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 12:33:20

Project Information:

Assessed By: Ben Marsh (STRO005374) Building Type: End-terrace House

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 105.64m²

Site Reference: New Project

Plot Reference: Plot 9

Address: Plot 9

Client Details:

Name: Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Mains gas

Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)

16.95 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.51 kg/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 44.7 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals 5.00 (design value)

Maximum 10.0 **OK**

4 Heating efficiency

Main Heating system: Database: (rev 507, product index 017953):

Boiler systems with radiators or underfloor heating - mains gas

Brand name: Vaillant

Model: ecoTEC exclusive 835 Model qualifier: VUW 356/5-7 (H-GB)

(Combi)

Efficiency 89.7 % SEDBUK2009

Minimum 88.0 % OK

Secondary heating system: None

Regulations Compliance Report

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

Thermal Bridge Report

Property Details: Plot 9

Address: Plot 9 Located in: England

Region: South East England

Thermal bridges

Thermal bridges: User-defined = UD

Default = D Approved = A

User-defined (individual PSI-values) Y-Value = 0.0883

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
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 Details:				
Ground floor	0.16	8.72	P1	[D]
Intermediate floor within a dwelling	0	8.72	P2	[D]
Roof (insulation at ceiling level)	0.24	8.72	P4	[D]

Predicted Energy Assessment



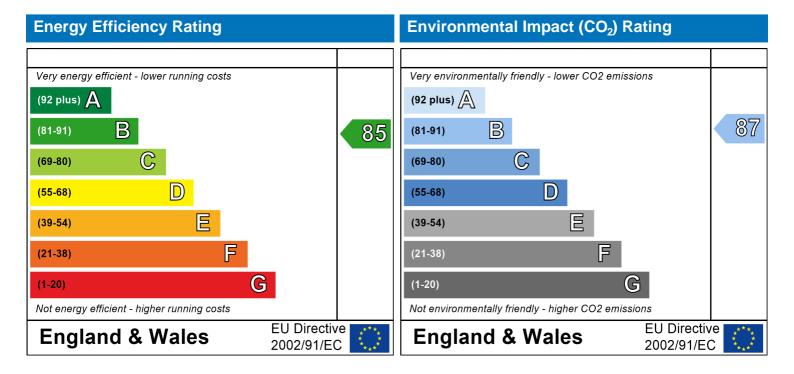
Plot 9

Dwelling type: End
Date of assessment: 19
Produced by: Ber
Total floor area: 105

End-terrace House 19 October 2022 Ben Marsh 105.64 m²

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

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



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

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

SAP Input

Property Details: Plot 9

Address: Plot 9 Located in: England

Region: South East England

UPRN:

Date of assessment: 19 October 2022 Date of certificate: 21 October 2022

Assessment type: New dwelling design stage

Transaction type:

Tenure type:

Related party disclosure:

Thermal Mass Parameter:

New dwelling
Owner-occupied
No related party
Indicative Value Low

Water use <= 125 litres/person/day: False

PCDF Version: 507

Property description:

Dwelling type: House
Detachment: End-terrace
Year Completed: 2022

Floor Location: Floor area:

Floor 0 52.82 m² 2.4 m Floor 1 52.82 m² 2.63 m

Living area: 24.5 m² (fraction 0.232)

Front of dwelling faces: Nort

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
Front	Manufacturer	Solid			PVC-U
Front	SAP 2012	Windows	double-glazed	Yes	PVC-U
Rear	SAP 2012	Windows	double-glazed	Yes	PVC-U

Storey height:

Name:	Gap:	Frame Fa	actor: g-value:	U-value:	Area:	No. of Openings:
Front	mm	0.7	0	1.4	2.14	1
Front	16mm or more	0.7	0.76	1.4	5.48	1
Rear	16mm or more	0.7	0.76	1.4	8.42	1

Type-Name: Location: Orient: Width: Height: Name: Front Ext Walls Front Ext Walls Unspecified 0 0 Ext Walls Unspecified Rear 0 0

Overshading: Average or unknown

Opaque Elements

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Карра:
External Element	<u>'S</u>						
Ext Walls	103.71	16.04	87.67	0.17	0	False	N/A
Cold Roof	52.82	0	52.82	0.11	0		N/A
Ground Floor	52.82			0.14			N/A
Internal Element	<u>s</u>						
Party Elements							
Party Wall	45.9						N/A

Thermal bridges:

SAP Input

Thermal bridges:	User-defin	ed (individual	PSI-values)	Y-Value = 0.0883
	Length	Psi-valu		
[Approved]	11.36	0.3	E2	Other lintels (including other steel lintels)
[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	0.00	E16	Corner (normal)
[Approved]	11.12	0.04	E12	Gable (insulation at ceiling level)
[Approved]	21.4	0.24	E5	Ground floor (normal)
[Approved]				Ground floor
	8.72	0.16	P1	Intermediate floor within a dwelling
	8.72 8.72	0 0.24	P2 P4	Roof (insulation at ceiling level)
Ventilation:				
Pressure test:	Yes (As de	signed)		
Ventilation:		ntilation (extra	act fans)	
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:	Ü			
Main heating system:	D. II.			derfloor heating
	Fuel: main Info Source Database: Has integra Brand nam Model: ecc Model qual (Combi boi Systems w Central hea	e: Boiler Datal (rev 507, prod al PFGHRD de: Vaillant DTEC exclusive lifier: VUW 35d iler) ith radiators ating pump: 2 w temperature	pase duct index (835 6/5-7 (H-GE 2013 or late	er
Main heating Control:	Bollet Intel	IOCK: YES		
Main heating Control:		emperature zo	one control	by suitable arrangement of plumbing and electrical
	services Control cod	de: 2110		
Secondary heating system:				
Secondary heating system:	None			
Water heating:				
Water heating:	Water code Fuel :main No hot wa Flue Gas H	s gas ter cylinder leat Recovery (rev 507, pro	System:)
Others:				

Standard Tariff

No

Electricity tariff:

In Smoke Control Area:

SAP Input

Conservatory: No conservatory

Low energy lights: 100%

Low rise urban / suburban

Terrain type: EPC language: English Wind turbine: No None Photovoltaics: No Assess Zero Carbon Home:

		User Details:				
Assessor Name:	Ben Marsh	Stroma Nu	mber:	STRO	005374	
Software Name:	Stroma FSAP 2012	Software V	ersion:	Versio	n: 1.0.5.58	
		Property Address: Plot	9			
Address :	Plot 9					
1. Overall dwelling dime	nsions:	A (0)	A 11 : 14	,		
Ground floor		Area(m²) 52.82 (1a) x	Av. Height(r	n) (2a) = [Volume(m³)) (3a)
First floor		52.82 (1b) x		(2b) =	138.92](3b)
	a)+(1b)+(1c)+(1d)+(1e)+(1		2.03		130.92	
•	a) ((15) ((15) ((15) ((15) (15) (15) (15)	,,	(3b)+(3c)+(3d)+(3e)-	(3p) - [٦
Dwelling volume		(3a)+(3D)+(3C)+(3U)+(3E)-	F(311) =	265.68	(5)
2. Ventilation rate:	main seconda	ary other	total		m³ per houi	
Number of objects	heating heating			х 40 = Г	<u> </u>	_
Number of chimneys			0	اِ	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	x 20 =	0	(6b)
Number of intermittent fa			3	x 10 =	30	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fi	res		0	x 40 =	0	(7c)
				Air ch	anges per ho	ur
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+$	(7a)+(7h)+(7c) -		-		_
•	een carried out or is intended, proce		30 e from (9) to (16)	÷ (5) =	0.11	(8)
Number of storeys in the	•	· /·	, , , ,	Г	0	(9)
Additional infiltration			1	(9)-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame of	or 0.35 for masonry con	struction	Ī	0	(11)
if both types of wall are po deducting areas of openir	resent, use the value corresponding	to the greater wall area (after				
	loor, enter 0.2 (unsealed) or (0.1 (sealed), else enter	0	Γ	0	(12)
If no draught lobby, en	ter 0.05, else enter 0			Ì	0	(13)
Percentage of windows	s and doors draught stripped			Ī	0	(14)
Window infiltration		0.25 - [0.2 x (14)	÷ 100] =	Ì	0	(15)
Infiltration rate		(8) + (10) + (11) +	+ (12) + (13) + (15) =	•	0	(16)
Air permeability value,	q50, expressed in cubic metr	es per hour per square	metre of envelo	pe area	5	(17)
If based on air permeabil	ity value, then $(18) = [(17) \div 20] +$	-(8), otherwise (18) = (16)		Ī	0.36	(18)
Air permeability value applie	s if a pressurisation test has been do	one or a degree air permeabil	ity is being used	_		
Number of sides sheltere	d				2	(19)
Shelter factor		(20) = 1 - [0.075]		Ĺ	0.85	(20)
Infiltration rate incorporat	ing shelter factor	$(21) = (18) \times (20)$	=		0.31	(21)
Infiltration rate modified for	or monthly wind speed		- i			
Jan Feb	Mar Apr May Jun	Jul Aug Se	p Oct No	v Dec		
Monthly average wind sp	eed from Table 7					

