softwa	a Num are Vei	rsion:			0005374 on: 1.0.5.58	
			DL	1.40		P	roperty	Address	: Plot 12					
Addre		olling di	PIO mension	t 12										
1. Uve	erali uwe	ening an	nension	5.			۸rc	a(m²)			ight(m)		Volume(m ³)	
Ground	l floor								(1a) x		2.4	(2a) =	126.77	(3a)
First flo								52.82	(1b) x		.63	(2b) =	138.92	(3b)
Total flo	oor area	a TFA =	(1a)+(1	o)+(1c)+	(1d)+(1e	e)+(1n		05.64	(4)	L		J		
Dwellin	g volum	ne							(3a)+(3b)+(3c)+(3d	l)+(3e)+	.(3n) =	265.68	(5)
2. Ver	ntilation	rate:												
				main heating		econdar neating	у	other		total			m ³ per hour	
Numbe	r of chir	nneys		0	_ + [0	+	0] = [0	X 4	40 =	0	(6a)
Numbe	r of ope	en flues	Γ	0	+	0] + [0] = [0	× 2	20 =	0	(6b)
Numbe	r of inte	rmittent	fans						- Ē	4	x ^	10 =	40	(7a)
Numbe	r of pas	sive ver	nts						Γ	0	x ^	10 =	0	(7b)
Numbe	r of flue	less ga	s fires						Ē	0	x 4	40 =	0	(7c)
												Air ch	anges per ho	ur
Infiltrati	on due	to chim	neys, flu	es and f	ans = (6	a)+(6b)+(7	a)+(7b)+	(7c) =	Г	40		÷ (5) =	0.15	(8)
lf a pr	essurisati	on test ha	s been ca	rried out o	r is intende	ed, proceed	d to (17),	otherwise	continue fr	rom (9) to ((16)			_
		•		elling (n	s)								0	(9)
		filtration									[(9)	-1]x0.1 =	0	(10)
								or mason		uction			0	(11)
				equal user		ponding to	ine grea		a (anoi					_
	•				·	led) or 0.	1 (seal	ed), else	enter 0				0	(12)
	-	•		05, else									0	(13)
	-		ows and	doors di	raught st	ripped							0	(14)
	low infilt							0.25 - [0.2					0	(15)
	ation ra									12) + (13) +			0	(16)
•		•		•			•	our per s	•	etre of e	nvelope	area	5	(17)
		-	-					vise (18) = (egree air pe		is boing u	ood		0.4	(18)
	-	es shelte		ressunsau	ontestnas	s been don	eoraue	gree an pe	meanity	is being us	360		2	(19)
Shelter								(20) = 1 -	[0.075 x (1	9)] =			0.85	(20)
Infiltrati	on rate	incorpo	rating sł	nelter fac	ctor			(21) = (18) x (20) =				0.34	(21)
Infiltrati	on rate	modifie	d for mo	nthly wir	nd speed	t								`
[Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Monthly	y avera	ge wind	speed f	rom Tab	le 7	_		_	_	_	_	_		
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7		

Wind 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]	
Adjust	ed infiltr	ation rat	e (allowi	ng for sh	nelter ar	nd wind s	peed) =	(21a) x	(22a)m	-	-		-	
0.1.1	0.43	0.43	0.42	0.37	0.37	0.32	0.32	0.31	0.34	0.37	0.38	0.4		
		c <i>tive air</i> al ventila	-	rate for t	he appli	cable ca	se						C) (23a)
				endix N. (2	3b) = (23a	a) × Fmv (e	equation (1	N5)) . othe	wise (23b) = (23a)				
						for in-use f				/ (/				
			•	-	•	at recove	•			2h)m + ('	23h) 🗙 [1	1 – (23c)		(230)
(24a)m=		0		0	0	0	0	0	0	0	0	0]	(24a)
		d mech	ı anical ve	ntilation	without	heat rec	coverv (N	и MV) (24b)m = (22	1 2b)m + (2	23b)		1	
(24b)m=		0	0	0	0	0	0	0	0	0	0	0]	(24b)
,					•	ve input v						1	1	
	r í	1	<u>, </u>	· · ·	, ,	o); otherv	· ·	r i	,	i i	ŕ	1	1	
(24c)m=		0	0	0	0	0	0	0	0	0	0	0		(24c)
,						ve input [,] erwise (2				0.5]				
(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58]	(24d)
Effe	ctive air	change	rate - er	nter (24a) or (24l	b) or (24	c) or (24	d) in boy	(25)	-			-	
(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58]	(25)
3. He	at losse	s and he	eat loss i	paramete	er:									
ELEN		Gros area	SS	Openin m	gs	Net Ar A ,r		U-valı W/m2		A X U (W/ł	K)	k-value kJ/m²⋅		A X k kJ/K
Doors						2.14	x	1	=	2.14				(26)
Windo	ws Type	e 1				5.48	x1	/[1/(1.4)+	0.04] =	7.27				(27)
Windo	ws Type	2				8.42	x1	/[1/(1.4)+	0.04] =	11.16				(27)
Floor						52.82	2 x	0.13		6.8666				(28)
Walls		103.	71	16.04	4	87.67	' x	0.18	=	15.78	i T		Ξ F	(29)
Roof		52.8	32	0		52.82	2 x	0.13	=	6.87	i T			(30)
Total a	area of e	lements	, m²			209.3	5		I					(31)
Party v	wall					45.9	x	0	=	0				(32)
				effective wi nternal wal		alue calcul	ated using	g formula 1	/[(1/U-valu	ie)+0.04] a	as given in	paragraph	h 3.2	
		s, W/K			,			(26)(30)	+ (32) =				50.	08 (33)
Heat c	apacity	Cm = S((Axk)						((28)	.(30) + (32	2) + (32a).	(32e) =	1533	
Therm	al mass	parame	ter (TMF	⁻ = Cm ÷	- TFA) iı	n kJ/m²K			Indica	tive Value:	: Medium		25	i0 (35)
	-	sments wh ad of a de			construct	tion are not	t known pr	recisely the	indicative	values of	TMP in Ta	able 1f		
					using Ap	opendix ł	<						10.	49 (36)
	-	•		own (36) =	• •	•								1、 ′
Total f	abric he	at loss							(33) +	(36) =			60.	57 <mark>(37)</mark>
Ventila	ation hea	at loss ca	alculated	monthl	/	· · · · ·		i	(38)m	= 0.33 × (25)m x (5)		-	
		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	1	

(38)m=	52.1	51.78	51.46	49.99	49.71	48.42	48.42	48.19	48.92	49.71	50.27	50.85		(38)
Heat tr	ansfer o	coefficier	nt. W/K						(39)m	= (37) + (3	38)m			
(39)m=	112.67	112.35	112.03	110.55	110.28	108.99	108.99	108.75	109.49	110.28	110.84	111.42		
I										-	Sum(39)1.	12 /12=	110.55	(39)
1		· · · · ·	HLP), W/	1						= (39)m ÷	1			
(40)m=	1.07	1.06	1.06	1.05	1.04	1.03	1.03	1.03	1.04	1.04	1.05	1.05	1.05	(40)
Numbe	er of day	/s in moi	nth (Tab	le 1a)					,	Average =	Sum(40) ₁ .	12 / 12=	1.05	(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:	
		ipancy, l										79		(42)
	A > 13.9 A £ 13.9		+ 1.76 x	[1 - exp	(-0.0003	849 x (TF	-A -13.9)2)] + 0.0	0013 x (⁻	TFA -13.	9)			
Annual	averag	e hot wa						(25 x N)).37		(43)
		-	hot water person per			-	-	to achieve	a water us	se target o	f			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot wate			day for ea		,			<u> </u>	Sep		NOV	Dec		
(44)m=	110.4	106.39	102.37	98.36	94.34	90.33	90.33	94.34	98.36	102.37	106.39	110.4		
	-										m(44) ₁₁₂ =		1204.4	(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	ables 1b, 1	c, 1d)		
(45)m=	163.72	143.19	147.76	128.82	123.61	106.67	98.84	113.42	114.78	133.76	146.01	158.56		
lf instant	aneous w	vater heatii	na at point	of use (no	hot water	^r storaae).	enter 0 in	boxes (46		Total = Su	m(45) ₁₁₂ =	-	1579.16	(45)
(46)m=	24.56	21.48	22.16	19.32	18.54	16	14.83	17.01	17.22	20.06	21.9	23.78		(46)