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

Wind Factor (2	22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
A -1:a.t.ad. ::.a.t:l.t.		. (مامدان دام	1\	(04 a)	(00-)	<u>.</u>	!	!	•	
Adjusted infiltr	0.39	e (allowi	ng for sr 0.34	o.33	a wina s	0.29	(21a) x 0.29	(22a)m 0.31	0.33	0.35	0.36]	
Calculate effe					l		0.29	0.51	0.33	0.33	0.30		
If mechanic	al ventila	ation:										0	(23a)
If exhaust air h	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If balanced wit	h heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (from	n Table 4h) =				0	(23c)
a) If balance	ed mech	anical ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balance	ed mech	anical ve	ntilation	without	heat red	covery (N	ЛV) (24b)m = (22	2b)m + (23b)			
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h					•								
		(23b), t	· ` `	<u> </u>		<u> </u>	ŕ	· ·	· ` `	ŕ	1	1	
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural if (22b)r		on or when (24d)		•					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)
Effective air	change	rate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)	•	•	•	•	
(25)m= 0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57		(25)
3. Heat losse	es and he	at lose r	orom ot										
		zai IUSS į	Jaramen	er:									
ELEMENT	Gros	SS	Openin m	gs	Net Ar A ,r		U-val		A X U (W/		k-value kJ/m²-l		A X k kJ/K
		SS	Openin	gs	Net Ar A ,r	m²			A X U (W/				
ELEMENT	Gros area	SS	Openin	gs	A ,r	m² x	W/m2	2K = [(W/				kJ/K
ELEMENT Doors Windows Type	Gros area e 1	SS	Openin	gs	A ,r 2.14 5.48	m ² x x 1/2	W/m2	eK = [0.04] = [2.996 7.27				kJ/K (26) (27)
Doors Windows Type Windows Type	Gros area e 1	SS	Openin	gs	A ,r 2.14 5.48 8.42	m ² x x1/2 x1/2	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+	eK = [0.04] = [0.04] = [2.996 7.27 11.16	K) 			(26) (27) (27)
Doors Windows Type Windows Type Floor	Gros area e 1 e 2	ss (m²)	Openin m	gs ²	A ,r 2.14 5.48 8.42 52.82	x10 x10 x x1	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+	eK = [0.04] = [0.04] = [= [2.996 7.27 11.16 7.3948	K) 			(26) (27) (27) (28)
Doors Windows Type Windows Type Floor Walls	Gros area e 1 e 2	SS (m²)	Openin m	gs ²	A ,r 2.14 5.48 8.42 52.82 87.67	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17	EK	(W// 2.996 7.27 11.16 7.3948 14.9	K) 			(26) (27) (27) (28) (29)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof	Gros area e 1 e 2 103.	71 32	Openin m	gs ²	A ,r 2.14 5.48 8.42 52.82 87.67	m ²	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+	eK = [0.04] = [0.04] = [= [2.996 7.27 11.16 7.3948	K) 			(26) (27) (27) (28) (29) (30)
Doors Windows Type Windows Type Floor Walls Roof Total area of e	Gros area e 1 e 2 103.	71 32	Openin m	gs ²	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3	m ²	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	EK	(W// 2.996 7.27 11.16 7.3948 14.9 5.81	K) 			(26) (27) (27) (28) (29) (30) (31)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e	Gros area e 1 e 2 103. 52.8 elements	71 32 4, m²	16.0.0	gs ₁ 2	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	eK = [0.04] = [0.04] = [(W// 2.996 7.27 11.16 7.3948 14.9 5.81	k)	kJ/m²-l		(26) (27) (27) (28) (29) (30)
Doors Windows Type Windows Type Floor Walls Roof Total area of e	Gros area e 1 e 2 103. 52.8 elements	71 32 , m ² ows, use e	Openin m 16.0	gs 4 Indow U-ve	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calcul	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	eK = [0.04] = [0.04] = [(W// 2.996 7.27 11.16 7.3948 14.9 5.81	k)	kJ/m²-l		(26) (27) (27) (28) (29) (30) (31)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and	Gros area e 1 e 2 103. 52.8 elements	71 32 ows, use e	16.00 0 offective winternal wall	gs 4 Indow U-ve	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calcul	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	EK	(W// 2.996 7.27 11.16 7.3948 14.9 5.81	k)	kJ/m²-l		(26) (27) (27) (28) (29) (30) (31)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are	Gros area e 1 e 2 103. 52.8 elements d roof wind as on both	71 32 ows, use e sides of interest of the sides of the	16.00 0 offective winternal wall	gs 4 Indow U-ve	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calcul	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	$ \begin{array}{ccc} 2K & = & & \\ 0.04] & = & & \\ 0.04] & = & & \\ 0.04] & = & & \\ & = & & \\ & = & & \\ & = & & \\ & & & $	(W// 2.996 7.27 11.16 7.3948 14.9 5.81	k)	kJ/m²-l	X	(26) (27) (27) (28) (29) (30) (31) (32)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat los	Gros area e 1 e 2 103. 52.8 elements d roof winde as on both ss, W/K: Cm = S(71 32 32 3, m ² ows, use e sides of in = S (A x (A x k)	16.0- 0	gs 1 ² 4 Indow U-va Is and pan	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	$ \begin{array}{ccc} 2K & = & & \\ 0.04] & = & & \\ 0.04] & = & & \\ 0.04] & = & & \\ & & = & \\ & & = & \\ & & & = & \\ & & & \\ & & & & \\ & & & & \\ & & & & $	(W// 2.996 7.27 11.16 7.3948 14.9 5.81	K)	kJ/m²-l	1 3.2 49.53	(26) (27) (27) (28) (29) (30) (31) (32)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat loo Heat capacity Thermal mass For design asses	Gros area e 1 e 2 103. 52.8 elements d roof wind as on both as on both cs, W/K: Cm = S(comparame co	71 32 ows, use e sides of in a S (A x k) eter (TMF)	16.0- 16.0- 16.0- 16.0- 17.0- 18.0- 19.0-	gs 1 ² 4 Indow U-ve Is and pan	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculations	x1/x1/x2 x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 // formula 1 (26)(30)	2K $= [$ $0.04] = [$ $0.04] = [$ $0.04] = [$ $= [$	(W// 2.996 7.27 11.16 7.3948 14.9 5.81 0 (e)+0.04] a	K)	paragraph(32e) =	15336.6	(26) (27) (27) (28) (29) (30) (31) (32) (33) (11) (34)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat loo Heat capacity Thermal mass For design asses can be used inste	Gros area e 1 e 2 103. 52.8 elements d roof winders on both ss, W/K: Cm = S(s parame sments whe ead of a de	71 32 ows, use e sides of int = S (A x (A x k) eter (TMF) ere the de tailed calcular	16.0. 16.0. 0 Iffective winternal wall U) P = Cm - tails of the culation.	gs 4 ndow U-ve ls and pan - TFA) ir construct	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions n kJ/m²K ion are not	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 // formula 1 (26)(30)	2K $= [$ $0.04] = [$ $0.04] = [$ $0.04] = [$ $= [$	(W// 2.996 7.27 11.16 7.3948 14.9 5.81 0 (e)+0.04] a	K)	paragraph(32e) =	7 3.2 49.53 15336.6	(26) (27) (27) (28) (29) (30) (31) (32) (33) (1) (34) (35)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat loo Heat capacity Thermal mass For design asses	Gros area e 1 e 2 103. 52.8 elements d roof winder as on both as on both ss, W/K: Cm = S(a parame sments wheeled of a de es: S (L	71 32 ows, use e sides of ine = S (A x (A x k) eter (TMF) ere the de tailed calcu	Openin m 16.0 16.0 0 offective with ternal wall U) P = Cm = tails of the ulation. culated to	gs 4 Indow U-vals and paner - TFA) ir constructed using Ap	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions n kJ/m²K ion are not opendix I	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 // formula 1 (26)(30)	2K $= [$ $0.04] = [$ $0.04] = [$ $0.04] = [$ $= [$	(W// 2.996 7.27 11.16 7.3948 14.9 5.81 0 (e)+0.04] a	K)	paragraph(32e) =	15336.6	(26) (27) (27) (28) (29) (30) (31) (32) (33) (11) (34)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat loo Heat capacity Thermal mass For design asses can be used inste	Gros area e 1 e 2 103. 52.8 elements d roof winders on both ess, W/K: Cm = S(es parame essments who ead of a de ess: S (L eal bridging	71 32 ows, use e sides of ine = S (A x (A x k) eter (TMF) ere the de tailed calcu	Openin m 16.0 16.0 0 offective with ternal wall U) P = Cm = tails of the ulation. culated to	gs 4 Indow U-vals and paner - TFA) ir constructed using Ap	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions n kJ/m²K ion are not opendix I	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 // formula 1 (26)(30)	eK = [0.04] = [0.04] = [(W// 2.996 7.27 11.16 7.3948 14.9 5.81 0 (e)+0.04] a	K)	paragraph(32e) =	7 3.2 49.53 15336.6	(26) (27) (27) (28) (29) (30) (31) (32) (33) (1) (34) (35)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat loo Heat capacity Thermal mass For design asses can be used inste Thermal bridg if details of therm	Gros area e 1 e 2 103. 52.8 elements d roof wind as on both as on both ss, W/K: Cm = S(a parame sments whe ad of a de es : S (L al bridging eat loss	71 32 32 3, m² sides of interest (TMF) erer the detailed calculation (XY) calculate (Ax k)	Openin 16.0 0 Iffective wind ternal walk U) P = Cm - tails of the culation. culated to own (36) =	gs 4 Indow U-ve Is and pan construct using Ap = 0.05 x (3	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions n kJ/m²K ion are not opendix I	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 // formula 1 (26)(30)	2K $= [$ $0.04] = [$ $0.04]$	(W// 2.996 7.27 11.16 7.3948 14.9 5.81 0 (a) + (3.0) +	K)	paragraph(32e) =	49.53 15336.6 100	(26) (27) (27) (28) (29) (30) (31) (32) (33) (1) (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 transfer coefficient, W/K			·	·		= (37) + (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		7,000
Heat loss parameter (HLP), W/m	²K					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		_
Number of days in month (Table	12)				A	Average =	Sum(40) ₁ .	12 /12=	1.11	(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)
							ļ			
4. Water heating energy require	ement:							kWh/ye	ar.	
4. Water fleating energy require	ment.						_	KVVII/yC	ai.	
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1	1 - exp(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (1	ΓFA -13.		79		(42)
if TFA £ 13.9, N = 1 Annual average hot water usage	in litres per da	ıv Vd av	erage =	(25 x N)	+ 36		10	5.65		(43)
Reduce the annual average hot water us	age by 5% if the d	lwelling is	designed t			se target o		5.05		(10)
not more that 125 litres per person per da	ay (all water use, h	not and co	ld)							
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each			1	· <i>′</i>			I			
(44)m= 116.21 111.99 107.76 1	103.54 99.31	95.08	95.08	99.31	103.54	107.76	111.99	116.21		7
Energy content of hot water used - calcul	lated monthly = 4.	190 x Vd,r	n x nm x E)Tm / 3600			m(44) ₁₁₂ = ables 1b, 1	L	1267.79	(44)
(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		_
If instantaneous water heating at point of	fuse (no hot water	etoraga)	enter∩in	hoves (16		Γotal = Su	m(45) ₁₁₂ =	= [1662.27	(45)
	· · · · · · · · · · · · · · · · · · ·					04.40	22.05	05.04		(46)
(46)m= 25.85 22.61 23.33 Water storage loss:	20.34 19.52	16.84	15.61	17.91	18.12	21.12	23.05	25.04		(40)
Storage volume (litres) including	any solar or W	/WHRS	storage	within sa	ame vess	sel		0		(47)
If community heating and no tank	k in dwelling, e	nter 110	litres in	(47)						
Otherwise if no stored hot water	(this includes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage loss:		. /1.14/1	/.l- \							
a) If manufacturer's declared los		wn (kvvr	n/day):					0		(48)
Temperature factor from Table 2				(40) (40)				0		(49)
Energy lost from water storage, k b) If manufacturer's declared cyl	•	or is not		(48) x (49)	=			0		(50)
Hot water storage loss factor from								0		(51)
If community heating see section	14.3									
Volume factor from Table 2a								0		(52)
Temperature factor from Table 2								0		(53)
Energy lost from water storage, k	kWh/year			(47) x (51)	x (52) x (5	53) =		0		(54)
Enter (50) or (54) in (55)	r aaah manth			((EG)m - (EE) (41)	~		0		(55)
Water storage loss calculated for	-	_	1	1	55) × (41)r					(50)
(56)m= 0 0 0 If cylinder contains dedicated solar storage	0 0 0	0 x [(50) = (0 H11)1 <i>→ (5</i> /	0 0) else (5	0 $7)m = (56)$	0 m where (0 H11) is fro	m Appendi	x H	(56)
			1						A.I.	(57)
(57)m= 0 0 0	0 0	0	0	0	0	0	0	0		(57)

Primary circuit loss (al-nual) from Table 3
Primary circuit loss calculated for each month (59)m = (58) + 365 × (41)m (modified by factor from Table H5 if there is solar water heating and a cylinder thermostat) (59)me 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(Sg)me 0 0 0 0 0 0 0 0 0
Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m (61)m=
(61)m=
(61)m=
(62)me 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 DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)me 0 0 0 0 0 0 0 0 0
(62)me 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 DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating) (add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)me 0 0 0 0 0 0 0 0 0
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G) (63)m= 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Coutput from water heater (64)me
Output from water heater (64)m= 172.34
Table Tabl
Table Tabl
Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m] (65)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 include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
(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 include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating 5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
5. Internal gains (see Table 5 and 5a): Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 167.16 167.18
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m= 167.16 167.18 167.16 167.16 167.16
(66)m= 167.16 16
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 (67)m= 64.27 57.08 46.42 35.14 26.27 22.18 23.96 31.15 41.81 53.09 61.96 66.05 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (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 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 54.5 54.5 54.5 54.5 54.5 54.5 54.5 54.
(67)m= 64.27 57.08 46.42 35.14 26.27 22.18 23.96 31.15 41.81 53.09 61.96 66.05 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (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 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 54.5 54.5 54.5 54.5 54.5 54.5 54.5 54.
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 (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 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 54.5 54.5 54.5 54.5 54.5 54.5 54.5 54.
(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 (68) Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m= 54.5 54.5 54.5 54.5 54.5 54.5 54.5 54.
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 (69)m=
(69)m= 54.5 54.5 54.5 54.5 54.5 54.5 54.5 54.
Pumps and fans gains (Table 5a) (70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
(70)m= 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
Losses e.g. evaporation (negative values) (Table 5) (71)m= -111.44 -111.44 -111.44 -111.44 -111.44 -111.44 -111.44 -111.44 -111.44 -111.44 (71)
(71)m= -111.44
Water heating gains (Table 5)
Transfer in Samuel (Transfer in Samuel)
(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 internal gains = $(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m$
(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)
6. Solar gains:
Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.
Orientation: Access Factor Area Flux g_ FF Gains Table 6d m² Table 6a Table 6b Table 6c (W)
Table 6d m ² Table 6a Table 6b Table 6c (W)
Solar gains in watts, calculated for each month (83)m = Sum(74)m(82)m
(83)m =