· · ·	storage		22.10	10.02	10.04	10	14.00	17.01	11.22	20.00	21.5	20.10		(10)
Storage	e volum	e (litres)	includin	ng any so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
	-	-	ind no ta		-									
			hot wate	er (this in	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			(, a.a.j / :					0		(49)
			storage		ear			(48) x (49)) =			0		(50)
			eclared of			or is not						<u> </u>		(00)
			factor fr		e 2 (kW	h/litre/da	ıy)					0		(51)
	•	from Ta	ee section ble 2a	on 4.3										(52)
			m Table	2b								0 0		(52) (53)
-			storage		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)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)

		•	,	om Table for each		59)m –	(58) ÷ 36	5 v (41)	m			0]	(58)
	·			le H5 if t		,	` '	``'		r thermo	stat)			
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0		(59)
Combi	loss ca	culated	for each	month ((61)m =	(60) ÷ 30	65 x (41)m					1	
(61)m=	50.96	46.03	50.96	48.51	48.08	44.55	46.03	48.08	48.51	50.96	49.32	50.96		(61)
Total h	eat requ	uired for	water h	eating ca	alculated	l for eac	h month	(62)m =	0.85 ×	(45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m=	214.68	189.22	198.72	177.33	171.69	151.21	144.87	161.5	163.28	184.72	195.33	209.52		(62)
Solar DH	IW input o	calculated	using App	endix G or	Appendix	H (negati	ve quantity	/) (enter '0	if no sola	r contribut	ion to wate	er heating)	1	
(add ad	ditiona	l lines if	FGHRS	and/or V	WWHRS	applies	, see Ap	pendix (S)					
(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=	214.68	189.22	198.72	177.33	171.69	151.21	144.87	161.5	163.28	184.72	195.33	209.52		
•								Outp	out from w	ater heate	r (annual)₁	12	2162.08	(64)
Heat g	ains fro	m water	heating	, kWh/mo	onth 0.2	5 ´ [0.85	× (45)m	ı + (61)m	n] + 0.8 x	x [(46)m	+ (57)m	+ (59)m]	
(65)m=	67.18	59.12	61.87	54.96	53.12	46.6	44.37	49.73	50.29	57.22	60.88	65.46		(65)
inclu	de (57)	m in cal	culation	of (65)m	only if c	ylinder i	s in the o	dwelling	or hot w	vater is fr	om com	munity h	eating	
5. Int	ernal ga	ains (see	e Table 5	5 and 5a):	-		-				•	-	
			e 5), Wat											
Metabo	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m=	139.3	139.3	139.3	139.3	139.3	139.3	139.3	139.3	139.3	139.3	139.3	139.3		(66)
Liahtin	a aains	(calcula	ted in Ar	pendix	L. equat	ion L9 o	r L9a), a	lso see ⁻	Table 5	<u> </u>			1	
(67)m=	25.71	22.83	18.57	14.06	10.51	8.87	9.59	12.46	16.72	21.23	24.78	26.42		(67)
	nces da	ins (calc	ulated ir	n Append	l dix L. ea	L uation L	13 or L1	i 3a), also	see Ta	l ble 5			1	
(68)m=	265.14	267.89	260.95	246.19	227.56	210.05	198.35	195.6	202.54	217.3	235.93	253.44]	(68)
Cookin	a aains	(calcula	L ated in A	ı ppendix	l equa	L tion I 15	or I 15a) also se	e Table	1 5			1	
(69)m=	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93	36.93		(69)
, í			(Table :	1 5a)									I	
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3]	(70)
				tive valu				-	-		-	-	I	`
	-	-111.44	· · ·	-111.44	, ,	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44	-111.44]	(71)