(84)m=	gains – ii	nternal a	and solar	· (84)m =	= (73)m -	+ (83)m	, watts							
(- ·) · · · ·	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 Ma	an inter	nal temr	perature	(heating	season)								
			neating p				from Tak	ole 0. Th	1 (°C)				21	(85)
•		ŭ	٠.			Ū)ic 5, 111	1 (0)				21	(00)
Utilisa		Feb	ains for I Mar		May	r	Jul	Δυα	Sep	Oct	Nov	Dec		
(86)m=	Jan 0.96	0.96	0.96	Apr 0.94	0.92	Jun 0.85	0.75	Aug 0.76	0.87	0.93	0.96	0.97		(86)
, ,						<u> </u>	ļ			0.93	0.90	0.97		(00)
		· ·	ature in		· `	i	i	i			ı		1	
(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)
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)			_		
(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 i	rest of d	welling,	h2,m (se	e Table	9a)						
(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)
Mear	interna	l temper	ature in	the rest	of dwelli	na T2 (f	ollow ste	ne 3 to	7 in Tahl		Į.			
(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)
(00)=	10.00	11.00		10.00	10.77		10.0	10.70	<u> </u>		g area ÷ (4	<u> </u>	0.23	(91)
											J (′	0.25	(0.7
			ature (fo									ı	ı	
(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)
			he mean			i — —				·	1	1		(22)
(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)
			uirement											
			ternal ter or gains i	•		ed at ste	ep 11 of	Table 9	o, so tha	t Ti,m=(76)m an	d re-calc	culate	
ine ui	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilis			ains, hm	•	iviay	Juli	ı Jui							
(94)m=		tor for g		ı -				1119	ССР		1101		l	
	I 0.94	0.94			0.87	0.78	1		0.8	0.89				(94)
` '	0.94 ul gains.		0.93	0.91	0.87 4)m	0.78	0.66	0.67			0.92	0.94		(94)
` '				0.91		0.78	1							(94) (95)
Usefu (95)m=	al gains, 610.4	hmGm ,	0.93 , W = (94 573.18	0.91 4)m x (84 525.34	4)m 467.4	392.77	0.66	0.67	0.8	0.89	0.92	0.94		, ,
Usefu (95)m=	al gains, 610.4	hmGm ,	0.93 , W = (94	0.91 4)m x (84 525.34	4)m 467.4	392.77	0.66	0.67	0.8	0.89	0.92	0.94		, ,
Usefu (95)m= Montl (96)m=	l gains, 610.4 hly avera	hmGm , 602.96 age exte	0.93 , W = (94 573.18 ernal tem	0.91 4)m x (84 525.34 perature 8.9	4)m 467.4 e from Ta 11.7	392.77 able 8	0.66 314.52	0.67 326.65	0.8	0.89 491.43 10.6	0.92 553.39	0.94 595.85		(95)
Usefu (95)m= Montl (96)m= Heat	l gains, 610.4 hly avera 4.3 loss rate	hmGm , 602.96 age exte 4.9	0.93 , W = (9 ⁴ 573.18 ernal tem 6.5	0.91 4)m x (8- 525.34 perature 8.9 al tempe	4)m 467.4 e from Ta 11.7	392.77 able 8	0.66 314.52	0.67 326.65	0.8	0.89 491.43 10.6	0.92 553.39	0.94 595.85 4.2		(95)
Usefu (95)m= Month (96)m= Heat (97)m=	1543.05	hmGm , 602.96 age exte 4.9 e for mea	0.93 , W = (94 573.18 ernal tem 6.5 an intern	0.91 4)m x (84 525.34 perature 8.9 al tempe	4)m 467.4 e from Ta 11.7 erature, 857.92	392.77 able 8 14.6 Lm , W =	0.66 314.52 16.6 =[(39)m : 395.56	0.67 326.65 16.4 x [(93)m-415.52	0.8 411.31 14.1 – (96)m 636.21	0.89 491.43 10.6]	0.92 553.39 7.1	0.94 595.85 4.2		(95) (96)
Usefu (95)m= Month (96)m= Heat (97)m=	1543.05	hmGm , 602.96 age exte 4.9 e for mea	0.93 , W = (94 573.18 ernal tem 6.5 an intern 1339.59	0.91 4)m x (84 525.34 perature 8.9 al tempe	4)m 467.4 e from Ta 11.7 erature, 857.92	392.77 able 8 14.6 Lm , W =	0.66 314.52 16.6 =[(39)m : 395.56	0.67 326.65 16.4 x [(93)m-415.52	0.8 411.31 14.1 – (96)m 636.21	0.89 491.43 10.6]	0.92 553.39 7.1	0.94 595.85 4.2		(95) (96)
Usefu (95)m= Montl (96)m= Heat (97)m= Space	l gains, 610.4 hly avera 4.3 loss rate 1543.05 e heatin	hmGm , 602.96 age exte 4.9 e for mea 1487.13 g require	0.93 , W = (94 573.18 ernal tem 6.5 an intern 1339.59 ement fo	0.91 4)m x (84 525.34 perature 8.9 al tempe 1112.81 r each m	4)m 467.4 e from Ta 11.7 erature, 857.92 nonth, k\	392.77 able 8 14.6 Lm, W = 587.29	0.66 314.52 16.6 =[(39)m : 395.56 th = 0.02	0.67 326.65 16.4 x [(93)m 415.52 24 x [(97) 0	0.8 411.31 14.1 — (96)m 636.21)m — (95	0.89 491.43 10.6] 957.84)m] x (4 347	0.92 553.39 7.1 1275.07 1)m 519.62	0.94 595.85 4.2 1537.82	4139.23	(95) (96)
Usefu (95)m= Montl (96)m= Heat (97)m= Space (98)m=	l gains, 610.4 hly avera 4.3 loss rate 1543.05 e heatin 693.89	hmGm, 602.96 age exte 4.9 e for mea 1487.13 g require 594.16	0.93 , W = (94 573.18 ernal tem 6.5 an intern 1339.59 ement fo 570.21	0.91 4)m x (84 525.34 perature 8.9 al tempe 1112.81 r each m	4)m 467.4 e from Ta 11.7 erature, 857.92 nonth, k\ 290.54	392.77 able 8 14.6 Lm , W = 587.29	0.66 314.52 16.6 =[(39)m : 395.56 th = 0.02	0.67 326.65 16.4 x [(93)m 415.52 24 x [(97) 0	0.8 411.31 14.1 - (96)m 636.21)m - (95	0.89 491.43 10.6] 957.84)m] x (4 347	0.92 553.39 7.1 1275.07 1)m 519.62	0.94 595.85 4.2 1537.82		(95) (96) (97)
Usefu (95)m= Montl (96)m= Heat (97)m= Space (98)m=	l gains, 610.4 hly avera 4.3 loss rate 1543.05 e heatin 693.89	hmGm , 602.96 age exte 4.9 e for mea 1487.13 g require 594.16	0.93 , W = (94 573.18 ernal tem 6.5 an intern 1339.59 ement fo 570.21 ement in	0.91 4) m x (8/ 525.34 perature 8.9 al tempe 1112.81 r each m 422.98	4)m 467.4 e from Ta 11.7 erature, 857.92 nonth, k\ 290.54	392.77 able 8 14.6 Lm , W = 587.29 Wh/mont	0.66 314.52 16.6 =[(39)m : 395.56 th = 0.02	0.67 326.65 16.4 x [(93)m 415.52 24 x [(97) 0 Tota	0.8 411.31 14.1 — (96)m 636.21)m — (95 0 I per year	0.89 491.43 10.6] 957.84)m] x (4 347	0.92 553.39 7.1 1275.07 1)m 519.62	0.94 595.85 4.2 1537.82	4139.23 39.18	(95) (96) (97)
Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space 9a. En	l gains, 610.4 hly avera 4.3 loss rate 1543.05 e heatin 693.89 e heatin	hmGm, 602.96 age exte 4.9 e for mea 1487.13 g require 594.16 g require	0.93 , W = (94 573.18 ernal tem 6.5 an intern 1339.59 ement fo 570.21	0.91 4) m x (8/ 525.34 perature 8.9 al tempe 1112.81 r each m 422.98	4)m 467.4 e from Ta 11.7 erature, 857.92 nonth, k\ 290.54	392.77 able 8 14.6 Lm , W = 587.29 Wh/mont	0.66 314.52 16.6 =[(39)m : 395.56 th = 0.02	0.67 326.65 16.4 x [(93)m 415.52 24 x [(97) 0 Tota	0.8 411.31 14.1 — (96)m 636.21)m — (95 0 I per year	0.89 491.43 10.6] 957.84)m] x (4 347	0.92 553.39 7.1 1275.07 1)m 519.62	0.94 595.85 4.2 1537.82		(95) (96) (97)
Usefu (95)m= Montl (96)m= Heat (97)m= Space (98)m= Space 9a. En	l gains, 610.4 hly avera 4.3 loss rate 1543.05 e heatin 693.89 e heatin ergy recee heatin	hmGm, 602.96 age exte 4.9 e for mea 1487.13 g require 594.16 g require	0.93 , W = (94 573.18 ernal tem 6.5 an intern 1339.59 ement fo 570.21 ement in	0.91 4) m x (84 525.34 perature 8.9 al tempe 1112.81 r each m 422.98 kWh/m²	4)m 467.4 e from Ta 11.7 erature, 857.92 nonth, k\ 290.54	392.77 able 8 14.6 Lm , W = 587.29 Wh/mont	0.66 314.52 16.6 =[(39)m : 395.56 th = 0.02 0	0.67 326.65 16.4 x [(93)m 415.52 24 x [(97) 0 Tota	0.8 411.31 14.1 — (96)m 636.21)m — (95 0 I per year	0.89 491.43 10.6] 957.84)m] x (4 347	0.92 553.39 7.1 1275.07 1)m 519.62	0.94 595.85 4.2 1537.82	39.18	(95) (96) (97) (98) (99)
Usefu (95)m= Montil (96)m= Heat (97)m= Space (98)m= Space 9a. En Space Fracti	l gains, 610.4 hly avera 4.3 loss rate 1543.05 e heatin 693.89 e heatin ergy receive heatin ion of sp	hmGm, 602.96 age exte 4.9 e for mea 1487.13 g require 594.16 g require quiremen ng: pace hea	0.93 , W = (94 573.18 ernal tem 6.5 an intern 1339.59 ement fo 570.21 ement in at from se	0.91 4) m x (84 525.34 perature 8.9 al tempe 1112.81 r each m 422.98 kWh/m² vidual h	4)m 467.4 e from Ta 11.7 erature, 857.92 nonth, k\ 290.54 eating sy	392.77 able 8 14.6 Lm , W = 587.29 Wh/mont	0.66 314.52 16.6 =[(39)m : 395.56 th = 0.02 0 ncluding	0.67 326.65 16.4 x [(93)m-415.52 24 x [(97) 0 Tota	0.8 411.31 14.1 — (96)m 636.21)m — (95 0 I per year	0.89 491.43 10.6] 957.84)m] x (4 347	0.92 553.39 7.1 1275.07 1)m 519.62	0.94 595.85 4.2 1537.82	39.18	(95) (96) (97) (98) (99)
Useful (95)m= Month (96)m= Heat (97)m= Space (98)m= Space Fracti	l gains, 610.4 hly avera 4.3 loss rate 1543.05 e heatin 693.89 e heatin ergy receive heatin ion of sp	hmGm , 602.96 age exte 4.9 e for mea 1487.13 g require 594.16 g require quiremen ng: pace hea pace hea	0.93 , W = (94 573.18 ernal tem 6.5 an intern 1339.59 ement fo 570.21 ement in	0.91 4)m x (84 525.34 perature 8.9 al tempe 1112.81 r each m 422.98 kWh/m² vidual h econdary	4)m 467.4 e from Ta 11.7 erature, 857.92 nonth, k\ 290.54 eating s y/supple em(s)	392.77 able 8 14.6 Lm , W = 587.29 Wh/mont	0.66 314.52 16.6 =[(39)m: 395.56 th = 0.02 0 ncluding	0.67 326.65 16.4 x [(93)m-415.52 24 x [(97) 0 Tota micro-C	0.8 411.31 14.1 — (96)m 636.21)m — (95 0 I per year	0.89 491.43 10.6] 957.84)m] x (4 347 (kWh/year	0.92 553.39 7.1 1275.07 1)m 519.62	0.94 595.85 4.2 1537.82	39.18	(95) (96) (97) (98) (99)

													_
	y of main spa		•									90.6	(206)
Efficienc	y of seconda				g system							0	(208)
	Jan Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	ar
· —	eating require	570.21	422.98	290.54	0	0	0	0	347	519.62	700.82]	
			<u> </u>		U	U	U U	U	347	010.02	700.02		(211)
	{[(98)m x (20	629.38	466.87	320.69	0	0	0	0	383.01	573.53	773.54		(211)
			1							211) _{15,1012}		4568.69	(211)
Space h	eating fuel (s	econdar	y), kWh/	month									``
•	x (201)] } x 1											_	
(215)m=	0 0	0	0	0	0	0	0	0	0	0	0		_
							Tota	I (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water he	•												
	om water hea 72.34 150.73	ter (calc 155.54	ulated a 135.6	bove) 130.12	112.28	104.04	119.39	120.82	140.8	153.7	166.9		
	of water hea		100.0					.20.02			.00.0	85	(216)
	9.43 89.41	89.34	89.17	88.79	85	85	85	85	88.91	89.26	89.47		(217)
Fuel for w	/ater heating,	kWh/mo	onth							l		l	
(219)m <u>=</u>	(64)m x 100) ÷ (217)	m									1	
(219)m= 19	92.72 168.59	174.1	152.07	146.54	132.09	122.4	140.46	142.14	158.37	172.19	186.56		¬
							Tota	I = Sum(2)	$(9a)_{112} =$			1888.23	(219)
A	-4-1-								11	Alla bra an			
Annual to Space he		ed. main	svstem	1					k¹	Wh/year		kWh/yeai	
Space he	ating fuel use	•	system	1					k¹	Wh/year		kWh/yea i 4568.69	
Space he		ed	·		t				k¹	Wh/year		kWh/yeai	
Space he Water hea Electricity	ating fuel use	ed ans and	·		t				k¹	Wh/year	30	kWh/yea i 4568.69	
Space he Water hea Electricity central h	ating fuel use ating fuel use for pumps, fa	ed ans and :	·		t				k¹	Wh/year		kWh/yea i 4568.69	
Space he Water hea Electricity central h boiler wi	ating fuel use ating fuel use for pumps, fa neating pump	ed ans and : sted flue	electric	keep-ho	t		sum	of (230a).			30	kWh/yea i 4568.69	(230c)
Space he Water hea Electricity central h boiler wi Total elec	ating fuel use ating fuel use for pumps, for pumps, for pump the a fan-assis	ed ans and : sted flue	electric	keep-ho	t		sum	of (230a).			30	kWh/yeai 4568.69 1888.23	(230c) (230e)
Space he Water hea Electricity central h boiler wi Total electricity	ating fuel use ating fuel use for pumps, fa neating pump th a fan-assis ctricity for the	ans and : sted flue above, k	electric	keep-hot		+ (232).					30	kWh/yeai 4568.69 1888.23	(230c) (230e) (231)
Space he Water hea Electricity central h boiler wi Total electricity Total deliv	ating fuel use ating fuel use for pumps, fa neating pump th a fan-assis stricity for the for lighting	ans and : sted flue above, k	electric <wh yea<br="">ses (211</wh>	keep-hot ur)(221)		+ (232).					30	kWh/year 4568.69 1888.23 75 453.98	(230c) (230e) (231) (232)
Space he Water hea Electricity central h boiler wi Total electricity Total deliv	ating fuel use ating fuel use for pumps, for heating pump th a fan-assis stricity for the for lighting vered energy	ans and : sted flue above, k	electric <wh yea<br="">ses (211</wh>	keep-hot ur)(221)	+ (231)				(230g) =		30	kWh/yeai 4568.69 1888.23 75 453.98 6985.9	(230c) (230e) (231) (232)
Space he Water hea Electricity central h boiler wi Total electricity Total deliv	ating fuel use ating fuel use for pumps, for heating pump th a fan-assis stricity for the for lighting vered energy	ans and : sted flue above, k	electric <wh yea<br="">ses (211</wh>	keep-hot ur)(221)	+ (231) Fu					rice	30	kWh/year 4568.69 1888.23 75 453.98	(230c) (230e) (231) (232)
Space he Water head Electricity central his boiler with Total electricity Total deliving 10a. Fue	ating fuel use ating fuel use for pumps, for heating pumpo th a fan-assis stricity for the for lighting vered energy	ans and the sted flue above, he for all us vidual he	electric «Wh/yea ses (211 eating sy	keep-hot ur)(221)	+ (231) Fu kW	el			(230g) =	rice 12)	30	kWh/yeai 4568.69 1888.23 75 453.98 6985.9	(230c) (230e) (231) (232)
Space he Water head Electricity central his boiler win Total electricity Total deliving 10a. Fue Space head Space head water his board of the	ating fuel use ating fuel use for pumps, fa neating pump th a fan-assis stricity for the for lighting vered energy	ans and the sted flue above, if for all us vidual he	electric «Wh/yea ses (211 eating sy	keep-hot ur)(221)	+ (231) Fu kW	el /h/year			(230g) = Fuel P (Table	rice 12)	30 45	kWh/year 4568.69 1888.23 75 453.98 6985.9 Fuel Cost £/year	(230c) (230e) (231) (232) (338)
Space he Water hea Electricity central h boiler wi Total electricity Total deliv 10a. Fue	ating fuel use ating fuel use for pumps, for heating pump th a fan-assis stricity for the for lighting vered energy el costs - indiv	ans and the sted flue above, if for all us vidual he system 1	electric «Wh/yea ses (211 eating sy	keep-hot ur)(221)	+ (231) Fu kW (211)	el /h/year			(230g) = Fuel P (Table	rice 12)	30 45 × 0.01 =	kWh/year 4568.69 1888.23 75 453.98 6985.9 Fuel Cost £/year	(230c) (230e) (231) (232) (338)
Space he Water hea Electricity central h boiler wi Total electricity Total deliv 10a. Fue Space he Space he	ating fuel use ating fuel use for pumps, for heating pump th a fan-assis stricity for the for lighting vered energy el costs - indiv	ans and the sted flue above, if for all us vidual he system 1 system 2 dary	electric kWh/yea ses (211 eating sy	keep-hot ur)(221)	+ (231) Fu kW (211)	el /h/year I) x B) x			(230g) = Fuel P (Table 3.4	Price 12)	30 45 x 0.01 = x 0.01 =	kWh/year 4568.69 1888.23 75 453.98 6985.9 Fuel Cost £/year 158.99 0	(230c) (230e) (231) (232) (338) (240) (241)
Space he Water hea Electricity central h boiler wi Total electricity Total deliv 10a. Fue Space he Space he Space he Water hea	ating fuel use ating fuel use for pumps, for heating pump th a fan-assis ctricity for the for lighting vered energy el costs - indiv ating - main s ating - main s ating - secon	ans and the sted flue above, if for all us vidual he system 1 system 2 dary her fuel)	electric kWh/yea ses (211 eating sy	keep-hot ur)(221)	+ (231) Fu kW (211 (213)	el /h/year I) × B) × 5) ×			(230g) = Fuel P (Table 3.4	Price 12)	30 45 × 0.01 = × 0.01 = × 0.01 =	kWh/year 4568.69 1888.23 75 453.98 6985.9 Fuel Cost £/year 158.99 0	(230c) (230e) (231) (232) (338) (240) (241) (242)
Space he Water hea Electricity central h boiler wi Total electricity Total deliv 10a. Fue Space he Space he Space he Water hea Pumps, fa	ating fuel used ating fuel used ating fuel used for pumps, for pumps, for the attricity for the attricity for the attricity for the attrict end of	ans and the sted flue above, if for all us vidual he system 2 dary her fuel) ric keep-	electric kWh/yea ses (211 eating sy	keep-hot	+ (231) Fu kW (211 (213 (215 (215) (231	el /h/year // x // 3) x // 5) x // 2) // as app	(237b)	=	(230g) = Fuel P (Table 3.4 13.4 13.6	Price 12) 8 19 19 19 10 10 10 10 10 10 10	x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 = x 0.01 =	kWh/year 4568.69 1888.23 75 453.98 6985.9 Fuel Cost £/year 158.99 0 0 65.71 9.89	(230c) (230e) (231) (232) (338) (240) (241) (242) (247)

		120 (251)
as needed		
247) + (250)(254) =		414.47 (255)
		0.42 (256)
(256)] ÷ [(4) + 45.0] =		1.16 (257)
		83.88 (258)
ems including micro-CHF		
Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
(211) x	0.216 =	986.84 (261)
(215) x	0.519 =	0 (263)
(219) x	0.216 =	407.86 (264)
(261) + (262) + (263) +	(264) =	1394.7 (265)
t (231) x	0.519 =	38.93 (267)
(232) x	0.519 =	235.61 (268)
	sum of (265)(271) =	1669.23 (272)
	(272) ÷ (4) =	15.8 (273)
		85 (274)
Energy kWh/year	Primary factor	P. Energy kWh/year
(211) x	1.22	5573.8 (261)
(215) x	3.07	0 (263)
(219) x	1.22	2303.64 (264)
(261) + (262) + (263) +	(264) =	7877.45 (265)
t (231) x	3.07	230.25 (267)
(232) x	0 =	1393.71 (268)
	sum of (265)(271) =	9501.41 (272)
	Energy kWh/year (211) x (215) x (219) x (261) + (262) + (263) + (211) x (215) x (219) x (261) x (211) x (211) x (212) x	247) + (250)(254) = (256)] ÷ [(4) + 45.0] = Energy Emission factor kWh/year kg CO2/kWh (211) x

(272) ÷ (4) =

Primary energy kWh/m²/year

89.94

(273)

		User Details:				
Assessor Name:	Ben Marsh	Stroma Nu	mber:	STRO	005374	
Software Name:	Stroma FSAP 2012	Software V	ersion:	Versio	n: 1.0.5.58	
		Property Address: Plot	9			
Address :	Plot 9					
1. Overall dwelling dime	nsions:	A (0)	A 11 : 14	,		
Ground floor		Area(m²) 52.82 (1a) x	Av. Height(r	n) (2a) = [Volume(m³)) (3a)
First floor		52.82 (1b) x		(2b) =	138.92](3b)
	a)+(1b)+(1c)+(1d)+(1e)+(1		2.03		130.92	
•	a) ((15) ((15) ((15) ((15) (15) (15) (15)	,,	(3b)+(3c)+(3d)+(3e)-	(3p) - [٦
Dwelling volume		(3a)+(3D)+(3C)+(3U)+(3E)-	F(311) =	265.68	(5)
2. Ventilation rate:	main seconda	ary other	total		m³ per houi	
Number of objects	heating heating			х 40 = Г	<u> </u>	_
Number of chimneys			0	اِ	0	(6a)
Number of open flues	0 + 0	+ 0 =	0	x 20 =	0	(6b)
Number of intermittent fa			3	x 10 =	30	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fi	res		0	x 40 =	0	(7c)
				Air ch	anges per ho	ur
Infiltration due to chimne	ys, flues and fans = $(6a)+(6b)+$	(7a)+(7h)+(7c) -		-		_
•	een carried out or is intended, proce		30 e from (9) to (16)	÷ (5) =	0.11	(8)
Number of storeys in the	•	· /·	, , , ,	Г	0	(9)
Additional infiltration			1	(9)-1]x0.1 =	0	(10)
Structural infiltration: 0	.25 for steel or timber frame of	or 0.35 for masonry con	struction	Ī	0	(11)
if both types of wall are po deducting areas of openir	resent, use the value corresponding	to the greater wall area (after				
	loor, enter 0.2 (unsealed) or (0.1 (sealed), else enter	0	Γ	0	(12)
If no draught lobby, en	ter 0.05, else enter 0			Ì	0	(13)
Percentage of windows	s and doors draught stripped			Ī	0	(14)
Window infiltration		0.25 - [0.2 x (14)	÷ 100] =	Ì	0	(15)
Infiltration rate		(8) + (10) + (11) +	+ (12) + (13) + (15) =	•	0	(16)
Air permeability value,	q50, expressed in cubic metr	es per hour per square	metre of envelo	pe area	5	(17)
If based on air permeabil	ity value, then $(18) = [(17) \div 20] +$	-(8), otherwise (18) = (16)		Ī	0.36	(18)
Air permeability value applie	s if a pressurisation test has been do	one or a degree air permeabil	ity is being used	_		
Number of sides sheltere	d				2	(19)
Shelter factor		(20) = 1 - [0.075]		Ĺ	0.85	(20)
Infiltration rate incorporat	ing shelter factor	$(21) = (18) \times (20)$	=		0.31	(21)
Infiltration rate modified for	or monthly wind speed		- i			
Jan Feb	Mar Apr May Jun	Jul Aug Se	p Oct No	v Dec		
Monthly average wind sp	eed from Table 7					

4.3

3.8

3.8

3.7

4

4.3

4.5

4.7

Wind Factor (2	22a)m =	(22)m ÷	4										
(22a)m= 1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18		
A -1:a.t.ad. ::.a.t:l.t.		. (مامدان دام	1\	(04 a)	(00-)	<u>.</u>	!	!	•	
Adjusted infiltr	0.39	e (allowi	ng for sr 0.34	o.33	a wina s	0.29	(21a) x 0.29	(22a)m 0.31	0.33	0.35	0.36]	
Calculate effe					l		0.29	0.51	0.33	0.33	0.30		
If mechanic	al ventila	ation:										0	(23a)
If exhaust air h	eat pump	using Appe	endix N, (2	3b) = (23a	a) × Fmv (e	equation (N	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If balanced wit	h heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (from	n Table 4h) =				0	(23c)
a) If balance	ed mech	anical ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balance	ed mech	anical ve	ntilation	without	heat red	covery (N	ЛV) (24b)m = (22	2b)m + (23b)			
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h					•								
		(23b), t	· ` `	<u> </u>		<u> </u>	ŕ	· ·	· ` `	ŕ	1	1	
(24c)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24c)
d) If natural if (22b)r		on or when (24d)		•					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)
Effective air	change	rate - er	iter (24a) or (24b	o) or (24	c) or (24	d) in box	x (25)	•	•	•	•	
(25)m= 0.58	0.57	0.57	0.56	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.57		(25)
3. Heat losse	es and he	at lose r	orom ot										
		zai IUSS į	Jaramen	er:									
ELEMENT	Gros	SS	Openin m	gs	Net Ar A ,r		U-val		A X U (W/		k-value kJ/m²-l		A X k kJ/K
		SS	Openin	gs	Net Ar A ,r	m²			A X U (W/				
ELEMENT	Gros area	SS	Openin	gs	A ,r	m² x	W/m2	2K = [(W/				kJ/K
ELEMENT Doors Windows Type	Gros area e 1	SS	Openin	gs	A ,r 2.14 5.48	m ² x x 1/2	W/m2	eK = [0.04] = [2.996 7.27				kJ/K (26) (27)
Doors Windows Type Windows Type	Gros area e 1	SS	Openin	gs	A ,r 2.14 5.48 8.42	m ² x x1/2 x1/2	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+	eK = [0.04] = [0.04] = [2.996 7.27 11.16	K) 			(26) (27) (27)
Doors Windows Type Windows Type Floor	Gros area e 1 e 2	ss (m²)	Openin m	gs ²	A ,r 2.14 5.48 8.42 52.82	x10 x10 x x1	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+	eK = [0.04] = [0.04] = [= [2.996 7.27 11.16 7.3948	K) 			(26) (27) (27) (28)
Doors Windows Type Windows Type Floor Walls	Gros area e 1 e 2	SS (m²)	Openin m	gs ²	A ,r 2.14 5.48 8.42 52.82 87.67	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17	EK	(W// 2.996 7.27 11.16 7.3948 14.9	K) 			(26) (27) (27) (28) (29)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof	Gros area e 1 e 2 103.	71 32	Openin m	gs ²	A ,r 2.14 5.48 8.42 52.82 87.67	m ²	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+	eK = [0.04] = [0.04] = [= [2.996 7.27 11.16 7.3948	K) 			(26) (27) (27) (28) (29) (30)
Doors Windows Type Windows Type Floor Walls Roof Total area of e	Gros area e 1 e 2 103.	71 32	Openin m	gs ²	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3	m ²	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	EK	(W// 2.996 7.27 11.16 7.3948 14.9 5.81	K) 			(26) (27) (27) (28) (29) (30) (31)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e	Gros area e 1 e 2 103. 52.8 elements	71 32 4, m²	16.0.0	gs ₁ 2	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	eK = [0.04] = [0.04] = [(W// 2.996 7.27 11.16 7.3948 14.9 5.81	k)	kJ/m²-l		(26) (27) (27) (28) (29) (30)
Doors Windows Type Windows Type Floor Walls Roof Total area of e	Gros area e 1 e 2 103. 52.8 elements	71 32 , m ² ows, use e	Openin m 16.0	gs 4 Indow U-ve	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calcul	m ²	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	eK = [0.04] = [0.04] = [(W// 2.996 7.27 11.16 7.3948 14.9 5.81	k)	kJ/m²-l		(26) (27) (27) (28) (29) (30) (31)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and	Gros area e 1 e 2 103. 52.8 elements	71 32 ows, use e	16.00 0 offective winternal wall	gs 4 Indow U-ve	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calcul	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	EK	(W// 2.996 7.27 11.16 7.3948 14.9 5.81	k)	kJ/m²-l		(26) (27) (27) (28) (29) (30) (31)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are	Gros area e 1 e 2 103. 52.8 elements d roof wind as on both	71 32 ows, use e sides of interest of the sides of the	16.00 0 offective winternal wall	gs 4 Indow U-ve	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calcul	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	$ \begin{array}{ccc} 2K & = & & \\ 0.04] & = & & \\ 0.04] & = & & \\ 0.04] & = & & \\ & = & & \\ & = & & \\ & = & & \\ & & & $	(W// 2.996 7.27 11.16 7.3948 14.9 5.81	k)	kJ/m²-l	X	(26) (27) (27) (28) (29) (30) (31) (32)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat los	Gros area e 1 e 2 103. 52.8 elements d roof winde as on both ss, W/K: Cm = S(71 32 32 3, m ² ows, use e sides of in = S (A x (A x k)	16.0- 0	gs 1 ² 4 Indow U-va Is and pan	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11	$ \begin{array}{ccc} 2K & = & & \\ 0.04] & = & & \\ 0.04] & = & & \\ 0.04] & = & & \\ & & = & \\ & & = & \\ & & & = & \\ & & & \\ & & & & \\ & & & & \\ & & & & $	(W// 2.996 7.27 11.16 7.3948 14.9 5.81 0	K)	kJ/m²-l	1 3.2 49.53	(26) (27) (27) (28) (29) (30) (31) (32)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat loo Heat capacity Thermal mass For design asses	Gros area e 1 e 2 103. 52.8 elements d roof wind as on both as on both cs, W/K: Cm = S(comparame co	71 32 ows, use e sides of in a S (A x k) eter (TMF)	16.0- 16.0- 16.0- 16.0- 17.0- 18.0- 19.0-	gs 1 ² 4 Indow U-ve Is and pan	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculations	x1/x1/x2 x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 // formula 1 (26)(30)	2K $= [$ $0.04] = [$ $0.04] = [$ $0.04] = [$ $= [$	(W// 2.996 7.27 11.16 7.3948 14.9 5.81 0 (e)+0.04] a	K)	paragraph(32e) =	15336.6	(26) (27) (27) (28) (29) (30) (31) (32) (33) (11) (34)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat loo Heat capacity Thermal mass For design asses can be used inste	Gros area e 1 e 2 103. 52.8 elements d roof winders on both ss, W/K: Cm = S(s parame sments whe ead of a de	71 32 ows, use e sides of int = S (A x (A x k) eter (TMF) ere the de tailed calcular	16.0. 16.0. 0 Iffective winternal wall U) P = Cm - tails of the culation.	gs 4 ndow U-ve ls and pan - TFA) ir construct	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions n kJ/m²K ion are not	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 // formula 1 (26)(30)	2K $= [$ $0.04] = [$ $0.04] = [$ $0.04] = [$ $= [$	(W// 2.996 7.27 11.16 7.3948 14.9 5.81 0 (e)+0.04] a	K)	paragraph(32e) =	7 3.2 49.53 15336.6	(26) (27) (27) (28) (29) (30) (31) (32) (33) (1) (34) (35)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat loo Heat capacity Thermal mass For design asses	Gros area e 1 e 2 103. 52.8 elements d roof winder as on both as on both ss, W/K: Cm = S(a parame sments wheeled of a de es: S (L	71 32 ows, use e sides of ine = S (A x (A x k) eter (TMF) ere the de tailed calcu	Openin m 16.0 16.0 0 offective with ternal wall U) P = Cm = tails of the ulation. culated to	gs 4 Indow U-vals and paner - TFA) ir constructed using Ap	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions n kJ/m²K ion are not opendix I	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 // formula 1 (26)(30)	2K $= [$ $0.04] = [$ $0.04] = [$ $0.04] = [$ $= [$	(W// 2.996 7.27 11.16 7.3948 14.9 5.81 0 (e)+0.04] a	K)	paragraph(32e) =	15336.6	(26) (27) (27) (28) (29) (30) (31) (32) (33) (11) (34)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat loo Heat capacity Thermal mass For design asses can be used inste	Gros area e 1 e 2 103. 52.8 elements d roof winders on both ess, W/K: Cm = S(es parame essments who ead of a de ess: S (L eal bridging	71 32 ows, use e sides of ine = S (A x (A x k) eter (TMF) ere the de tailed calcu	Openin m 16.0 16.0 0 offective with ternal wall U) P = Cm = tails of the ulation. culated to	gs 4 Indow U-vals and paner - TFA) ir constructed using Ap	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions n kJ/m²K ion are not opendix I	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 // formula 1 (26)(30)	eK = [0.04] = [0.04] = [(W// 2.996 7.27 11.16 7.3948 14.9 5.81 0 (e)+0.04] a	K)	paragraph(32e) =	7 3.2 49.53 15336.6	(26) (27) (27) (28) (29) (30) (31) (32) (33) (1) (34) (35)
ELEMENT Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the are Fabric heat loo Heat capacity Thermal mass For design asses can be used inste Thermal bridg if details of therm	Gros area e 1 e 2 103. 52.8 elements d roof wind as on both as on both ss, W/K: Cm = S(a parame sments whe ad of a de es : S (L al bridging eat loss	71 32 32 3, m² sides of interest (TMF) erer the detailed calculation (XY) calculate (Ax k)	Openin 16.0 0 Iffective wind ternal walk U) P = Cm - tails of the culation. culated to own (36) =	gs 4 Indow U-ve Is and pan construct using Ap = 0.05 x (3	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions n kJ/m²K ion are not opendix I	x1/2 x x x x x x x x x x x x x x x x x x x	W/m2 1.4 /[1/(1.4)+ /[1/(1.4)+ 0.14 0.17 0.11 0 // formula 1 (26)(30)	2K $= [$ $0.04] = [$ $0.04]$	(W// 2.996 7.27 11.16 7.3948 14.9 5.81 0 (a) + (3.0) +	K)	paragraph(32e) =	49.53 15336.6 100	(26) (27) (27) (28) (29) (30) (31) (32) (33) (1) (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 transfer coefficient, W/K				·		= (37) + (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		7,000
Heat loss parameter (HLP), W/m	²K					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		_
Number of days in month (Table	12)				A	Average =	Sum(40) ₁ .	12 /12=	1.11	(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)
							ļ			
4. Water heating energy require	ement:							kWh/ye	ar.	
4. Water fleating energy require	ment.						_	KVVII/yC	ai.	
Assumed occupancy, N if TFA > 13.9, N = 1 + 1.76 x [1	1 - exp(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (1	ΓFA -13.		79		(42)
if TFA £ 13.9, N = 1 Annual average hot water usage	in litres per da	ıv Vd av	erage =	(25 x N)	+ 36		10	5.65		(43)
Reduce the annual average hot water us	age by 5% if the d	lwelling is	designed t			se target o		5.05		(10)
not more that 125 litres per person per da	ay (all water use, h	not and co	ld)							
Jan Feb Mar	Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each			1	· <i>′</i>			I			
(44)m= 116.21 111.99 107.76 1	103.54 99.31	95.08	95.08	99.31	103.54	107.76	111.99	116.21		7
Energy content of hot water used - calcul	lated monthly = 4.	190 x Vd,r	n x nm x E)Tm / 3600			m(44) ₁₁₂ = ables 1b, 1	L	1267.79	(44)
(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		_
If instantaneous water heating at point of	fuse (no hot water	etoraga)	enter∩in	hoves (16		Γotal = Su	m(45) ₁₁₂ =	= [1662.27	(45)
	· · · · · · · · · · · · · · · · · · ·					04.40	22.05	05.04		(46)
(46)m= 25.85 22.61 23.33 Water storage loss:	20.34 19.52	16.84	15.61	17.91	18.12	21.12	23.05	25.04		(40)
Storage volume (litres) including	any solar or W	/WHRS	storage	within sa	ame vess	sel		0		(47)
If community heating and no tank	k in dwelling, e	nter 110	litres in	(47)						
Otherwise if no stored hot water	(this includes i	nstantar	neous co	mbi boil	ers) ente	er '0' in (47)			
Water storage loss:		. /1.14/1	(1-)							
a) If manufacturer's declared los		wn (kvvr	n/day):					0		(48)
Temperature factor from Table 2				(40) (40)				0		(49)
Energy lost from water storage, k b) If manufacturer's declared cyl	•	or is not		(48) x (49)	=			0		(50)
Hot water storage loss factor from								0		(51)
If community heating see section	14.3									
Volume factor from Table 2a								0		(52)
Temperature factor from Table 2								0		(53)
Energy lost from water storage, k	kWh/year			(47) x (51)	x (52) x (5	53) =		0		(54)
Enter (50) or (54) in (55)	r aaah manth			((EG)m - (EE) (41)r	~		0		(55)
Water storage loss calculated for	-	_	1	1	55) × (41)r					(50)
(56)m= 0 0 0 If cylinder contains dedicated solar storage	0 0 0	0 x [(50) = (0 H11)1 <i>→ (5</i> /	0 0) else (5	0 $7)m = (56)$	0 m where (0 H11) is fro	m Appendi	x H	(56)
			1						A.I.	(57)
(57)m= 0 0 0	0 0	0	0	0	0	0	0	0		(57)