` ´		gains (1											I	
(72)m=	90.29	87.97	83.16	76.33	71.4	64.73	59.64	66.84	69.85	76.9	84.55	87.98	1	(72)
		gains =		10.00						(70)m + (7			l	
(73)m=	448.93	446.48	430.47	404.38	377.26	351.44	335.37	342.7	356.9	383.22	413.05	435.63	1	(73)
	ar gains		+30.+1	404.00	511.20	001.44	000.01	042.1	000.0	303.22	410.00	400.00		(10)
			using sola	r flux from	Table 6a	and assoc	iated equa	itions to co	nvert to th	ne applicat	le orientat	ion.		
-		Access F	-	Area		Flu			g_		FF		Gains	
		able 6d		m²			ble 6a	Т	able 6b	Т	able 6c		(W)	
Solar g	ains in	watts, ca	alculated	d 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	0		(83)
-														

(84)m=	448.93	446.48	430.47	404.38	377.26	351.44	335.37	342.7	356.9	383.22	413.05	435.63		(84)
7. Me	an inter	nal temp	erature	(heating	season)								
Temp	erature	during h	eating p	eriods ir	n the livii	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)					I		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(86)m=	1	1	1	1	1	0.99	0.95	0.96	0.99	1	1	1		(86)
Mean	interna	l temper	ature in	living are	ea T1 (fo	ollow ste	ps 3 to 7	r in Tabl	e 9c)					
(87)m=	19.71	19.77	19.92	20.15	20.41	20.68	20.85	20.84	20.64	20.31	19.98	19.7		(87)
Tomr		durina h	eating r	eriods ir	rest of	dwelling	from Ta	ا م م الم	ר רייר (ייר)	I				
(88)m=	20.03	20.03	20.03	20.04	20.05	20.06	20.06	20.06	20.05	20.05	20.04	20.04		(88)
		tor for a	aina far	L	volling	L		ـــــــــــــــــــــــــــــــــــــ						
(89)m=			1	rest of d	weiling, I	0.98	0.89	9a) 0.9	0.98	1	1	1		(89)
												1		(00)
		· · ·		the rest		<u>, </u>	i	ri	1	, 	40.00	40.00		(90)
(90)m=	18.28	18.37	18.6	18.95	19.32	19.72	19.95	19.94	19.65	19.17	18.69 g area ÷ (4	18.28	0.00	_
											ig area - (-	-) -	0.23	(91)
		<u> </u>	· · ·	or the wh				<u>`</u>	<u> </u>	i		· · · · · ·		
(92)m=	18.61	18.7	18.9	19.23	19.58	19.94	20.16	20.15	19.88	19.43	18.99	18.61		(92)
				internal		1		1		r i i i i i i i i i i i i i i i i i i i	40.00	40.04		(93)
(93)m=	18.61	18.7	18.9	19.23	19.58	19.94	20.16	20.15	19.88	19.43	18.99	18.61		(93)
		ting requ												
			ernal ter	mneratui	e ohtain	hed at st	on 11 of	Table 9	h so tha	t Ti m–ľ	76)m an	d re-calc	ulate	
				mperatui using Ta		ned at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	ulate	
				•		Jun	ep 11 of Jul	Table 9l Aug	o, so tha Sep	t Ti,m=(Oct	76)m an Nov	d re-calc Dec	ulate	
the ut	ilisation Jan	factor fo	or gains Mar	using Ta Apr	ble 9a					r ·	, 1		ulate	
the ut Utilisa (94)m=	ilisation Jan ation fac	factor fo Feb tor for ga	or gains Mar ains, hm 1	using Ta Apr 1	ble 9a May 0.99					r ·	, 1		ulate	(94)
the ut Utilisa (94)m= Usefu	ilisation Jan ation fac 1 Il gains,	factor fo Feb tor for ga 1 hmGm ,	or gains Mar ains, hm 1 W = (94	using Ta Apr 1: 4)m x (84	ble 9a May 0.99 4)m	Jun 0.97	Jul 0.9	Aug 0.91	Sep 0.98	Oct 1	Nov 1	Dec 1	ulate	. ,