Primary circuit loss (annual) from Ta	ble 3							0		(58)
Primary circuit loss calculated for ea	ch month (59)m = (5	58) ÷ 36	5 × (41)	m				•	
(modified by factor from Table H5	if there is s	olar wate	r heatir	ng and a	cylinde	r thermo	stat)			
(59)m= 0 0 0 0	0	0	0	0	0	0	0	0		(59)
Combi loss calculated for each mon	th (61)m =	(60) ÷ 365	5 × (41)	m						
(61)m= 0 0 0 0	0	0	0	0	0	0	0	0		(61)
Total heat required for water heating	calculated	for each	month	(62)m =	0.85 × ((45)m +	(46)m +	(57)m +	(59)m + (61)m	
(62)m= 172.34 150.73 155.54 135			104.04	119.39	120.82	140.8	153.7	166.9		(62)
Solar DHW input calculated using Appendix	G or Appendix	H (negative	e quantity) (enter '0	if no sola	r contributi	ion to wate	er heating)		
(add additional lines if FGHRS and/	or WWHRS	applies,	see App	pendix (€)					
(63)m= 0 0 0 0	0	0	0	0	0	0	0	0		(63)
FHRS 0 0 0 0	0	0	0	0	0	0	0	0	•	(63) (G2
Output from water heater										
(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		
	!	!!		Outp	out from w	ater heate	r (annual)₁	12	1662.27	(64)
Heat gains from water heating, kWh	month 0.2	5 ´ [0.85 ×	د (45)m	+ (61)m	n] + 0.8 x	κ [(46)m	+ (57)m	+ (59)m]	_
(65)m= 57.3 50.12 51.72 45.0	_	37.33	34.59	39.7	40.17	46.82	51.1	55.5	_	(65)
include (57)m in calculation of (65	m only if c	vlinder is	in the c	lwelling	or hot w	ater is fr	om com	munity h	eating	
5. Internal gains (see Table 5 and	•	,		<u> </u>				,	3	
	<i>5</i> 4).									
Metabolic gains (Table 5), Watts Jan Feb Mar Ar	r May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m= 139.3 139.3 139.3 139		139.3	139.3	139.3	139.3	139.3	139.3	139.3		(66)
Lighting gains (calculated in Append	ļ	<u> </u>	ļ							, ,
(67)m= 25.71 22.83 18.57 14.0	<u> </u>	8.87	9.59	12.46	16.72	21.23	24.78	26.42		(67)
Appliances gains (calculated in App	!		ļ			<u> </u>	21.70	20.12		(- /
(68)m= 265.14 267.89 260.95 246.			198.35	195.6	202.54	217.3	235.93	253.44		(68)
` '							200.90	200.44		(00)
Cooking gains (calculated in Appen (69)m= 36.93 36.93 36.93 36.93			 			36.93	36.93	36.93		(69)
	3 36.93	36.93	36.93	36.93	36.93	30.93	30.93	30.93		(00)
Pumps and fans gains (Table 5a)				•		Ι ,		Ι .	ı	(70)
(70)m= 3 3 3 3	3	3	3	3	3	3	3	3		(70)
Losses e.g. evaporation (negative v	aluae) (Tah	I ~ E \								
							· · · · · · · ·	I	ı	(74)
(71)m= -111.44 -111.44 -111.44 -111.			-111.44	-111.44	-111.44	-111.44	-111.44	-111.44		(71)
(71)m= -111.44 -111.44 -111.44 -111.44 -111.44 Water heating gains (Table 5)	14 -111.44	-111.44				<u> </u>				
(71)m= -111.44 -111.44 -111.44 -111.	14 -111.44		-111.44 46.5	-111.44 53.36	-111.44 55.79	-111.44 62.93	70.98	74.59		(71)
(71)m= -111.44 -111.44 -111.44 -111.44 -111.44 Water heating gains (Table 5)	14 -111.44	51.85	46.5	53.36	55.79	<u> </u>	70.98	74.59		
(71)m= -111.44	2 58.15	-111.44 - 51.85 (66)m	46.5	53.36	55.79	62.93	70.98	74.59		
(71)m= -111.44	2 58.15 66 364.01	-111.44 - 51.85 (66)m 338.56	46.5 n + (67)m 322.23	53.36 + (68)m +	55.79 + (69)m + (342.84	62.93 (70)m + (7 369.24	70.98 1)m + (72) 399.48	74.59 m 422.24		(72)
(71)m= -111.44	2 58.15 66 364.01 om Table 6a	-111.44 -111.4	46.5 n + (67)m 322.23	53.36 + (68)m +	55.79 + (69)m + (342.84	62.93 (70)m + (7 369.24	70.98 1)m + (72) 399.48	74.59 m 422.24		(72)
(71)m= -111.44	2 58.15 36 364.01 om Table 6a a	-111.44 -111.4	46.5 n + (67)m 322.23	53.36 + (68)m + 329.21	55.79 + (69)m + 1 342.84 envert to the	62.93 (70)m + (7 369.24	70.98 1)m + (72) 399.48 ble orientat	74.59 m 422.24	Gains (W)	(72)
(71)m= -111.44	2 58.15 66 364.01 om Table 6a	-111.44 -111.4	46.5 n + (67)m 322.23	53.36 + (68)m + 329.21	55.79 + (69)m + (342.84	62.93 (70)m + (7 369.24	70.98 1)m + (72) 399.48	74.59 m 422.24	Gains (W)	(72)
(71)m= -111.44	2 58.15 66 364.01 om Table 6a a	-111.44 -111.44 -111.44 -111.44 -111.44 -111.44 -111.44 -111.45 -111.4	46.5 n + (67)m 322.23 tted equat	53.36 + (68)m + 329.21 tions to co	55.79 - (69)m + (342.84 - (69)m + (69)	62.93 (70)m + (7 369.24 de applicab	70.98 1)m + (72) 399.48 ble orientat	74.59 m 422.24		(72)
(71)m= -111.44	2 58.15 66 364.01 om Table 6a a	-111.44 -111.44 -111.44 -111.44 -111.44 -111.44 -111.44 -111.45 -111.4	46.5 n + (67)m 322.23 tted equat	53.36 + (68)m + 329.21 tions to co	55.79 + (69)m + 1 342.84 envert to the	62.93 (70)m + (7 369.24 de applicab	70.98 1)m + (72) 399.48 ble orientat	74.59 m 422.24		(72)

Total g	gains – i	nternal a	and solar	· (84)m =	= (73)m -	+ (83)m	, watts							
(84)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		(84)
7 Me	an inter	nal temr	perature	(heating	season)								
			neating p	`		,	from Tah	ole 9 Th	1 (°C)				21	(85)
		_	ains for			_		, iii	. ()				21	
Utilisa	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)
, ,		<u> </u>	<u> </u>	ļ						0.57	0.50	0.55		(00)
		 	ature in	<u>_</u>	· ·	ı —	i —							(07)
(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		(87)
Temp	erature	during h	eating p	eriods ir	rest of	dwelling	from Ta	ble 9, T	h2 (°C)				•	
(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	ctor 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 (fa	ollow ste	ns 3 to	7 in Tabl	e 9c)			l	
(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	l						f	LA = Livin	g area ÷ (4	4) =	0.23	(91)
						\ 4		, , , , , , , , , , , , , , , , , , ,	4)					` ′
			ature (fo							40.40	47.57	40.00	1	(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)
	16.85	17.02	he mear 17.42	18.04	18.74	ature fro	m Table	4e, wne	re appro	18.46	17.57	16.83		(93)
(93)m=			L		16.74	19.45	19.00	19.65	19.32	16.46	17.57	10.63		(90)
			uirement		ro obtoin	and at at	on 11 of	Table O	o oo tha	+ Ti m_/	76\m an	d ro colo	vuloto	
			ernal ter or gains	•		ieu ai sii	зр гтог	Table 91	J, 50 IIIa		rojili ali	u re-caic	uiale	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisa	ation fac	tor for g	ains, hm	<u> </u>				U						
(94)m=	0.97	0.97	0.97	0.96	0.93	0.88	0.79	0.79	0.89	0.95	0.97	0.97		(94)
Usefu	ıl gains,	hmGm	, W = (94	4)m x (8	4)m								l	
(95)m=	423.64	420.32	402.57	373.43	339.82	297.67	253.08	261.51	306.12	349.2	385.79	411.53		(95)
Montl	hly aver	age exte	rnal tem	perature	from Ta	able 8								
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat	loss rate	e for me	an intern	al tempe	erature,	Lm , W =	=[(39)m :	x [(93)m	– (96)m]			1	
(97)m =	1489 33	1434.58	1290.4	1069.04	821	560.29	379.14	398.01	606.11	916.75	1226.99	1485.19		(97)
(01)	1 100.00													
		g require	ement fo	r each n	nonth, k\	Wh/mont	th = 0.02	4 x [(97))m – (95)m] x (4 ⁻	1)m			
		g require 681.58	ement fo	r each n 500.84	nonth, k\ 357.99	Wh/mont 0	th = 0.02	24 x [(97))m — (95 0)m] x (4 ⁻ 422.26	1)m 605.66	798.81		
Space	e heatin	- 	r	T				0		422.26	605.66		4820.56	(98)
Space (98)m=	e heatin 792.88	681.58	r	500.84	357.99			0	0	422.26	605.66		4820.56 45.63	(98)
Space (98)m=	e heatin 792.88 e heatin	681.58	660.54 ement in	500.84 kWh/m²	357.99 ² /year	0	0	0 Tota	0 I per year	422.26	605.66			긬
Space (98)m= Space 9a. En	e heating 792.88 e heating ergy rec	681.58 g require	660.54	500.84 kWh/m²	357.99 ² /year	0	0	0 Tota	0 I per year	422.26	605.66			긬
Space (98)m= Space 9a. En	e heatin e heatin ergy rec e heatin	681.58 g require quirement	660.54 ement in	500.84 kWh/m²	357.99 P/year eating s	0 ystems i	0 ncluding	0 Tota	0 I per year	422.26	605.66			긬
Space (98)m= Space 9a. En Space Fracti	e heatin 792.88 e heatin ergy rec e heatin ion of sp	681.58 g require quirement pace hea	660.54 ement in	kWh/m² ividual h	357.99 Pyear eating sylvy/supple	0 ystems i	ncluding system	0 Tota	0 I per year	422.26	605.66		45.63	(99)
Space (98)m= Space 9a. En Space Fracti	e heating 792.88 e heating ergy receive heating ion of spinon of	681.58 g require quirement pace head	ement in	kWh/m² ividual h econdar	357.99 Plyear eating sylysupple em(s)	0 ystems i	ncluding system	0 Tota micro-C	0 I per year	422.26 (kWh/year	605.66		45.63	(99)

Efficiency of main appear heating system 1								00.0	(206)
Efficiency of main space heating system 1 Efficiency of secondary/supplementary heating	n evetem	n %						90.6	(208)
Jan Feb Mar Apr May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/yea	」
Space heating requirement (calculated above)	Juli	Jui	Aug	Sep	<u> </u>	INOV	Dec	Kvvii/yea	a i
792.88 681.58 660.54 500.84 357.99	0	0	0	0	422.26	605.66	798.81		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)					•			•	(211)
875.14 752.3 729.08 552.8 395.14	0	0	0	0	466.07	668.5	881.69		_
			Tota	I (kWh/yea	ar) =Sum(2	211)	=	5320.71	(211)
Space heating fuel (secondary), kWh/month									
$= \{[(98)m \times (201)]\} \times 100 \div (208)$ $(215)m = 0 $	0	0	0	0	0	0	0		
				l (kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water heating									_
Output from water heater (calculated above)	440.00	10101	140.00	400.00		450.7	400.0	Ī	
172.34 150.73 155.54 135.6 130.12 Efficiency of water heater	112.28	104.04	119.39	120.82	140.8	153.7	166.9	85	(216)
(217)m= 89.55 89.53 89.48 89.35 89.04	85	85	85	85	89.13	89.41	89.58	00	(217)
Fuel for water heating, kWh/month									, ,
(219) m = (64) m x $100 \div (217)$ m					T			1	
(219)m= 192.46 168.36 173.83 151.78 146.14	132.09	122.4	140.46	142.14 I = Sum(2)	157.97	171.9	186.32	4005.00	7(040)
Annual totals			Tota	i – Guiii(2		Wh/year	,	1885.86 kWh/year	(219)
Space heating fuel used, main system 1						i i i y cai		5320.71	7
Water heating fuel used								1885.86	Ī
Electricity for pumps, fans and electric keep-hot	t								_
central heating pump:							30		(230c)
boiler with a fan-assisted flue							45		(230e)
Total electricity for the above, kWh/year			sum	of (230a).	(230g) =			75	(231)
Electricity for lighting								453.98	(232)
Total delivered energy for all uses (211)(221)	+ (231)	+ (232).	(237b)	=				7735.54	(338)
12a. CO2 emissions – Individual heating syste	ms inclu	uding mi	cro-CHP)					
	En	ergy			Emice	ion fac	tor	Emissions	
		/h/year			kg CO		loi	kg CO2/yea	ar
Space heating (main system 1)	(211	I) x			0.2	16	=	1149.27	(261)
Space heating (secondary)	(215	5) x			0.5	19	=	0	(263)
Water heating	(219	9) x			0.2	16	=	407.35	(264)
Space and water heating	(261	1) + (262) -	+ (263) + (264) =				1556.62] (265)
Electricity for pumps, fans and electric keep-hot	(231	l) x			0.5	19	=	38.93	(267)
Electricity for lighting		2) x			0.5	==	=	235.61](268)
Total CO2, kg/year				sum o	f (265)(2			1831.16](272)
. 5.5. 552, ng, 5541					, , , ,	•		1031.10	_(~(~)

Dwelling CO2 Emission Rate

El rating (section 14)

 $(272) \div (4) =$

17.33 (273)

84 (274)

		User Details:				
Assessor Name:	Ben Marsh		Number:	STRO	005374	
Software Name:	Stroma FSAP 2012		e Version:		n: 1.0.5.58	
Continuio italiio.		operty Address: P		1 0.0.0	111 11010100	
Address :	Plot 9					
1. Overall dwelling dime	nsions:					
		Area(m²)	Av. Height	(m)	Volume(m³)
Ground floor		52.82	a) x 2.4	(2a) =	126.77	(3a)
First floor		52.82 (11	o) x 2.63	(2b) =	138.92	(3b)
Total floor area TFA = (1a	a)+(1b)+(1c)+(1d)+(1e)+(1n	105.64 (4)				
Dwelling volume		(3	3a)+(3b)+(3c)+(3d)+(3e	e)+(3n) =	265.68	(5)
2. Ventilation rate:				-		
	main secondary heating heating	y other	total		m³ per hou	r
Number of chimneys	0 + 0	+ 0	= 0	x 40 =	0	(6a)
Number of open flues	0 + 0	+ 0	= 0	x 20 =	0	(6b)
Number of intermittent fa	ns		4	x 10 =	40	(7a)
Number of passive vents			0	x 10 =	0	(7b)
Number of flueless gas fi	res		0	x 40 =	0	(7c)
				Air ch	anges per ho	r
Infiltration due to chimne	ys, flues and fans = (6a)+(6b)+(7a	a)+(7b)+(7c) =	40	÷ (5) =		(8)
•	een carried out or is intended, proceed		40 tinue from (9) to (16)	+ (5) =	0.15	(0)
Number of storeys in the	ne dwelling (ns)				0	(9)
Additional infiltration				[(9)-1]x0.1 =	0	(10)
	.25 for steel or timber frame or	•			0	(11)
if both types of wall are pr deducting areas of openin	resent, use the value corresponding to nas); if equal user 0.35	the greater wall area (after			
•	loor, enter 0.2 (unsealed) or 0.	1 (sealed), else er	iter 0	[0	(12)
If no draught lobby, ent	ter 0.05, else enter 0				0	(13)
Percentage of windows	s and doors draught stripped			Ī	0	(14)
Window infiltration		0.25 - [0.2 x	$(14) \div 100] =$	Ī	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15)	=	0	(16)
Air permeability value,	q50, expressed in cubic metres	s per hour per squ	are metre of envel	ope area	5	(17)
If based on air permeabil	ity value, then $(18) = [(17) \div 20] + (8)$), otherwise (18) = (16)		0.4	(18)
	s if a pressurisation test has been done	e or a degree air perme	eability is being used	_		_
Number of sides sheltere	d	(20) 1 [0]	75 v (40)1		2	(19)
Shelter factor		(20) = 1 - [0.0]			0.85	(20)
Infiltration rate incorporat		(21) = (18) x	(∠∪) =		0.34	(21)
Infiltration rate modified for						
Jan Feb	Mar Apr May Jun	Jul Aug	Sep Oct N	lov Dec		
Monthly average wind sp	eed from Table 7					

4.9

4.4

4.3

3.8

3.8

3.7

4.3

4.5

4.7

5

Wind Factor (2	22a\m -	(22)m ÷	Л										
(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]	
								<u> </u>	<u>I</u>	<u>!</u>	<u> </u>	l	
Adjusted infiltr	ation rat	e (allowi	ng for sl 0.37	nelter an	d wind s	i ´	`´	ì	0.07	0.00	T 0.4	l	
Calculate effe		I -		l		0.32 ise	0.31	0.34	0.37	0.38	0.4		
If mechanica		-										0	(23a)
If exhaust air h	eat pump	using Appe	endix N, (2	(23a) = (23a	a) × Fmv (e	equation (I	N5)) , othe	rwise (23b) = (23a)			0	(23b)
If balanced with	n heat reco	overy: effic	iency in %	allowing f	or in-use f	actor (fron	n Table 4h) =				0	(23c)
a) If balance	ed mech	anical ve	ntilation	with he	at recov	ery (MVI	HR) (24a	a)m = (22)	2b)m + (23b) × [1 – (23c)	÷ 100]	
(24a)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24a)
b) If balance	ed mech	anical ve	ntilation	without	heat red	covery (N	MV) (24b	m = (22)	2b)m + (23b)	,	•	
(24b)m= 0	0	0	0	0	0	0	0	0	0	0	0		(24b)
c) If whole h				•	•								
<u> </u>		k (23b), t	· ·		ŕ –		ŕ	ŕ		i 		1	(0.4=)
(24c)m= 0	0	0		0	0	0	0	0	0	0	0		(24c)
d) If natural if (22b)r		on or wh en (24d)							0.51				
(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)
Effective air	change	rate - er	ter (24a) or (24b	o) or (24	c) or (24	·d) in bo	x (25)				l	
(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)
0.11(1		(]				ı	1	1			1		
Heat losse	is and ne	eat ioss p	paramet	er:									
EI EMENT	Gros	·			Not Ar	.ea	l l-val	IIA	ΔΧΙΙ		k-valu	۵	ΔXk
ELEMENT	Gros area	SS	Openin m	gs	Net Ar A ,r		U-val W/m2		A X U (W/		k-value kJ/m²-		A X k kJ/K
ELEMENT Doors		SS	Openin	gs		m²							
	area	SS	Openin	gs	A ,r	m² x	W/m2	2K = [(W/				kJ/K
Doors	area	SS	Openin	gs	A ,r	m² x x1	W/m2	2K = [- 0.04] = [(W/ 2.14				kJ/K (26)
Doors Windows Type	area	SS	Openin	gs	A ,r 2.14 5.48	m² x x1 x1	W/m2 1 /[1/(1.4)+	2K = [- 0.04] = [2.14 7.27	K)			kJ/K (26) (27)
Doors Windows Type Windows Type	area	ss (m²)	Openin	gs ₁ ²	A ,r 2.14 5.48 8.42	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+	2K = [· 0.04] = [· 0.04] = [2.14 7.27 11.16	K)			kJ/K (26) (27) (27)
Doors Windows Type Windows Type Floor	area	ss (m²)	Openin m	gs ₁ ²	A ,r 2.14 5.48 8.42 52.82	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+	eK = [- 0.04] = [- 0.04] = [= = [2.14 7.27 11.16 6.8666	K)			(26) (27) (27) (28)
Doors Windows Type Windows Type Floor Walls	area area 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	71 32	Openin	gs ₁ ²	A ,r 2.14 5.48 8.42 52.82 87.67	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18	2K = [0.04] = [0.04] = [= = [2.14 7.27 11.16 6.8666 15.78	K)			(26) (27) (27) (28) (29)
Doors Windows Type Windows Type Floor Walls Roof	area area 1 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	71 32	Openin	gs ₁ ²	A ,r 2.14 5.48 8.42 52.82 87.67	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18	2K = [0.04] = [0.04] = [= = [2.14 7.27 11.16 6.8666 15.78	K)			(26) (27) (27) (28) (29) (30)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and	area 1 103. 52.8 Selements	71 32 5, m ²	Openin m 16.0 0	gs 4 Indow U-ve	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calcul	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13	2K = [0.04] = [0.04] = [2.14 7.27 11.16 6.8666 15.78 6.87	K)	kJ/m²-		(26) (27) (27) (28) (29) (30) (31)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the area	area 103. 52.8 1 roof wind as on both	71 32 5, m ² sows, use e	16.0 0	gs 4 Indow U-ve	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calcul	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13	2K = [- 0.04] = [2.14 7.27 11.16 6.8666 15.78 6.87	K)	kJ/m²-		kJ/K (26) (27) (27) (28) (29) (30) (31) (32)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the area Fabric heat los	area 103. 52.8 1 roof wind as on both ss, W/K	71 32 5, m ² sows, use e sides of int = S (A x	16.0 0	gs 4 Indow U-ve	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calcul	m ²	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13	$ \begin{array}{ccc} 2K & = & \\ & 0.04 & = & \\ & 0.04 & = & \\ & =$	(W/ 2.14 7.27 11.16 6.8666 15.78 6.87 0 (e)+0.04] &	K)	kJ/m²-l		kJ/K (26) (27) (27) (28) (29) (30) (31) (32)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the area Fabric heat los Heat capacity	area 103. 52.8 lements roof wind as on both as, W/K: Cm = Si	71 32 32 3, m² ows, use e sides of in = S (A x (A x k)	16.0 0	gs 12 4 Indow U-va Is and pan	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions	x1 x1 x1 x2 x x x x x x x x x x x x x x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13	$ \begin{array}{ccc} 2K & = & \\ & 0.04 & = & \\ & 0.04 & = & \\ & =$	(W/ 2.14 7.27 11.16 6.8666 15.78 6.87 0 (e)+0.04] a	K)	kJ/m²-l	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	(26) (27) (27) (28) (29) (30) (31) (32) (33) (34)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the area Fabric heat los Heat capacity Thermal mass	area 103.	71 32 32 33 30 30 30 30 30 30 30 30 30	16.0 0 ffective with ternal wall U) $P = Cm - Cm - Cm$	gs 4 Indow U-va Is and pan	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions	x1 x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13 0 formula 1 (26)(30	$ \begin{array}{ccc} 2K & = & \\ $	(W/ 2.14 7.27 11.16 6.8666 15.78 6.87 0 (a) (a) (a) (a) (b) (a) (b) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	K)	paragraph(32e) =	3.2	(26) (27) (27) (28) (29) (30) (31) (32)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the area Fabric heat los Heat capacity	area 2 1 103. 52.8 Lelements Loof wind as on both as on both Cm = So a parame asments wh	71 32 35, m² 60ws, use elesides of interest (TMF) eter (TMF) here the de	16.0 0 ffective winternal wall U) $P = Cm - tails of the$	gs 4 Indow U-va Is and pan	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions	x1 x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13 0 formula 1 (26)(30	$ \begin{array}{ccc} 2K & = & \\ $	(W/ 2.14 7.27 11.16 6.8666 15.78 6.87 0 (a) (a) (a) (a) (b) (a) (b) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	K)	paragraph(32e) =	7 3.2 50.08	(26) (27) (27) (28) (29) (30) (31) (32) (33) (34)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the area Fabric heat los Heat capacity Thermal mass For design assess	area 103. 52.8 l roof wind as on both ss, W/K: Cm = So parame sments wh ad of a de	71 32 32 3, m² 6 sides of int = S (A x (A x k) eter (TMF) eter the decentailed calculations	16.0 16.0 0 offective waternal wall U) P = Cm - tails of the culation.	gs 4 Indow U-ve Is and part - TFA) ir	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions	x1 x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13 0 formula 1 (26)(30	$ \begin{array}{ccc} 2K & = & \\ $	(W/ 2.14 7.27 11.16 6.8666 15.78 6.87 0 (a) (a) (a) (a) (b) (a) (b) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	K)	paragraph(32e) =	7 3.2 50.08	kJ/K (26) (27) (27) (28) (29) (30) (31) (32) 3 (33) 61 (34) (35)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the area Fabric heat los Heat capacity Thermal mass For design assess can be used inste	area area 103. 103. 52.8 lelements 1 roof wind as on both as, W/K: Cm = So a parame aments whad of a de es: S (L	71 32 35, m² 60ws, use elesides of interestine de tailed calculation (XY)	16.0 16.0 0 offective with ternal walk the properties of the culation. culated	gs 4 4 Indow U-vals and paner constructed using Ap	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions n kJ/m²K ion are not	x1 x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13 0 formula 1 (26)(30	$ \begin{array}{ccc} 2K & = & \\ $	(W/ 2.14 7.27 11.16 6.8666 15.78 6.87 0 (a) (a) (a) (a) (b) (a) (b) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	K)	paragraph(32e) =	7 3.2 50.08 15336.	kJ/K (26) (27) (27) (28) (29) (30) (31) (32) 3 (33) 61 (34) (35)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the area Fabric heat los Heat capacity Thermal mass For design assess can be used inste Thermal bridge if details of therma Total fabric he	area 103. 103. 103. 103. 103. 103. 103. 103. 103. 104. 105. 105. 106. 107. 108.	71 32 32 3, m² 6 ows, use ender sides of interest (TMF) eter (TMF) eter (the dentation of the dentation of t	opening 16.0 16.0 0 offective with ternal walk ternal walk ternal walk ternal walk ternal walk to the tails of the culation. culated own (36) =	gs 4 4 indow U-ve Is and pan construct using Ap = 0.05 x (3	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions n kJ/m²K ion are not	x1 x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13 0 formula 1 (26)(30	2K = [0.04] = [(W/ 2.14 7.27 11.16 6.8666 15.78 6.87 0 (a) (a) (a) (a) (b) (a) (b) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	K)	paragraph(32e) =	7 3.2 50.08 15336.	(26) (27) (27) (28) (29) (30) (31) (32) (33) (61) (34) (35)
Doors Windows Type Windows Type Floor Walls Roof Total area of e Party wall * for windows and ** include the area Fabric heat los Heat capacity Thermal mass For design assess can be used inste Thermal bridge if details of thermal	area 103. 103. 103. 103. 103. 103. 103. 103. 103. 104. 105. 105. 106. 107. 108.	71 32 32 3, m² 6 ows, use ender sides of interest (TMF) eter (TMF) eter (the dentation of the dentation of t	opening 16.0 16.0 0 offective with ternal walk ternal walk ternal walk ternal walk ternal walk to the tails of the culation. culated own (36) =	gs 4 4 indow U-ve Is and pan construct using Ap = 0.05 x (3	A ,r 2.14 5.48 8.42 52.82 87.67 52.82 209.3 45.9 alue calculatitions n kJ/m²K ion are not	x1 x	W/m2 1 /[1/(1.4)+ /[1/(1.4)+ 0.13 0.18 0.13 0 formula 1 (26)(30	$ \begin{array}{cccc} 2K & & & & & & \\ & & & & & & \\ & & & & &$	(W/ 2.14 7.27 11.16 6.8666 15.78 6.87 0 (a) + (3.0) +	K)	paragraph(32e) =	50.08 15336. 250	(26) (27) (27) (28) (29) (30) (31) (32) 3 (33) 61 (34) (35)