the ut Utilisa (94)m= Usefu (95)m=	ilisation Jan ation fac 1 I gains, 448.57	factor for Feb tor for ga 1 hmGm , 446.08	or gains Mar ains, hm 1 W = (94 429.92	using Ta Apr 1: 4)m x (84 403.44	ble 9a May 0.99 4)m 374.95	Jun 0.97 342.39	Jul	Aug	Sep	Oct	Nov	Dec	ulate	(94) (95)
the ut Utilisa (94)m= Usefu (95)m= Month	ilisation Jan ation fac 1 Jan 448.57 Aly avera	factor for Feb tor for ga 1 hmGm , 446.08 age exte	or gains Mar ains, hm 1 W = (94 429.92 rnal tem	using Ta Apr 1: 4)m x (84 403.44 perature	ble 9a May 0.99 4)m 374.95 e from Ta	Jun 0.97 342.39 able 8	Jul 0.9 302.01	Aug 0.91 311.64	Sep 0.98 349.93	Oct 1 381.76	Nov 1 412.52	Dec 1 435.35	ulate	(95)
the ut Utilisa (94)m= Usefu (95)m= Montł (96)m=	ilisation Jan ation fac 1 Jan Jan Jan Jan Jan Jan Jan Jan Jan Jan	factor for Feb ttor for ga 1 hmGm , 446.08 age exte 4.9	or gains Mar ains, hm 1 W = (94 429.92 rnal tem 6.5	using Ta Apr 1 4)m x (84 403.44 perature 8.9	ble 9a May 0.99 4)m 374.95 e from Ta 11.7	Jun 0.97 342.39 able 8 14.6	Jul 0.9 302.01 16.6	Aug 0.91 311.64 16.4	Sep 0.98 349.93 14.1	Oct 1 381.76 10.6	Nov 1	Dec 1	ulate	. ,
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat	ilisation Jan ation fac 1 Jan 448.57 hly avera 4.3 loss rate	factor for Feb tor for ga 1 hmGm , 446.08 age exte 4.9 e for mea	or gains Mar ains, hm 1 W = (94 429.92 rnal tem 6.5 an intern	Apr Apr 1 4)m x (84 403.44 perature 8.9 nal tempe	ble 9a May 0.99 4)m 374.95 e from Ta 11.7 erature,	Jun 0.97 342.39 able 8 14.6 Lm , W =	Jul 0.9 302.01 16.6 =[(39)m 2	Aug 0.91 311.64 16.4 x [(93)m	Sep 0.98 349.93 14.1 – (96)m	Oct 1 381.76 10.6]	Nov 1 412.52 7.1	Dec 1 435.35 4.2	ulate	(95)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m=	ilisation Jan ation fac 1 Jan Jagains, 448.57 hly avera 4.3 loss rate 1612.23	factor for Feb tor for ga 1 hmGm , 446.08 age exte 4.9 e for mea 1549.95	or gains Mar ains, hm 1 W = (94) 429.92 rnal tem 6.5 an intern 1389.52	using Ta Apr 1 4)m x (84 403.44 aperature 8.9 nal tempe 1141.55	ble 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51	Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53	Jul 0.9 302.01 16.6 =[(39)m 2 388.24	Aug 0.91 311.64 16.4 x [(93)m 407.81	Sep 0.98 349.93 14.1 - (96)m 632.91	Oct 1 381.76 10.6] 974.26	Nov 1 412.52 7.1 1317.48	Dec 1 435.35	ulate	(95) (96)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m=	ilisation Jan ation fac 1 Jan Jagains, 448.57 hly avera 4.3 loss rate 1612.23	factor for Feb tor for ga 1 hmGm , 446.08 age exte 4.9 e for mea 1549.95	or gains Mar ains, hm 1 W = (94) 429.92 rnal tem 6.5 an intern 1389.52	Apr Apr 1 4)m x (84 403.44 perature 8.9 nal tempe	ble 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51	Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53	Jul 0.9 302.01 16.6 =[(39)m 2 388.24	Aug 0.91 311.64 16.4 x [(93)m 407.81	Sep 0.98 349.93 14.1 - (96)m 632.91	Oct 1 381.76 10.6] 974.26	Nov 1 412.52 7.1 1317.48	Dec 1 435.35 4.2	ulate	(95) (96)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space	ilisation Jan ation fac 1 Jan 448.57 hly avera 