	_											ı	
(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 transfe	r coefficie	nt, W/K						(39)m	= (37) + (38)m			
(39)m= 112.6	7 112.35	112.03	110.55	110.28	108.99	108.99	108.75	109.49	110.28	110.84	111.42		_
Heat loss pa	rameter (l	HLP), W	/m²K	_		_			Average = = (39)m ÷	Sum(39) ₁ . - (4)	12 /12=	110.55	(39)
(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		_
Number of d	ovo in mo	nth /Tah	lo 1o\					,	Average =	Sum(40) ₁	12 /12=	1.05	(40)
Jan		Mar		May	Jun	Jul	Δυα	Sep	Oct	Nov	Dec		
(41)m= 31	28	31	Apr 30	31	30	31	Aug 31	30 30	31	30	31		(41)
(41)													(11)
4 \\/_t	-ti										1-10/1- /		
4. Water he	ating ene	rgy requ	rement:								kWh/ye	ear:	
Assumed oc											.79		(42)
if TFA > 13		+ 1.76 x	[1 - exp	(-0.0003	349 x (TF	FA -13.9)2)] + 0.0	0013 x (ΓFA -13.	.9)		'	
Annual avera	,	ater usad	ae in litre	es per da	av Vd.av	erage =	(25 x N)	+ 36		100	0.37		(43)
Reduce the anr	nual average	hot water	usage by	5% if the c	lwelling is	designed			se target o		0.07		(.0)
not more that 12	25 litres per	person pei	day (all w	rater use, i	hot and co	ld)		•	•			ı	
Jan		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usag	e in litres pei	r day for ea	ach month	Vd,m = fa	ctor from T	Table 1c x	(43)	·	ı	1		ı	
(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		_
Energy content	of hot water	used - cal	culated mo	onthly = 4 .	190 x Vd,r	n x nm x E	OTm / 3600			m(44) ₁₁₂ = ables 1b, 1		1204.4	(44)
(45)m= 163.7	2 143.19	147.76	128.82	123.61	106.67	98.84	113.42	114.78	133.76	146.01	158.56		
					, ,	. 0:			Total = Su	m(45) ₁₁₂ =	=	1579.16	(45)
If instantaneous			·	not water	r storage), r	enter U In	DOXES (46)) to (61)	1		1	l	
(46)m= 24.56 Water storage		22.16	19.32	18.54	16	14.83	17.01	17.22	20.06	21.9	23.78		(46)
Storage volu) includir	ng anv so	olar or W	/WHRS	storage	within sa	ame ves	sel		0		(47)
If community	` '		0 ,			Ū					0		()
Otherwise if	_			_			` '	ers) ente	er '0' in (47)			
Water storag	je loss:		,					•		•			
a) If manufa	cturer's d	eclared I	oss facto	or is kno	wn (kWh	n/day):					0		(48)
Temperature	factor fro	m Table	2b								0		(49)
Energy lost f		-	-				(48) x (49)) =			0		(50)
b) If manufa			•									[(= 4)
Hot water sto If community	-			e z (kvv	n/iitre/da	ıy)					0		(51)
Volume facto	_		011 4.0								0		(52)
Temperature	factor fro	m Table	2b							-	0		(53)
Energy lost f	rom water	storage	, kWh/ye	ear			(47) x (51)) x (52) x (53) =		0		(54)
Enter (50) o		_	,								0		(55)
Water storag	je loss cal	culated t	for each	month			((56)m = (55) × (41)ı	m			ı	
(56)m= 0	0	0	0	0	0	0	0	0	0	0	0		(56)
If cylinder conta		_					_		_	_	-	ix H	
(57)m= 0	0	0	0	0	0	0	0	0	0	0	0		(57)
(07)111-													(31)

Primary circuit	loss (ar	nnual) fro	om Table	e 3							0]	(58)
Primary circuit	,	,			(59)m =	(58) ÷ 36	65 × (41))m				1	
(modified by					• •	• •	, ,		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= 50.96	46.03	50.96	48.51	48.08	44.55	46.03	48.08	48.51	50.96	49.32	50.96	1	(61)
Total heat reg	uired for	water he	eating ca	alculated	t for eac	h month	(62)m =	. 0 85 x	(45)m +	(46)m +	(57)m +	ı (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 DHW input	L calculated	using App	endix G o	r Appendix	ι κ Η (negati	ve quantity	/) (enter '0	l if no sola	r contribut	ion to wate	r heating)	J	
(add additiona											0,		
(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= 214.68	189.22	198.72	177.33	171.69	151.21	144.87	161.5	163.28	184.72	195.33	209.52]	
` /	I	<u> </u>	<u> </u>		<u> </u>	I	Outr	ut from w	I ater heate	<u>l</u> r (annual)₁	12	2162.08	(64)
Heat gains fro	m water	heating	kWh/m	onth 0.2	5 ′ [0 85	× (45)m				,			J` ′
(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	Ì	(65)
include (57)	n in cal	L culation (of (65)m	only if c	l Vlinder i	s in the (l dwelling	<u> </u>	l	om com	munity h	l neating	. ,
` '			. ,	-	Jylli Idei I	3 111 1110 1	awciiiig	OI HOUW	ator is in	OIII COIII	indinty i		
5. Internal ga	·).									
Metabolic gair	Ĭ		Ĭ	May	Lun	l 11		Con	Oct	Nov	Doo	l	
(66)m= 139.3	Feb 139.3	Mar 139.3	Apr 139.3	May 139.3	Jun 139.3	Jul 139.3	Aug 139.3	Sep 139.3	Oct 139.3	Nov 139.3	Dec 139.3	ļ	(66)
` ′	ļ		<u> </u>		<u> </u>	ļ		ļ	139.3	139.3	139.3		(00)
Lighting gains	r `		·	' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' ' 	1	· ·	r	1	T 04 00	04.70	T 00 40	1	(67)
(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)
Appliances ga	`							1				1	(00)
(68)m= 265.14		260.95	246.19	227.56	210.05	198.35	195.6	202.54	217.3	235.93	253.44		(68)
Cooking gains	·		' 	- ' -	1		<u> </u>				1	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)
Pumps and fa	ns gains	(Table 5	5a)									•	
(70)m= 3	3	3	3	3	3	3	3	3	3	3	3		(70)
Losses e.g. ev	/aporatio	n (nega	tive valu	es) (Tab	ole 5)	-		-	-				
(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 (1	able 5)							_		_	_	
(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		(72)
Total internal	gains =	•			(66))m + (67)m	n + (68)m -	+ (69)m +	(70)m + (7	1)m + (72))m		
(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		(73)
6. Solar gains	s:	•	-	•	•	•	•	•	•	-	•		
Solar gains are	calculated	using sola	r flux from	Table 6a	and assoc	iated equa	ations to co	onvert to th	ne applicat	ole orientat	tion.		
Orientation: A			Area		Flu		_	g_	_	FF		Gains	
	Table 6d		m²		Tal	ble 6a	Т	able 6b	T	able 6c		(W)	
Solar gains in	watts, ca	alculated	for eac	h month			(83)m = S	um(74)m	(82)m			1	
(83)m= 0	0	0	0	0	0	0	0	0	0	0	0		(83)