4.3 loss rate 1612.23 e heatin	factor for Feb tor for ga 1 hmGm , 446.08 age exte 4.9 e for mea 1549.95 g require	or gains Mar ains, hm 1 W = (94 429.92 rnal tem 6.5 an intern 1389.52 ement fo	using Ta Apr 1 4)m x (8 403.44 perature 8.9 nal tempe 1141.55 or each n	ble 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51 nonth, k\	Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mon	Jul 0.9 302.01 16.6 =[(39)m 2 388.24 th = 0.02	Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97 0	Sep 0.98 349.93 14.1 - (96)m 632.91)m - (95 0	Oct 1 381.76 10.6] 974.26)m] x (4 440.82	Nov 1 412.52 7.1 1317.48 1)m	Dec 1 435.35 4.2 1605.23 870.39	ulate 5182.94	(95) (96)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m=	ilisation Jan ation fac 1 ul gains, 448.57 hly avera 4.3 loss rate 1612.23 e heatin 865.76	factor for Feb tor for ga 1 hmGm , 446.08 age exte 4.9 e for mea 1549.95 g require 741.8	or gains Mar ains, hm 1 W = (94) 429.92 rnal tem 6.5 an intern 1389.52 ement fo 713.94	using Ta Apr 1 4)m x (84 403.44 perature 8.9 nal tempe 1141.55 or each n 531.44	ble 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51 nonth, k\ 367.21	Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mon	Jul 0.9 302.01 16.6 =[(39)m 2 388.24 th = 0.02	Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97 0	Sep 0.98 349.93 14.1 - (96)m 632.91)m - (95 0	Oct 1 381.76 10.6] 974.26)m] x (4 440.82	Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23 870.39	5182.94	(95) (96) (97) (98)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m=	ilisation Jan ation fac 1 ul gains, 448.57 hly avera 4.3 loss rate 1612.23 e heatin 865.76	factor for Feb tor for ga 1 hmGm , 446.08 age exte 4.9 e for mea 1549.95 g require 741.8	or gains Mar ains, hm 1 W = (94 429.92 rnal tem 6.5 an intern 1389.52 ement fo 713.94	using Ta Apr 1 4)m x (84 403.44 403.44 perature 8.9 nal tempe 1141.55 or each n 531.44	ble 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51 nonth, k 367.21	Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mon 0	Jul 0.9 302.01 16.6 =[(39)m : 388.24 th = 0.02 0	Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97) 0 Tota	Sep 0.98 349.93 14.1 - (96)m 632.91)m - (95 0 1 per year	Oct 1 381.76 10.6] 974.26)m] x (4 440.82	Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23 870.39		(95) (96) (97)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space (98, En	ilisation Jan ation fac 1 I gains, 448.57 hly avera 4.3 loss rate 1612.23 e heatin 865.76 e heatin ergy rec	factor for Feb tor for ga 1 hmGm , 446.08 age exte 4.9 e for mea 1549.95 g require 741.8 g require	or gains Mar ains, hm 1 W = (94 429.92 rnal tem 6.5 an intern 1389.52 ement fo 713.94	using Ta Apr 1 4)m x (84 403.44 perature 8.9 nal tempe 1141.55 or each n 531.44	ble 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51 nonth, k 367.21	Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mon 0	Jul 0.9 302.01 16.6 =[(39)m : 388.24 th = 0.02 0	Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97) 0 Tota	Sep 0.98 349.93 14.1 - (96)m 632.91)m - (95 0 1 per year	Oct 1 381.76 10.6] 974.26)m] x (4 440.82	Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23 870.39	5182.94	(95) (96) (97) (98)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space 9a. En Space	ilisation Jan ation fac 1 al gains, 448.57 hly avera 4.3 loss rate 1612.23 e heatin 865.76 e heatin ergy rec e heatir	factor for Feb tor for ga 1 hmGm , 446.08 age exte 4.9 e for mea 1549.95 g require 741.8 g require guiremen ng:	or gains Mar ains, hm 1 W = (94 429.92 rnal tem 6.5 an intern 1389.52 ement fo 713.94 ement in ats - Ind	using Ta Apr 1 4)m x (84 403.44 403.44 perature 8.9 nal tempe 1141.55 or each n 531.44	ble 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51 nonth, k\ 367.21 2/year eating s	Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mon	Jul 0.9 302.01 16.6 =[(39)m : 388.24 th = 0.02 0 ncluding	Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97) 0 Tota micro-C	Sep 0.98 349.93 14.1 - (96)m 632.91)m - (95 0 1 per year	Oct 1 381.76 10.6] 974.26)m] x (4 440.82	Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23 870.39	5182.94	(95) (96) (97) (98)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space 9a. En Space Fracti	ilisation Jan ation fac 1 al gains, 448.57 hly avera 4.3 loss rate 1612.23 e heatin 865.76 e heatin ergy rec e heatin	factor for Feb tor for ga 1 hmGm , 446.08 age exte 4.9 e for mea 1549.95 g require 741.8 g require quiremen ng: bace hea	or gains Mar ains, hm 1 W = $(94$ 429.92 rnal tem 6.5 an intern 1389.52 ement fo 713.94 ement in its - Ind	using Ta Apr 1 4)m x (84 403.44 perature 8.9 nal tempe 1141.55 r each n 531.44 kWh/m ² ividual h	ble 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51 nonth, k\ 367.21 2/year eating sy y/supple	Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mon	Jul 0.9 302.01 16.6 =[(39)m 2 388.24 th = 0.02 0 ncluding	Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97) 0 Tota micro-C	Sep 0.98 349.93 14.1 - (96)m 632.91)m - (95 0 1 per year	Oct 1 381.76 10.6] 974.26)m] x (4 440.82	Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23 870.39	5182.94 49.06	(95) (96) (97) (98) (99)
the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space (98)m= Space Fracti	ilisation Jan ation fac 1 al gains, 448.57 hly avera 4.3 loss rate 1612.23 e heatin 865.76 e heatin ergy rec e heatir ion of sp ion of sp	factor for Feb tor for ga 1 hmGm , 446.08 age exte 4.9 e for mea 1549.95 g require 741.8 g require quiremen ng: pace hea pace hea	or gains Mar ains, hm 1 W = (94) 429.92 rnal tem 6.5 an intern 1389.52 ement fo 713.94 ement in its - Ind it from so it from n	using Ta Apr 1 4)m x (84 403.44 aperature 8.9 nal tempe 1141.55 or each n 531.44 kWh/m ² ividual h	ble 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51 nonth, kV 367.21 2 /year eating s y/supple em(s)	Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mon	Jul 0.9 302.01 16.6 =[(39)m : 388.24 th = 0.02 0 ncluding	Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97 0 Tota micro-C (202) = 1	Sep 0.98 349.93 14.1 - (96)m 632.91)m - (95 0 1 per year CHP)	Oct 1 381.76 10.6] 974.26)m] x (4 440.82 (kWh/year	Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23 870.39	5182.94 49.06 0	(95) (96) (97) (98) (99)

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

														_
Efficiency of main space heating system 1													93.4	(206)
Efficie	ency of	seconda	ary/suppl	ementar	y heating	g systen	n, %	-	-	-	-		0	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	ar
Space		ř	r Ò	1	d above)		<u> </u>	<u> </u>	-		I		I	
	865.76	741.8	713.94	531.44	367.21	0	0	0	0	440.82	651.57	870.39		
(211)m	1 = {[(98 926.94	6)m x (20 794.22	$(4)] \} x $	<u> </u>	06) 393.16	0		0	0	471.97	697.62	021.0	I	(211)
	926.94	794.22	764.39	569	393.10	0	0	-	-	-	211) _{15,1012}	931.9	5549.19	(211)
Snac	a haatin	a fual (s	econdar	w) k\M/b	/month				(- 15,1012	2	5549.19	
•		•	00 ÷ (20	• ·	monur									
(215)m=		0	0	0	0	0	0	0	0	0	0	0		
								Tota	l (kWh/yea	ar) =Sum(2	215) _{15,1012}	<u>_</u>	0	(215)
Water	heating	9												_
Output	from w	ater hea	ter (calc 198.72	ulated a	bove) 171.69	151.21	144.87	161.5	163.28	184.72	195.33	209.52	I	
Efficier		ater hea		111.55	171.03	101.21	144.07	101.5	103.20	104.72	199.99	209.52	80.3	(216)
(217)m=	· ·	88.15	87.99	87.64	86.92	80.3	80.3	80.3	80.3	87.16	87.85	88.25		(217)
		1	, kWh/m										l	
(219)m	<u>1 = (64)</u>	<u>m x 10</u>	0 ÷ (217	<u>)m</u>	i				· · · · · ·		i		1	
(219)m=	243.42	214.67	225.85	202.33	197.53	188.31	180.41	201.12	203.34	211.93	222.34	237.42		-
A								Tota	I = Sum(2				2528.67	(219)
Annual totals kWh/year Space heating fuel used, main system 1												-	kWh/year 5549.19	7
•	-	, fuel use		,									2528.67	
	•			olootrio	kaan ha	+							2020.01	
				electric	keep-ho	L							1	(000
central heating pump:												30		(2300
boiler with a fan-assisted flue							45							(230)
Total electricity for the above, kWh/year							sum of (230a)(230g) =							(231)
Electricity for lighting													453.98	(232)
Total d	lelivered	d energy	for all u	ises (211)(221)	+ (231)	+ (232)	(237b)	=				8606.83	(338)
12a. (CO2 err	nissions	– Individ	lual heat	ing syste	ems incl	uding mi	icro-CHF)					
	Energy Emission factor									tor	Emissions			
						Vh/year		kg CO				kg CO2/yea		
Space heating (main system 1)					(21	1) x			0.2	16	=	1198.62	(261)	
Space heating (secondary)						(21	5) x			0.5		=	0	(263)
Water heating							9) x					=		(264)
-								· (262) · (264) -	0.2	16		546.19	-
Space and water heating								+ (263) + (204) =				1744.82	(265
Electricity for pumps, fans and electric keep-hot							1) x			0.5	19	=	38.93	(267
Electricity for lighting						(23	2) x			0.5	19	=	235.61	(268
Total C	CO2, kg	/year							sum o	f (265)(271) =		2019.36	(272)

TER =

19.12 (273)