i Jiai y	jains – i	nternal a	and solar	(84)m =	= (73)m -	+ (83)111	, walls							
(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 temr	perature	(heating	season)								
			neating p				from Tah	ole 9 Th	1 (°C)				21	(85)
		_	٠.			_)ic 0, 111	1 (0)					(00)
UtiliSa	Jan	Feb	ains for l			r`	Jul	۸۰۰۰	Con	Oct	Nov	Dec		
(OC)~		-		Apr	May	Jun		Aug	Sep					(86)
(86)m=	1	1	1	1	1	0.99	0.95	0.96	0.99	1	1	1		(00)
Mean		l temper	ature in	living are	ea T1 (fo	llow ste	ps 3 to 7	in Table	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)
Temp	erature	during h	neating p	eriods ir	rest of	dwelling	from Ta	ıble 9, Ti	h2 (°C)					
(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)
l Itilie:	ation fac	tor for a	ains for	rest of di	welling	h2 m (se	a Tahla	(a)	•					
(89)m=	1	1	1	1	1	0.98	0.89	0.9	0.98	1	1	1		(89)
									<u>[</u>	ļ		•		` '
		i	ature in			· ` `		i –	1			1		(00)
(90)m=	18.28	18.37	18.6	18.95	19.32	19.72	19.95	19.94	19.65	19.17	18.69	18.28		(90)
									1	fLA = Livin	g area ÷ (4	1) =	0.23	(91)
Mean	interna	l temper	ature (fo	r the wh	ole dwe	lling) = fl	_A × T1	+ (1 – fL	.A) × T2					
(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)
vlaaA	adiuetn		ha maan		*			4						
1-1-17	aujusti	nent to t	ne mear	ımtemai	tempera	ature tro	m Table	4e, whe	ere appro	opriate				
	18.61	18.7	18.9	19.23	19.58	19.94	20.16	4e, whe	19.88	19.43	18.99	18.61		(93)
(93)m=	18.61	18.7		19.23						·	18.99	18.61		(93)
(93)m= 8. Spa	18.61 ace hea i to the i	18.7 Iting requ mean int	18.9 uirement ternal ter	19.23 mperatur	19.58	19.94	20.16	20.15	19.88	19.43			ulate	(93)
(93)m= 8. Spa	18.61 ace hea i to the i	18.7 Iting requ mean int	18.9 uirement	19.23 mperatur using Ta	19.58 re obtain	19.94 ned at ste	20.16 ep 11 of	20.15 Table 9l	19.88 o, so tha	19.43	76)m an		ulate	(93)
(93)m= 8. Spansor Set To the ut	18.61 ace heat it to the rillisation Jan	18.7 Iting required interest for the second interest f	18.9 uirement ternal ter or gains Mar	19.23 mperatur using Ta Apr	19.58	19.94	20.16	20.15	19.88	19.43		d re-calo	ulate	(93)
(93)m= 8. Spanner Set To the ut	18.61 ace heat it to the rillisation Jan	18.7 Iting required interest for the second interest f	18.9 uirement ternal ter or gains	19.23 mperatur using Ta Apr	19.58 re obtain	19.94 ned at ste	20.16 ep 11 of	20.15 Table 9l	19.88 o, so tha	19.43	76)m an	d re-calo	ulate	(93)
(93)m= 8. Spanner Set To the ut Utilisa (94)m=	18.61 ace head if to the rillisation Jan ation face	18.7 tting required factor for graduate factor fac	18.9 uirement ternal ter or gains Mar ains, hm	19.23 mperatur using Ta Apr :	19.58 re obtainable 9a May 0.99	19.94 ned at ste	20.16 ep 11 of Jul	20.15 Table 9l	19.88 o, so tha	19.43 at Ti,m=(76)m an Nov	d re-calc	ulate	
(93)m= 8. Sport Set To the ut Utilisation (94)m= Useful	18.61 ace head if to the rillisation Jan ation face	18.7 tting required factor for graduate factor fac	18.9 uirement ternal ter or gains Mar ains, hm	19.23 mperatur using Ta Apr :	19.58 re obtainable 9a May 0.99	19.94 ned at ste	20.16 ep 11 of Jul	20.15 Table 9l	19.88 o, so tha	19.43 at Ti,m=(76)m an Nov	d re-calc	ulate	
(93)m= 8. Sparents Set Tithe ut Utilisa (94)m= Usefu (95)m=	18.61 ace head if to the recilisation face to	ting required the second secon	18.9 uirement ternal ter or gains Mar ains, hm 1 , W = (94)	mperaturusing Ta Apr : 1 4)m x (84 403.44	19.58 re obtainable 9a May 0.99 4)m 374.95	19.94 ned at ste Jun 0.97	20.16 ep 11 of Jul 0.9	20.15 Table 9l Aug 0.91	19.88 o, so that Sep	19.43 It Ti,m=(76)m an Nov	d re-calc	ulate	(94)
(93)m= 8. Spet T the ut Utilisa (94)m= Usefu (95)m= Month	18.61 ace head if to the recilisation face to	ting required the second secon	18.9 uirement ternal ter or gains Mar ains, hm 1 , W = (94 429.92	mperaturusing Ta Apr : 1 4)m x (84 403.44	19.58 re obtainable 9a May 0.99 4)m 374.95	19.94 ned at ste Jun 0.97	20.16 ep 11 of Jul 0.9	20.15 Table 9l Aug 0.91	19.88 o, so that Sep	19.43 It Ti,m=(76)m an Nov	d re-calc	ulate	(94)
(93)m= 8. Sparents Set T the ut Utilisa (94)m= Usefu (95)m= Month (96)m=	18.61 ace head it to the recilisation face of	ting required the second secon	18.9 uirement ternal ter or gains Mar ains, hm 1 , W = (94 429.92	nperaturusing Ta Apr 1 4)m x (84 403.44 perature 8.9	19.58 re obtainable 9a May 0.99 4)m 374.95 e from Ta	19.94 ned at ste Jun 0.97 342.39 able 8 14.6	20.16 ep 11 of Jul 0.9 302.01	20.15 Table 9t Aug 0.91 311.64	19.88 Do, so that Sep 0.98 349.93	19.43 It Ti,m=(Oct 1 381.76	76)m an Nov 1	Dec 1 435.35	ulate	(94) (95)
(93)m= 8. Spanner Set Trust the utstand	18.61 ace head it to the recilisation face face face face face face face face	ting requirement into factor for general factor factor factor for general factor f	18.9 uirement ternal t	nperaturusing Ta Apr : 1 4)m x (84 403.44 perature 8.9 al tempe	19.58 re obtainable 9a May 0.99 4)m 374.95 e from Ta 11.7 erature,	19.94 ned at ste Jun 0.97 342.39 able 8 14.6	20.16 ep 11 of Jul 0.9 302.01	20.15 Table 9t Aug 0.91 311.64	19.88 Do, so that Sep 0.98 349.93	19.43 It Ti,m=(Oct 1 381.76	76)m and Nov 1 412.52 7.1	Dec 1 435.35	ulate	(94) (95)
(93)m= 8. Spanning Set Tithe ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m=	18.61 ace head it to the recilisation face of	ting required the second secon	18.9 uirement ternal ter or gains Mar ains, hm 1 , W = (94 429.92 ernal tem 6.5 an intern	nperaturusing Ta Apr 1 4)m x (84 403.44 perature 8.9 pal tempe	19.58 re obtainable 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51	19.94 ned at ste Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53	20.16 ep 11 of Jul 0.9 302.01 16.6 =[(39)m x 388.24	20.15 Table 9l Aug 0.91 311.64 16.4 x [(93)m 407.81	19.88 5, so that Sep 0.98 349.93 14.1 - (96)m 632.91	19.43 It Ti,m=(Oct 1 381.76 10.6] 974.26	76)m and Nov 1 412.52 7.1	Dec 1 435.35 4.2	ulate	(94) (95) (96)
(93)m= 8. Space Set Trust the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space	18.61 ace head it to the recilisation face of	ting required the second secon	18.9 uirement ternal ter gains Mar ains, hm 1 , W = (94 429.92 ernal tem 6.5 an intern 1389.52	nperaturusing Ta Apr 1 4)m x (84 403.44 perature 8.9 pal tempe	19.58 re obtainable 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51	19.94 ned at ste Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53	20.16 ep 11 of Jul 0.9 302.01 16.6 =[(39)m x 388.24	20.15 Table 9l Aug 0.91 311.64 16.4 x [(93)m 407.81	19.88 5, so that Sep 0.98 349.93 14.1 - (96)m 632.91	19.43 It Ti,m=(Oct 1 381.76 10.6] 974.26	76)m and Nov 1 412.52 7.1	Dec 1 435.35 4.2	ulate	(94) (95) (96)
(93)m= 8. Space Set Trust the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space	18.61 ace hea i to the rillisation Jan ation fac 1 ul gains, 448.57 nly avers 4.3 loss rate 1612.23 e heatin	ting requirement into factor for general factor factor for general factor	18.9 uirement ternal ter or gains Mar ains, hm 1 , W = (94 429.92 ernal tem 6.5 an intern 1389.52 ement fo	nperaturusing Ta Apr : 1 4)m x (84 403.44 perature 8.9 al tempe 1141.55 r each m	19.58 re obtainable 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51 nonth, k\	19.94 led at ste Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mont	20.16 ep 11 of Jul 0.9 302.01 16.6 =[(39)m : 388.24 th = 0.02	20.15 Table 9l Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97) 0	19.88 5, so that Sep 0.98 14.1 - (96)m 632.91)m - (95 0	19.43 It Ti,m=(' Oct 1 381.76 10.6] 974.26 [)m] x (4	76)m and Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23	ulate 5182.94	(94) (95) (96)
(93)m= 8. Spr Set T the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m=	18.61 ace hea i to the rillisation Jan ation face 1 ul gains, 448.57 hly avera 4.3 loss rate 1612.23 e heatin 865.76	18.7 Iting requires	18.9 uirement ternal t	nperaturusing Ta Apr 1 4)m x (84 403.44 perature 8.9 pal tempe 1141.55 r each m 531.44	19.58 re obtainable 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 1 868.51 month, k\ 367.21	19.94 led at ste Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mont	20.16 ep 11 of Jul 0.9 302.01 16.6 =[(39)m : 388.24 th = 0.02	20.15 Table 9l Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97) 0	19.88 5, so that Sep 0.98 14.1 - (96)m 632.91)m - (95 0	19.43 It Ti,m=(Oct 1 381.76 10.6] 974.26)m] x (4: 440.82	76)m and Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23	5182.94	(94) (95) (96) (97)
(93)m= 8. Spr Set T the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m=	18.61 ace hea i to the rillisation Jan ation face 1 ul gains, 448.57 nly avera 4.3 loss rate 1612.23 e heatin 865.76	ting required to the table table to the table	18.9 uirement ternal t	mperaturusing Ta Apr 1 Apr 1 4)m x (84 403.44 perature 8.9 pal tempe 1141.55 r each m 531.44	19.58 re obtainable 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 1 868.51 month, k\ 367.21	19.94 ned at ster Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mont	20.16 ep 11 of Jul 0.9 302.01 16.6 =[(39)m : 388.24 th = 0.02 0	20.15 Table 9l Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97) 0 Tota	19.88 5, so that Sep 0.98 349.93 14.1 - (96)m 632.91 0 I per year	19.43 It Ti,m=(Oct 1 381.76 10.6] 974.26)m] x (4: 440.82	76)m and Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23		(94) (95) (96) (97)
(93)m= 8. Space 8. Space 93. En	18.61 ace hea i to the rillisation Jan ation face 1 all gains, 448.57 alloss rate 1612.23 e heatin 865.76 e heatin ergy received	18.7 Iting requirement Iting r	18.9 uirement ternal t	mperaturusing Ta Apr 1 Apr 1 4)m x (84 403.44 perature 8.9 pal tempe 1141.55 r each m 531.44	19.58 re obtainable 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 1 868.51 month, k\ 367.21	19.94 ned at ster Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mont	20.16 ep 11 of Jul 0.9 302.01 16.6 =[(39)m : 388.24 th = 0.02 0	20.15 Table 9l Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97) 0 Tota	19.88 5, so that Sep 0.98 349.93 14.1 - (96)m 632.91 0 I per year	19.43 It Ti,m=(Oct 1 381.76 10.6] 974.26)m] x (4: 440.82	76)m and Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23	5182.94	(94) (95) (96) (97)
(93)m= 8. Spi Set T the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space 9a. En Space	18.61 ace hea i to the rillisation Jan ation face 1 ul gains, 448.57 nly avera 4.3 loss rate 1612.23 e heatin 865.76 e heatin ergy rece e heatir	18.7 Iting requirements	18.9 uirement ternal 1389.52 ement for 713.94	mperaturusing Ta Apr 1 Apr 1 4)m x (84 403.44 perature 8.9 pal tempe 1141.55 r each m 531.44 kWh/m²	19.58 re obtainable 9a May 0.99 4)m 374.95 e from Ta 11.7 erature, 868.51 nonth, k\ 367.21	19.94 ned at stern Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mont 0	20.16 ep 11 of Jul 0.9 302.01 16.6 =[(39)m : 388.24 th = 0.02 0	20.15 Table 9l Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97) 0 Tota	19.88 5, so that Sep 0.98 349.93 14.1 - (96)m 632.91 0 I per year	19.43 It Ti,m=(Oct 1 381.76 10.6] 974.26)m] x (4: 440.82	76)m and Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23	5182.94	(94) (95) (96) (97) (98) (99)
(93)m= 8. Space 8. Space (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space 9a. En	18.61 ace hea i to the rillisation Jan ation face 1 all gains, 448.57 all gains, 448.57 all gains, 4.3 all gain	18.7 Iting requirements Teb Iting requirements Iting requireme	18.9 uirement ternal ter or gains Mar ains, hm 1 429.92 ernal tem 6.5 an intern 1389.52 ement fo 713.94 ement in at from se	nperaturusing Ta Apr : 1 4)m x (84 403.44 perature 8.9 nal tempe 1141.55 r each m 531.44 kWh/m² ividual he	19.58 re obtainable 9a May 0.99 4)m 374.95 refrom Ta 11.7 refrature, 868.51 refronth, k\ 367.21 regrature sy/supple	19.94 ned at stern Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mont 0	20.16 ep 11 of Jul 0.9 302.01 16.6 =[(39)m : 388.24 th = 0.02 0	20.15 Table 9l Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97) 0 Tota	19.88 5, so that Sep 0.98 349.93 14.1 - (96)m 632.91 0 I per year	19.43 It Ti,m=(Oct 1 381.76 10.6] 974.26)m] x (4: 440.82	76)m and Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23	5182.94 49.06	(94) (95) (96) (97) (98) (99)
(93)m= 8. Spi Set T the ut Utilisa (94)m= Usefu (95)m= Month (96)m= Heat (97)m= Space (98)m= Space Fracti Fracti	18.61 ace hea i to the rillisation Jan ation face 1 al gains, 448.57 aly avers 4.3 loss rate 1612.23 e heatin 865.76 e heatin ergy receive heatin ion of spinon of spi	18.7 Iting requirements	18.9 uirement ternal 1389.52 ement for 713.94	mperaturusing Ta Apr : 1 4)m x (84 403.44 perature 8.9 al tempe 1141.55 r each m 531.44 kWh/m² ividual he econdary	19.58 re obtainable 9a May 0.99 4)m 374.95 refrom Ta 11.7 rerature, 868.51 nonth, kl 367.21 reating sy/supple em(s)	19.94 ned at stern Jun 0.97 342.39 able 8 14.6 Lm , W = 582.53 Wh/mont 0	20.16 ep 11 of Jul 0.9 302.01 16.6 =[(39)m : 388.24 th = 0.02 0 ncluding	20.15 Table 9l Aug 0.91 311.64 16.4 x [(93)m 407.81 24 x [(97) 0 Tota micro-C	19.88 5, so that Sep 0.98 349.93 14.1 - (96)m 632.91 0 I per year	19.43 It Ti,m=(' Oct 1 381.76 10.6] 974.26 S)m] x (4' 440.82 (kWh/year	76)m and Nov 1 412.52 7.1 1317.48 1)m 651.57	Dec 1 435.35 4.2 1605.23	5182.94	(94) (95) (96) (97) (98) (99)

Efficiency of main space heating system 1							93.4	(206)
Efficiency of secondary/supplementary heating s	0	(208)						
Jan Feb Mar Apr May	Jun Jul	Aug	Sep	Oct	Nov	Dec	kWh/ye	⊐ ar
Space heating requirement (calculated above)					•	1		
865.76 741.8 713.94 531.44 367.21	0 0	0	0	440.82	651.57	870.39		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)		 			T		1	(211)
926.94 794.22 764.39 569 393.16	0 0	0 Total	0 (k\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	471.97	697.62 211) _{15,1012}	931.9	5540.40	(211)
Space heating fuel (secondary), kWh/month		Total	(KVVIII y Ce	ar) =00m(2	211/15,1012	<u>-</u>	5549.19	(211)
$= \{[(98) \text{m x } (201)] \} \times 100 \div (208)$								
(215)m= 0 0 0 0 0	0 0	0	0	0	0	0		
	-	Total	(kWh/yea	ar) =Sum(2	215) _{15,1012}	=	0	(215)
Water heating								
Output from water heater (calculated above) 214.68 189.22 198.72 177.33 171.69 1	51.21 144.87	161.5	163.28	184.72	195.33	209.52	1	
Efficiency of water heater	01.21	1 10110	100.20	1012	100.00	200.02	80.3	(216)
<u> </u>	80.3 80.3	80.3	80.3	87.16	87.85	88.25		(217)
Fuel for water heating, kWh/month	<u> </u>						ı	
(219) m = (64) m x $100 \div (217)$ m (219)m= 243.42 214.67 225.85 202.33 197.53 1	88.31 180.41	201.12	203.34	211.93	222.34	237.42	1	
(219)11- 240.42 214.07 220.00 202.00 197.00 1	00.31 100.41		= Sum(2		222.34	237.42	2528.67	(219)
Annual totals					Wh/year		kWh/year	┛` ′
Space heating fuel used, main system 1					•		5549.19	
Water heating fuel used							2528.67	Ī
Electricity for pumps, fans and electric keep-hot								_
central heating pump:						30		(230c)
boiler with a fan-assisted flue						45		(230e)
Total electricity for the above, kWh/year		sum	of (230a).	(230g) =	:		75	(231)
Electricity for lighting	453.98	<u> </u> (232)						
Total delivered energy for all uses (211)(221) +	8606.83	(338)						
12a. CO2 emissions – Individual heating system	. , ,						000000	<u>`</u>
	<u> </u>				. ,			
	Energy kWh/yea	r		kg CO	ion fac 2/kWh	tor	Emissions kg CO2/yea	
Space heating (main system 1)	(211) x			0.2	16	=	1198.62	(261)
Space heating (secondary)	(215) x			0.5	19	=	0	(263)
Water heating	(219) x			0.2	16	=	546.19	(264)
Space and water heating	(261) + (262)) + (263) + (2	264) =				1744.82	(265)
Electricity for pumps, fans and electric keep-hot	(231) x			0.5	19	=	38.93	(267)
Flootsinity for limbing	(222) v							<u> </u>
Electricity for lighting	(232) x			0.5	19 l	=	235.61	(268)
Total CO2, kg/year	(232) X		sum o	0.5 f (265)(2		=	235.61	$\frac{1}{268}$

TER = 19.12 (273)